United States General Accounting Office

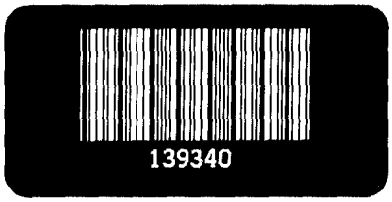
GAO

Report to the Chairman, Subcommittee on Oversight and Investigations, Committee on Energy and Commerce, House of Representatives

July 1989

AIR POLLUTION

EPA's Ambient Air Policy Results in Additional Pollution



GAO/RCED-89-144

GAO

United States
General Accounting Office
Washington, D.C. 20548

Resources, Community, and
Economic Development Division

B-220184

July 26, 1989

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

Dear Mr. Chairman:

As you requested, we examined the Environmental Protection Agency's (EPA) use of pollution concentration estimates obtained from air quality dispersion models in carrying out the requirements of the Clean Air Act.

As arranged with your office, unless you publicly release its contents earlier, we plan no further distribution of this report until 30 days from the date of this letter. At that time, copies of the report will be sent to appropriate congressional committees; the Administrator, EPA; and the Director, Office of Management and Budget.

This work was performed under the direction of Richard L. Hembra, Director, Environmental Protection Issues, on (202) 275-5489. Major contributors are listed in appendix I.

Sincerely yours,

J. Dexter Peach
Assistant Comptroller General

Executive Summary

Purpose

The Environmental Protection Agency (EPA) reported in March 1989 that over 100 million Americans live in areas where air pollution exceeds National Ambient Air Quality Standards. Efforts to protect the public health by making the air cleaner and keeping it clean frequently involve the use of air quality models. Models are used in decisions on whether and at what levels industrial sources are allowed to emit pollution.

In 1986, GAO issued a report entitled Air Pollution: Improvements Needed in Developing and Managing EPA's Air Quality Models (GAO/RCED-86-94, Apr. 22, 1986), which disclosed that air quality models estimate pollution concentrations with wide ranges of uncertainties. As a follow-on to that report the Chairman, Subcommittee on Oversight and Investigations, House Committee on Energy and Commerce, asked GAO to review whether (1) EPA's policy on what constitutes ambient air results in approval of increased emissions limits and (2) EPA's policies and procedures are designed to ensure the consistent use of air quality models in regulatory decisions.

Background

As required by the Clean Air Act, EPA established National Ambient Air Quality Standards for six widespread pollutants. Through a variety of processes, EPA and state and local agencies attempt to control air pollution concentrations to achieve and/or maintain compliance with the air quality standards. However, the act is silent on what constitutes ambient air, that is, where the air quality standards must be met.

The Clean Air Act authorizes the use of air quality models in estimating concentrations of airborne pollutants in the ambient air. Models simulate the effects of wind speed, wind direction, and other atmospheric conditions on pollutants as they are emitted into the air from a specific source. Various input data such as meteorological conditions and pollutant emissions rates are entered into a model's mathematical equations to simulate the dispersal of airborne pollutants and estimate the resulting ambient air quality in a designated area. Models estimate the effectiveness of pollution control measures and evaluate the effectiveness of proposed emission limits for major sources of air pollution. Instructions on the use of models and their estimates in regulatory decisions are provided by EPA's Guideline on Air Quality Models (Revised), which are incorporated by reference in EPA's regulations.

Results in Brief

In the absence of any statutory definition of ambient air, or congressional guidance as to its intended meaning, EPA has discretion to define the term. EPA defines ambient air as that portion of the atmosphere, external to buildings, to which the general public has access. Under EPA's policy, air above company-controlled property is not considered ambient air and EPA exempts such air from the act's requirements for attainment of National Ambient Air Quality Standards. This policy was adopted to allow flexibility in implementing Clean Air Act requirements and to allow certain industries to continue operations. However, this policy has been stretched as some sources have been allowed to increase emissions by acquiring additional land where violations of ambient air quality standards had been recorded and restricting public access to it. According to EPA officials, exclusions of acquired land are consistent with its ambient air policy. Since the environmental consequences of EPA's ambient air policy are increased pollution in the atmosphere, GAO believes EPA's policy needs to be reevaluated.

While EPA has issued guidelines governing the use of air quality models, these guidelines need to be applied consistently to assure fair and uniform treatment of entities being regulated. GAO's review of the use of air quality models in 12 cases disclosed 2 regulatory decisions that contained 4 instances where modeling analyses did not conform with EPA's modeling guidelines. Failure by EPA, states, and other model users to follow EPA's guidelines resulted in one instance of selecting an inappropriate model, two instances of improperly calibrating models, and one instance of improperly omitting existing pollution from a modeling analysis. Noncompliance with EPA's recommended modeling policies and procedures may have resulted in the approval of higher emission limits than would have otherwise been approved.

Principal Findings

Air Above Company Property Omitted From Modeling Analyses

EPA's policy of allowing emitting sources to exclude the air above large tracts of company-controlled land if public access to the property is restricted has resulted in higher emissions limits than would otherwise be permitted. During the 1980's, numerous regulatory decisions have been approved where the ambient air policy had a direct bearing on the amount of emissions allowed. The effect of EPA's policy is illustrated by two regulatory decisions. One decision involved a copper smelting plant that was allowed to exclude the ambient air above 120 square miles

(76,800 acres) of company property from the modeling analysis used to estimate sulfur dioxide emission limits. In 1985, EPA approved an increase in sulfur dioxide emissions from the plant from an average of 72 tons per day to an average of 218 tons per day. This increase would not have been approved without excluding company property from the analysis because violations of air quality standards occurred on company property at emission levels as low as 123 tons per day.

