

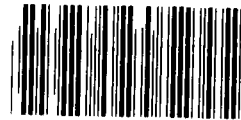
GAO

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

March 1987

AIR POLLUTION

States Assigned a Major Role in EPA's Air Toxics Strategy



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

**Resources, Community, and
Economic Development Division**

B-226223

March 31, 1987

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

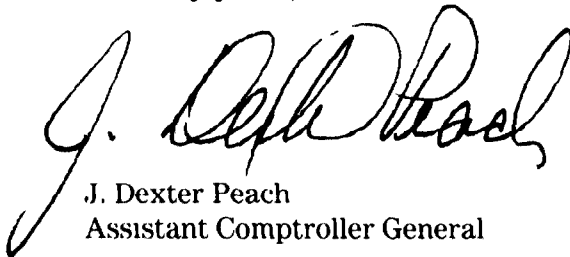
Dear Mr. Chairman:

As you requested, we have reviewed the Environmental Protection Agency's (EPA) strategy to rely more on states in regulating toxic air pollutants. This report discusses the status of the strategy, certain legal issues related to states regulating toxic air pollutants, and variances among state air toxics program.

As arranged with your office, unless you publicly release its contents earlier, we will make this report available to other interested parties 30 days after 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 general direction of Hugh Wessinger, Senior Associate Director. Major contributors are listed in appendix V.

Sincerely yours,

A handwritten signature in black ink, appearing to read 'J. Dexter Peach'. The signature is written in a cursive, flowing style.

J. Dexter Peach
Assistant Comptroller General

Executive Summary

Purpose

Hundreds of chemicals that are routinely emitted into the nation's air may cause health problems as serious as cancer and heart disease. EPA commonly refers to these pollutants as air toxics. Under the Clean Air Act Amendments of 1970, the Environmental Protection Agency (EPA) was given responsibility and authority to establish national emission standards, or levels above which an air pollutant threatens public health.

Concern over EPA's slow progress in regulating toxic air pollutants and over whether the Agency's increased reliance on states would prove effective prompted the Chairman, Subcommittee on Oversight and Investigations, House Committee on Energy and Commerce, to ask GAO to examine

- certain legal issues related to states establishing emission standards,
- states' approaches to toxic air pollution regulation and how they vary, and
- whether different regulatory stringency among state programs will create "pollution havens" and allow some states to attract more industry because of fewer pollution controls.

Background

Although the Clean Air Act authorizes EPA to regulate all hazardous air pollutants, EPA has regulated only seven—including asbestos and mercury—since the Clean Air Act's inception in 1970. In 1983, a GAO report pointed out that EPA had made slow progress in regulating pollutants that pose significant health risks. EPA agreed that more needed to be done to regulate other hazardous air pollutants, and after conducting a study, it initiated a strategy to deal with the numerous other pollutants

A major component of the strategy focuses on a broad delegation of EPA's authority whereby states would set standards and regulations for toxic air pollutants and pollution sources that EPA found to pose no national problems. Currently, EPA helps maintain existing state pollution control programs and develop new ones by providing funding and technical assistance. Previously, EPA had planned to formally refer pollutants, in some cases, to states for regulation. However, EPA discontinued this approach because of reaction to the concept and experience with a pilot referral project.

Results in Brief

EPA's strategy of broad delegation to the states raised three areas of concern to groups ranging from environmental organizations to Members of

Congress. These concerns consisted of (1) legal issues, (2) public health implications due to inconsistencies in state programs, and (3) industry location implications.

One national environmental organization argued that EPA does not have the discretion to delegate regulatory responsibility if the Agency has identified a pollutant as hazardous. EPA disagrees, saying that it has the discretion to decide which substances to regulate and when to make such decisions. The question is now under litigation. Another legal question concerns whether states have the authority to regulate a pollutant if EPA does not regulate it. GAO believes that the Clean Air Act allows states to regulate toxic air pollutants for which no national standards exist, and does not require consistency among state programs.

Pollutants not regulated by EPA vary widely in the extent to which they are regulated by states. State air pollution control programs differ in their stringency. Consequently, the levels of toxic air pollutants to which the public is exposed can vary from state to state.

Some organizations and individuals also suggested that inconsistencies in the relative stringency of state programs could affect states' abilities to attract industry. However, GAO's review shows that environmental regulation does not generally affect industry location decisions to a significant extent.

Principal Findings

Legal Issues

When EPA issued preliminary notices of intent to regulate seven air pollutants in 1985, it also referred an eighth pollutant to 15 states for evaluation and regulation. In 1986, a national environmental group sued EPA, charging that once the Agency determines that a pollutant is hazardous EPA should set national standards and should not give regulatory responsibility to states. While EPA believes that the Clean Air Act gives the Agency discretion in deciding which substances to regulate and when to make such decisions, EPA has discontinued the formal referral of toxic air pollutants to the states. However, it is continuing to identify potential pollution sources in states and furnishing states with studies for use in evaluation and regulation.

Variance Among State Programs

EPA's goal is for all states to have toxic air pollution control programs. As of May 1986, 17 states had such programs in place and 29 states were developing programs. The four remaining states said that they either lacked resources to establish a toxic air pollution program or they did not believe they had significant enough problems to warrant such a program in their state. The existing state programs vary in terms of the pollutants and sources regulated, strategies for regulation, and methods used to establish acceptable emission levels. These differences will likely continue as EPA encourages states to assume more responsibilities for identifying and regulating toxic air pollutants within their borders.

Two organizations representing state and local air pollution control officials believe that regulations among state air pollution control programs should be more consistent, in order to assure adequate public health protection. In order to achieve consistency, these organizations recommend that EPA (1) establish the minimum standards for toxic air pollutants referred to states, (