In another case, about 9,000 acres of land controlled by a paper mill were excluded from the modeling analysis used to establish the maximum sulfur dioxide emission limit. In 1984, EPA approved an increase to 66 tons per day, a 35-percent increase over the existing 49 tons per day limit. This increase would not have been approved without excluding company property from the analysis because violations of air quality standards were detected on the property when emissions were limited to 49 tons per day.

Noncompliance With EPA's Recommended Modeling Policies and Procedures

GAO's review identified four instances of noncompliance with EPA's recommended modeling policies and procedures. For example, in the paper mill case, the selection of an air quality model allowed was improperly based on the model's capability to estimate pollution concentrations on a nearby hill rather than its capability to estimate pollution concentrations in the nearby town. If the proper modeling selection procedures had been followed, a different model would have been used and according to an EPA consultant would have resulted in a lower allowable emission limit. A conservative estimate revealed that 30 tons of emissions per day would have been approved compared with the approved limit of 66 tons per day. In addition, in two instances models were improperly calibrated. Portions of EPA's guideline pertaining to model calibration are not written in sufficient detail to promote consistent understanding among modeling personnel and may have contributed to the noncompliance.

Recommendations

In light of the significant environmental consequences of EPA's policy which allowed increased emissions and the feasibility of an alternative interpretation of ambient air boundaries which restricts nonambient air to the immediate vicinity of the emitting source's production area, GAO recommends that the EPA Administrator initiate a formal rulemaking process to redefine ambient air in a manner that is more protective of the environment. GAO also recommends that EPA (1) review and revise its modeling regulations to more clearly and precisely identify and prohibit

unacceptable practices such as model calibration and (2) consider the need to review its modeling policies and procedures to determine whether they are being uniformly and consistently applied and initiate corrective actions as deemed appropriate if such a review detects any inconsistency.

Agency Comments

GAO has discussed factual information concerning air quality models with EPA officials, but in accordance with the Chairman's wishes official agency comments on a draft of this report have not been solicited.

Contents

Abbreviations

CO	carbon monoxide
EPA	Environmental Protection Agency
GAO	General Accounting Office
NAAQS	National Ambient Air Quality Standards
SIP	State Implementation Plan
SO_2	sulfur dioxide

Introduction

Air quality dispersion models are widely used by the Environmental Protection Agency (EPA), states, local governments, and industry to estimate air pollution levels from new or modified sources of pollution. Such estimates form the basis for regulatory decisions concerning the amounts of air pollutants allowed to be emitted.

In our 1986 report, Air Pollution: Improvements Needed in Developing and Managing EPA's Air Quality Models (GAO/RCED-86-94, Apr. 22, 1986), we reported that, among other things, air quality models estimate pollution concentrations with wide ranges of uncertainties. As a follow-on to that report, the Chairman, Subcommittee on Oversight and Investigations, House Committee on Energy and Commerce, requested that we review whether EPA's policy on what constitutes ambient air results in approval of increased emissions limits and whether EPA's policies and procedures are designed to ensure the consistent use of air quality models in regulatory decisions.

Clean Air Act Requires Consistent Application of Air Quality Dispersion Models

The Clean Air Act was enacted by the Congress to promote public health and welfare by protecting and improving the quality of the nation's air.[1] Although EPA administers the act, it has delegated certain operational responsibilities to state and local governments.

The act authorizes EPA, states, and local governments to employ air quality models in arriving at allowable pollution emission levels. Air quality models estimate the dispersal and concentrations of airborne pollutants in an area by simulating the effects of wind speed, wind direction, and other atmospheric conditions on pollutants as they are emitted into the air from a specific source. If model inputs are varied, the model can estimate levels of pollution on the basis of those inputs, such as different meteorological data or increased amounts of source emissions. Thus, the model can estimate possible future pollution readings.

Instructions concerning the use of air quality models are contained in EPA's Guideline on Air Quality Models, (Revised).[2] These instructions contain EPA's modeling requirements, and EPA expects all parties in air quality regulatory matters (i.e., EPA's regional offices, states, local governments, and industry) to comply with them. In September 1986, EPA published regulations requiring adherence to this guideline in order to

[1] 42 U.S.C. 7401 et seq.

[2] EPA-450/2-78-027R, July 1987.

achieve consistency in the application of air quality models. (40 C.F.R. 52.21 (l).)

Air Quality Models Commonly Used in Regulatory Decisions

Estimates of pollution concentrations from air quality models are generally used in the following regulatory decisions.

Attainment of Air Quality Standards

EPA has established national ambient air quality standards (NAAQS) for airborne concentrations of six widespread pollutants--carbon monoxide, lead, nitrogen dioxide, ozone, sulfur dioxide, and suspended particulates. On February 3, 1983, EPA published in the Federal Register a listing of all areas of the country that were in nonattainment with the NAAQS for each of the six pollutants. Since then, states have applied for redesignation to attainment for any pollutant for which pollution control procedures have resulted in sufficient improvement of the pollution concentrations in the ambient air.

Generally an area may be redesignated to attainment when the most recent eight consecutive quarters of air quality monitoring data show no violations of the NAAQS. However, there are situations where model estimates must be used in addition to monitoring data to make such attainment decisions. The situations include

- when there are an insufficient number of approved monitors in an area;
- when fewer than eight consecutive quarters of monitoring data exist; and
- when a source uses meteorological variations (i.e., wind speed and direction) for the purpose of preventing NAAQS violations.

State Implementation Plans

When any part of a state has failed to attain the national standards, the state describes in a State Implementation Plan (SIP) the pollution control measures it will use to achieve attainment. A SIP establishes emission limits for major sources of air pollution and must include timetables for adopting pollution control measures.

In preparing SIPs, states use air quality models to estimate the effects of air pollution control measures and to demonstrate future attainment. EPA also uses models in reviewing the SIPs to determine the efficacy of controls.

Air Pollution Control Permit Decisions

Any entity wishing either to build a major stationary pollution source or to make major modifications of any existing source needs to obtain a permit to do so. The permit application must demonstrate that emissions from the proposed source will neither violate the national standards nor significantly degrade existing air quality. These permit applications are frequently based on estimates by air quality models.

How Models Are Used in Regulatory Decisions

The air quality modeling process involves two phases: (1) selection of a model best suited to the location and its surrounding terrain and (2) application of the selected model in estimating the emission limits and controls required to attain air quality standards.

EPA's guideline lists nine preferred models that may be selected, depending on their applicability to the site's characteristics, without a separate evaluation of their accuracy in estimating pollutant concentrations at the site. Before using a model not recommended in EPA's guideline, an applicant must demonstrate that an alternate model would be better at estimating future pollution. This demonstration, known as a model evaluation study, compares the accuracy of the alternate model vs. EPA's preferred model, based on how closely each model replicates pollutant concentrations measured under known conditions. The measured data, particularly pollutant emission rates and meteorological data, are entered into the models' equations to simulate how the pollutants are spread through the surrounding atmosphere and to estimate the pollutant concentrations resulting at designated locations around the source. Pollutant concentrations actually measured at these locations under the same conditions are compared against the models' estimated concentrations to assess model accuracy.

After a model has been selected, it is then used to estimate the emission limits (maximum amount of pollution which can be emitted in a given time period) allowable while attaining air quality standards around the source. In this analysis, the same meteorological data used in the model evaluation process may again be entered into the model. The pollutant concentrations estimated through this analysis are used to determine the plant's emission limit—the highest emission rate that will result in compliance with air quality standards.

The extent and location of the air simulated in a modeling analysis can substantially affect the results of both the model evaluation and model

application phases. This is true because the amount of pollution estimated by models varies depending on the locations included in the analysis. More specifically, higher emission rates are allowable if the locations experiencing the highest pollution concentrations are omitted from the modeling analysis. EPA's definition of ambient air, which excludes air above property to which public access is restricted, is of central importance in determining the areas included in modeling analyses and substantially influences the results of these analyses. For example, under this definition property that has historically experienced pollution concentrations in excess of air quality standards is omitted from EPA's modeling analysis if a company owns or leases such property and restricts public access to it.

Previous GAO Reports Concerning Air Quality Dispersion Models

In 1986, GAO issued its first in a series of reports addressing EPA's management, development, and use of air quality dispersion models. In our 1986 report, Air Pollution: Improvements Needed in Developing and Managing EPA's Air Quality Models (GAO/RCED-86-94, Apr. 22, 1986), we reported the following:

- Because of limitations in the current state of the art of model development, air quality models estimate pollution concentrations with wide ranges of uncertainties.
- More refined models need to be developed to fully implement the air pollution programs required by the Clean Air Act.
- EPA had spent $3 million and 5 years on a project to develop a new model but had used a cooperative agreement as the procurement instrument and therefore did not require delivery of a product. As a result, EPA had to competitively award a contract to another party to complete the project.

On June 9, 1986, the office of the Chairman, Subcommittee on Oversight and Investigations, House Committee on Energy and Commerce, asked EPA a series of questions based on that report and asked GAO to evaluate EPA's responses. This request in turn resulted in two reports.

The first, Air Pollution: EPA's Efforts to Develop a New Model for Regulating Utility Emissions (GAO/RCED-88-57, Jan. 22, 1988), addressed EPA's policy for purchasing computerized models and its efforts to obtain one of these, the Advanced Utility Simulation Model. In summary, we found that (1) EPA had no recourse against the initial developer for nondelivery of the Advanced Utility Simulation Model because delivery was not specified in the procurement instrument, (2) it would have been more

appropriate for EPA to use a procurement contract that specified terms of delivery on the initial procurement instrument, and (3) EPA was continuing to have problems with procurement of models because of use of inappropriate procurement instruments and the lack of clauses in procurement instruments precluding proprietary restrictions. Based on our recommendation, EPA, on June 21, 1988, issued an additional chapter to the Assistant Administration Manual which provides guidance on the use of contracts, cooperative agreements, and interagency agreements. This revised guidance states a contract must be used when models will be developed primarily for EPA's direct benefit and use.

The second report, Air Pollution: Reliability and Adequacy of Air-Quality Dispersion Models (GAO/RCED-88-192, Aug. 24, 1988), addressed EPA's (1) testing of models to estimate their reliability and ranges of reliability and (2) efforts to develop additional models to meet identified needs. In summary, we found that 45 of the 48 air quality dispersion models used in making regulatory decisions have been evaluated by EPA or other organizations. The evaluations indicate that model reliability ranges widely depending on the type model and its specific application. For EPA's preferred models (designated by EPA as usable in regulatory decisions without special justification), estimated reliability ranged from 50 percent underestimation to 60 percent overestimation. We also reported that EPA had determined that to fully implement the requirements of the Clean Air Act during the next 10 years, it had identified 241 modeling needs. As of August 1988, models under development will satisfy 65 of the identified needs. EPA considers the remaining 176 needs to be generally of lower priority than the needs that will be met by models being developed.

Objectives, Scope, and Methodology

As a follow-on to these reports, we agreed with the Subcommittee's office to evaluate whether EPA's policy on what constitutes ambient air results in approval of increased emissions limits and whether EPA's procedures are designed to ensure the consistent application of air quality models in regulatory decisions.

To evaluate whether EPA's ambient air policy results in approval of increased emissions limits and whether EPA's policies and procedures are designed to ensure the consistent use of air quality models, we performed case studies concerning the use of air quality models in regulatory decisions. We conducted our review at 2 of EPA's 10 regional offices—Philadelphia, Pennsylvania, (Region III), and San Francisco,

California (Region IX)—three state control agencies (in Arizona, Pennsylvania, and Virginia), and one local agency (the Bay Area Air Quality Management District, San Francisco). These offices were chosen for three reasons: (1) their personnel had been involved in all types of air quality models; (2) they had reviewed applications for attainment, SIP revisions, and construction permits based on models; and (3) they provided diverse geographical coverage of the United States.

We asked both regional EPA offices to select from their files typical attainment cases and typical SIP-revision cases that had used model estimates. We also asked each of the four state and local agencies to provide us from their files typical permit decisions involving model estimates. In total, we reviewed 12 regulatory decisions. In all these cases, we reviewed the files and interviewed regulatory officials to determine whether the decisionmakers had used the model estimates consistently in arriving at their decisions on these cases.

We reviewed the legislative history of the Clean Air Act to obtain an understanding of what constitutes ambient air and obtained EPA's legal analysis of its policy. We also asked EPA to provide us with information concerning other known regulatory decisions where EPA's ambient air policy made a significant impact on the resulting regulatory decisions.

We conducted this review from July through December 1988, in accordance with generally accepted government auditing standards. We discussed factual information with EPA officials and have included their comments where appropriate. However, in accordance with the Chairman's wishes, we did not solicit official agency comments on a draft of this report.

EPA's Policy Regarding Ambient Air Needs to Be Reevaluated

The Clean Air Act requires EPA to establish and enforce air quality standards for air pollutants. The act is silent, however, on what constitutes ambient air, that is, where air quality standards must be met. EPA defines ambient air as that portion of the atmosphere, external to buildings, to which the general public has access. Accordingly, company property to which public access is restricted by a fence or other physical barrier is exempted from the act's requirements, and air pollution over the property is not considered in the modeling analyses used to estimate source emission limits. In some cases, this has resulted in the approval of increased source emission rates that would not have been allowed if the analyses had included land areas controlled by the company.

Since EPA promulgated its definition of ambient air in 1971, considerable agency attention has been directed towards assessing the legal and environmental soundness of various applications of the definition and of possible alternate policies. The debate on EPA's policy has not, however, undergone a formal rulemaking wherein the general public is allowed to comment on the proposed rule. Although these internal analyses found questionable aspects about the existing ambient air policy, EPA has continued it because alternate policies were deemed too complicated or inflexible. However, we found that at least one state has implemented an alternate policy which reduces the size of the "non ambient" areas to only that area required for work processes.

Evolution of EPA's Ambient Air Policy

EPA's ambient air definition has been the subject of considerable internal legal and policy debate. The Clean Air Act uses the term "ambient air quality standards," but does not define the term "ambient air." In implementing the act, EPA promulgated a definition of ambient air as "that portion of the atmosphere, external to buildings, to which the general public has access." Although the preamble to the 1971 regulation defining ambient air does not explain the basis for the definition, internal EPA documents prepared later indicate that EPA officials consider the definition necessary to provide needed flexibility in implementing the Clean Air Act. Such flexibility was deemed necessary to allow certain industries to continue operations. Therefore, EPA follows a policy that the air quality standards do not apply to property owned or controlled by a source where physical access by the general public is precluded by a fence or other means.

In 1976, while reviewing a proposed regulatory decision, EPA reviewed and debated the definition of ambient air. An EPA Associate General Counsel, in a memorandum to the Deputy Assistant Administrator of the

Office of Air Quality Planning and Standards, opposed EPA's proposed decision in this case which allowed land acquisition as a means of avoiding control requirements. He stated his opinion that land acquisition as an acceptable control avoidance technique would make a "laughingstock" out of EPA and would be a "palpable (and incredible) affront to the Clean Air Act." The Associate General Counsel recommended that EPA publish an interpretation of the definition allowing for exemption of only the amount of company-controlled property required for the safe and efficient operation of the source. However, EPA's policy regarding the use of land acquisition as a control technique was not clarified at that time.

The next significant review of the ambient air policy was initiated in 1978, triggered by the 1977 amendments to the Clean Air Act. The 1977 amendments restricted the use of dispersion techniques such as tall smokestacks which spread pollution over a larger area. The Assistant Administrator for Air and Waste Management requested the views of the regional administrators on several alternate policies concerning attainment of ambient air quality standards on company property. Three options were considered:

- Retain the present policy of excluding company-controlled property to which public access is restricted.
- Redefine ambient air to include all air.
- Exclude only a small amount of land in the immediate vicinity of the source.

To assist the regional administrators in responding, an EPA Associate General Counsel evaluated these options from a legal and policy standpoint. He proposed a policy that, in effect, would be a flexible implementation of the second option, that is, one that permits monitoring up to a source's buildings but does not require it. This policy was envisioned to be accomplished through revised guidelines that provided discretion for the states and regional offices to decide whether to require monitors "in the shadow of a source" if the circumstances indicate a less stringent approach. The Associate General Counsel concluded that this was ". . . consistent with the 1977 Amendments' emphasis on attaining standards through continuous emission reduction rather than by dispersion dependent techniques."

The Associate General Counsel criticized the option of retaining the existing policy of exempting all fenced property from the application of

ambient standards on the grounds that it provided no incentive for innovation in control or process technologies.

With respect to the third option, the EPA Associate General Counsel explained that excluding only a small parcel from ambient air would require EPA and the states to specify what constitutes a reasonable parcel of land for many types of source operations. In his opinion, these decisions would provide sources with a separate basis for court challenges to the boundaries drawn.

EPA policymakers decided to follow the existing policy. According to EPA officials, the option to redefine ambient air to include all air was abandoned, primarily because it was thought to require some sources to attain standards in areas, such as open pit mines, where it is impossible to do so. The option of excluding from ambient air only a small amount of land in the immediate vicinity of the source was discarded because efforts to define a safe and efficient operations area for various types of sources led to overly complicated draft policies.

EPA's position on ambient air was restated in a letter dated December 19, 1980, from Administrator Costle to Senator Jennings Randolph. The letter stated that the atmosphere over land to which public access is precluded by a fence or other physical barrier is exempt from EPA's definition of ambient air. The letter also stated that individual situations would continue to be reviewed on a case-by-case basis.

Since 1980, EPA has reviewed its interpretation of the definition of ambient air on several occasions. For example, in 1983, while reviewing its ambient air policy concerning a proposed SIP for a copper smelter in Utah, EPA considered whether allowing the smelter to exclude acquired land from ambient air was a dispersion technique limited under section 123 of the 1977 amendments of the Clean Air Act. An EPA attorney, in a draft memorandum, generally concluded that

> ". . . land acquisition is not a dispersion technique. The term dispersion suggests a technique which spreads a pollutant over space or over time. Arguably, land acquisition does neither, but rather simply removes air over the acquired property from the requirements of the Clean Air Act."

However, the attorney, as well as other EPA officials, also wrote that the environmental consequences of dispersion techniques such as tall smokestacks and land acquisition are similar. The dispersion technique issue was not addressed on the record in the February 1985 rulemaking

which approved the SIP revision. Rather, EPA stated that it would apply its ambient air definition and exclude the source's property from meeting the national ambient air quality standards.

From 1979 through 1987, reports from EPA regions submitted to EPA's Office of Air Quality Planning and Standards indicated that regional inconsistency in the application of ambient air policy was occurring. EPA regions reported inconsistent interpretations of ambient air in 35 regulatory decisions. Some of the regions where excluding air over bodies of water or rooftops and balconies from meeting ambient air quality standards, whereas other regions were enforcing air quality standards over such areas. For example, EPA Region V (Chicago) excluded the Great Lakes from ambient air requirements because ". . . if the mills had to control (emissions) to meet the standard over the lakes, then it would be much more costly to control." However, EPA Region I (Boston) considered air over water, including the Boston Harbor, as ambient air in its regulatory decisions.

Subsequently, in 1987, EPA issued several memoranda to the regions giving interpretations of ambient air boundaries for different scenarios in an effort to standardize and clarify application of the policy. The guidance stated that air over bodies of water and over rooftops of buildings are to be considered to be in ambient air and air quality standards must be met there. However, the guidance did not address whether land acquisition is an acceptable pollution control technique nor did the guidance require EPA regions to reanalyze previously issued regulatory decisions were ambient air was considered differently.

In December 1988, EPA officials told us that the ambient air definition as clarified by Administrator Costle's 1980 letter remains EPA policy. That is, the atmosphere over company-controlled property to which public access is precluded by a fence or other physical barrier is exempt from EPA's definition of ambient air.

Arizona has in practice defined ambient air to exclude only that area around the source required for work processes. This area is defined on a case-by-case basis for each permitted stationary source. Arizona reports little difficulty defining these work areas and has experienced no court challenges since the practice was adopted in the late 1970s.

Environmental Consequences of EPA's Ambient Air Policy

EPA's internal analyses over the years have raised the issue of whether the environmental consequences of its ambient air policy are similar to those the Congress intended to prevent in the act's provisions prohibiting dispersion techniques. Dispersion techniques reduce concentrations of pollutants, not by reducing the amounts of pollutants emitted into the air but by relying on the dispersion of pollutants throughout the atmosphere. For this reason, the Congress, in the 1977 amendments to the Clean Air Act, added section 123 to the act to restrict the use of dispersion techniques.[1] Section 123 of the amended act provides that the emission limitation of a source cannot be increased simply because the pollution is being dispersed through a tall stack or "any other dispersion techniques." While the act does not prohibit a tall stack per se, the dispersion of pollutants from these stacks cannot be used as a means of achieving air quality standards. The conference report accompanying the 1977 legislation stated that the ". . . adoption of these provision is intended to reaffirm . . . that atmospheric loading through dispersion technology is not an acceptable means of meeting State Implementation Plan emission limitations."[2]

Although the Congress sought to limit the use of dispersion techniques, it did not define the term "dispersion technique," except to state that the term includes "any intermittent or supplemental control of air pollutants varying with atmosphere conditions." An example of intermittent controls is reducing the operation of a power plant when dispersion of pollutants in the atmosphere is poor and increasing its operation when dispersion is more favorable.

Neither section 123 nor its legislative history mentions land acquisition, much less prohibits it, as a dispersion technique. However, EPA officials have stated that the adverse environmental consequences of land acquisition are similar to those from the use of tall stacks because neither prevents air pollution at its source, nor decreases emissions which otherwise would violate air quality standards. Instead, both techniques increase allowable emissions by increasing the distance between the source and locations where air quality is monitored or modeled. This increased distance allows pollutant concentrations to be diluted prior to their contact with the monitored or modeled locations. As a result of this dilution, source emissions can be increased without causing violations of air quality standards. According to EPA officials, dilution of pollutants

[1]H.R. Rep. No. 95-294, 95th Cong., 1st. Sess. 81-94.

[2]H.R. Rep. No. 95-564, 95th Cong. 1st. Sess. 144.

through the use of excessive stack heights relies more on distance in the vertical dimension as opposed to distance in the horizontal dimension achieved through acquisition of property around the source. Thus, although tall stacks are, in effect, prohibited by statute as a control technique and land acquisition is permitted by EPA regulation, the adverse environmental impact of both is similar.

Precedent-Setting Applications of EPA's Ambient Air Policy

Two regulatory decisions occurring in the early 1980s were, according to EPA officials, precedent-setting applications of EPA's ambient air policy. One case involved a paper mill in Maryland and the other involved a copper smelter in Utah. In both cases, large tracts of company-owned property were excluded from consideration in the modeling analyses supporting the regulatory decisions to allow increased emissions. Both companies acquired additional parcels of land where NAAQS violations had been monitored, and EPA subsequently excluded these areas from the modeling analyses. Higher emission limits allowed in these cases were based directly on the size and locations of the property excluded from consideration. The cases were precedent setting, according to EPA officials, due to (1) the size of acreage excluded—9,000 acres in Maryland and 76,800 acres in Utah—and (2) the exclusion of property acquired by the company after violations were monitored there.

Maryland Paper Mill Case

In this case, the state of Maryland proposed a SIP revision to allow increased sulfur dioxide (SO_2) emissions from a paper mill in Luke, Maryland. A total of about 9,000 acres of company-controlled property was excluded from consideration in the modeling analysis used to set the mill's emissions limit. The company acquired part of this acreage after models estimated violations of national air quality standards over it.

In December 1984, EPA approved a SIP revision allowing the company to increase its maximum emissions to 66 tons of SO_2 per day, a 35-percent increase from an interim emissions limit of 49 tons per day. EPA had established the interim limit in 1980 after an EPA analysis showed that additional monitoring and modeling would be needed to establish the allowable emissions. Because violations of air quality standards had been monitored on the property when emissions were limited to 49 tons per day, the increase to 66 tons per day in 1984 could not have been approved without excluding the property acquired by the company from the modeling analysis.

Utah Copper Smelter Case

In 1981, the state of Utah requested a SIP revision to allow increased SO_2 emissions from a copper smelting plant located in the state. Some 120 square miles (76,800 acres) of unfenced company property was excluded from ambient air in the modeling analysis used to estimate SO_2 emission limits. Part of this area was acquired by the company in a land exchange with the Bureau of Land Management after violations of the SO_2 standard were monitored on the property. In 1985, EPA approved a revised SIP strategy for attainment of the SO_2 NAAQS around the plant, which allowed an increase in SO_2 emissions at the main stack from an average of 72 tons per day to an average of 218 tons per day.[3] This increase could not have been approved if company property had been considered in the analysis because NAAQS violations had been monitored on company property at emission levels as low as 123 tons per day.

Other Examples of Applications of EPA's Ambient Air Policy

During the 1980s, EPA regional offices as well as state air pollution control agencies have approved numerous air quality permit applications and SIP revisions where the ambient air policy had a direct bearing on the amount of emissions allowed. Examples of these decisions include:

- In 1983 data from monitors and estimates from models showed violations of the SO_2 and suspended particulates standards in the air above the Potomac River on the Quantico Marine Base. EPA took the position that since the general public would not be present for any extended time at any location on the Potomac River, then the air over the river was not ambient air.
- In a regulatory decision from EPA's Chicago region, the region stated that several steel mills were contiguous of each other and that it was hard to distinguish where one plant stops and another one starts. Therefore, the region considered the entire industrial park as being nonambient air.
- In a permit issued to allow operation of new boilers at the St. Louis Airport, air above the runways and grassy strips near the runways was considered not to be ambient air. SO_2 violations were estimated by a model in these "non ambient" areas.
- In 1982, areas surrounding two mines in Alaska were considered to be nonambient air. In one case, the only reasonable public access was from the sea. Since the mine and processing plant were in a remote area, the area was considered not to be ambient air. In the second case, because the company agreed to control access to the only road leading to the

[3]In 1977, EPA stipulated that it would not enforce the 72 tons per day limit in response to litigation filed challenging the limit.

claims area and general access to the area is precluded by the rugged nature of the terrain, the area was considered to be "non ambient air."

Conclusions

Because of the absence of any statutory definition of the term "ambient air", or any other congressional guidance as to its intended meaning, EPA has the discretion to define the term. EPA's ambient air policy allows exclusion of large tracts of company-controlled land from the requirements of the Clean Air Act, and, in effect, allows companies to use land acquisition as a pollution control technique.

EPA's practice of allowing the use of land acquisition as, in effect, a remedy for violations of air quality standards appears to have adverse consequences similar to those resulting from the prohibited dispersion techniques outlined in section 123 of the act. In neither case is there prevention or control of air pollution at it source, nor is there a decrease of plant emissions which otherwise would violate air quality standards.

While EPA has recognized, in internal correspondence and debates, that land acquisition can have consequences similar to those resulting from prohibited dispersion techniques, it has not taken formal action on its policy. The debate on the legality and soundness of EPA's policy has remained internal. EPA has not changed its ambient air policy because alternates were thought to result in policies that were too complex or inflexible. However, the experiences of one state, Arizona, indicate that an alternate policy, which prevents the use of land acquisition as a pollution-control technique, may be feasible.

Therefore, in view of (1) the significant environmental consequences of EPA's policy which allows increased emissions, (2) Arizona's success in applying an alternate interpretation of ambient air boundaries, which restricts the size of nonambient areas, and (3) the lack of a formal rulemaking action with respect to the ambient air policy, we believe EPA needs to initiate a formal rulemaking action to redefine ambient air, involving the formal solicitation and consideration of public comment.

Recommendation to the Administrator, EPA

In light of (1) the significant environmental consequences of EPA's policy which allowed increased emissions and (2) the feasibility of an alternative interpretation of ambient air boundaries which restricts the size of nonambient air, we recommend that the Administrator, EPA, initiate a formal rulemaking process to redefine ambient air in a manner that is more protective of the environment.

Model Policies and Procedures Inconsistently Applied

The Clean Air Act authorizes the use of air quality models in regulatory decisions that affect the quality of ambient air. The act requires the fair and uniform implementation and enforcement of its provisions, including consistency in the application of air quality models. Consistent application is required to ensure the equitable treatment of industry across the country. While EPA has issued guidelines governing the use of air quality models, these guidelines need to be applied consistently to ensure fair and uniform treatment of entities being regulated. In our review of 12 regulatory decisions, we found that 2 regulatory decisions contained four instances where modeling analyses did not conform with EPA's modeling guidelines. More specifically, failure by EPA, states, and other model users to follow EPA's guidelines resulted in one instance of selecting an inappropriate model, two instances of improperly calibrating models, and one instance of improperly omitting existing pollution from a modeling analysis.

Inappropriate Model Selection

The air quality modeling process begins with the selection of a model best suited to the location and its surrounding terrain. To facilitate model selection, EPA has approved nine preferred models for use without further justification. If an entity seeking a regulatory decision desires to use an alternate model, a comparison of the alternate model to an approved model is required. Selection of such an alternate model must be based on an evaluation which demonstrates that the model replicates actual pollutant concentrations better than an applicable approved model. EPA's guidelines state that the goal of model performance evaluation is to determine whether an alternate model proposed by the applicant provides better estimates of concentrations germane to the regulatory aspects of the problem than does EPA's preferred model.

In the Luke, Maryland, case, model selection was based on a model's replications of pollution concentrations at improper locations. More specifically, a model developed by the paper mill and a model named SHORTZ, which was approved by EPA as an alternate model, were compared based on how closely their estimates replicated actual sulfur dioxide concentrations measured under known meteorological conditions during a 2-year monitoring period. Eight of the nine monitors were located on nearby hillsides where highest concentrations were thought to occur. EPA approved selection of the paper mill's model because it more closely estimated the actual concentrations measured at the hillside locations. However, once selected, the model was used to estimate pollution concentrations at sites in the populated areas surrounding the plant, excluding the hillside area emphasized in the model selection process.

According to an EPA official, EPA's alternate SHORTZ model should have been selected. Its estimates were closer to measured concentrations at the sites in the populated areas that were considered in the regulatory decision. An EPA consultant further concluded that a conservative approach, which EPA would probably have used if monitoring data had been unavailable, would have resulted in an emission limit of 30 tons per day, compared with the approved limit of 66 tons per day.

Improper Model Calibration

Model parameters are sometimes adjusted in the evaluation process in an effort to improve a model's replication of measured pollutant concentrations. Such adjustments to the model's parameters will cause changes in the model's output. For example, changes to meteorological data will affect the model's estimate of pollution concentrations. The Director of EPA's Model Clearinghouse refers to such adjustments as model "calibration."

Calibration causes a model to more closely replicate a historical pollutant concentration, but has an unknown effect on the model's accuracy in future applications. Thus, calibration may create the appearance of greater model accuracy than actually exists for future applications. We found that two proposals for SIP revisions were influenced by emissions estimates generated by models that had been improperly calibrated.

EPA's guideline states that model calibration is generally unacceptable, because it is subject to error and misunderstanding. The guideline further states that:

"There have been attempts by some to compare estimates and measurements on an event-by-event basis and then to calibrate a model with results of that comparison. This approach is severely limited by uncertainties in both source and meteorological data and therefore it is difficult to precisely estimate the concentration at an exact location for a specific increment of time. Such uncertainties make calibration of short-term models of questionable benefit. Therefore, short-term model calibration is unacceptable."

The guideline does not specifically describe what constitutes model calibration. However, according to the Director of EPA's Model Clearinghouse, model calibration involves adjusting model parameters without sufficient scientific basis. Further, the Director acknowledged that the guideline is not clear as to what type of adjustments constitute model calibration.

In the first case, a SIP revision proposal for Luke, Maryland, requested permission to increase a local paper mill's allowable SO_2 emissions from the prior limit of 49 tons per day. The request was supported by an estimate from a model developed by the paper mill. The model estimated that up to 85 tons of sulfur dioxide could be emitted daily without violating the national standard. However, according to EPA officials, EPA rejected that estimate on the basis of a review of the modeling analysis conducted by a consultant to EPA. The review concluded that model input data had been improperly calibrated through the assumption of an artificial north wind direction and unjustified adjustments to several model assumptions. As a result of this review, EPA required the company to perform another analysis, not using the artificial north wind but employing other adjusted assumptions. The emissions limit that would have been estimated from an uncalibrated modeling analysis was not determined.

In the second case, Arizona sought approval for a proposed SIP revision for Maricopa County (the Phoenix area), which had been unable to attain the national air quality standard for carbon monoxide (CO). In 1988, Arizona submitted a plan which estimated attainment of the standard by 1991 by adopting additional emission control measures. However, the plan's estimates were derived from an air quality model that had been improperly calibrated.

Model input data was adjusted prior to using the model to estimate the effectiveness of various control measures. The initial evaluation of the model's accuracy (based on its ability to replicate actual monitored pollution concentration) indicated that the model overestimated the maximum measured carbon monoxide level by about 50 percent at one important location. In an effort to improve the model's performance, meteorological mixing height parameters[1] were changed in subsequent evaluation trials. However, the measured data which provided the basis for the initial mixing heights did not change. Using one set of adjusted values, model estimates varied from measured concentrations by no more than 20 percent—an apparent improvement compared with the previous 50 percent overestimation. However, certain traffic data assumptions employed in these evaluations were later found to be erroneous. Once these traffic assumptions were corrected, the calibrated model (using adjusted mixing heights) substantially underestimated

[1]According to an analyst with the Arizona Department of Environmental Quality, mixing height is defined as the height above ground where a change in atmospheric stability occurs.

measured concentrations. Thus, model inaccuracies that had been attributed to inaccurate mixing height assumptions in the model's calibration were actually caused by inaccurate traffic data. Mixing heights were readjusted, following detection of the traffic data error, to again bring the model's apparent accuracy within acceptable limits. However, the final mixing heights differed substantially from the initial values, although the measured data did not change. EPA officials acknowledged that these mixing height adjustments amount to calibration, since the adjusted values were no more justifiable, scientifically, than the initial values. Nevertheless, Arizona used the model to estimate the timing and extent of reductions necessary to achieve attainment with NAAQS.

Improper Omission of Existing Pollution

According to EPA's guideline, modeling analyses of a proposed facility's impact on air quality must add the pollutant concentrations existing in the area before the proposed facility's operation—known as the "background" air quality level—to the estimated concentrations to be contributed by the new facility. In the Luke, Maryland, case, the modeling analysis did not include background concentrations of sulfur dioxide from other sources in the area. This created an artificially "clean" environment against which to estimate the impact of increased sulfur dioxide emissions on air quality. Failure to include these data did not have an effect in this case because Maryland set a lower emission limit than estimated by the model. However, omission of these data results in lower pollution estimates and could result in higher allowable emission limits.

Conclusions

The Clean Air Act requires fair and uniform implementation and enforcement of its provisions, including the consistent application of modeling procedures. However, we found four instances of noncompliance with EPA's modeling guidelines that were allowed by EPA. These instances of noncompliance may have permitted greater emissions of pollutants than would otherwise have been allowed. Failure to consistently comply with EPA's modeling procedures can also result in the inequitable treatment of industry because requirements for control measures hinge on the emission limits estimated through modeling analyses.

To help address this situation, we believe that EPA needs to revise the portion of its guideline pertaining to model calibration to make clear what improper model calibration is and that it is prohibited. We also believe that EPA should consider reviewing the modeling performed by its regions and state and local agencies to determine whether they are

uniformly applying modeling procedures and initiate corrective actions as deemed appropriate.

Recommendations

We recommend that the EPA Administrator review and, where necessary, revise the modeling guideline to more clearly and precisely identify and prohibit unacceptable practices such as model calibration. We also recommend that the EPA Administrator consider the need for a review of the modeling performed by EPA regions and state and local air pollution control agencies to determine whether they are uniformly and consistently applying the modeling policies and procedures. If such a review detects inconsistent application of the modeling policies and procedures, then we recommend that the EPA Administrator initiate corrective actions as deemed appropriate.

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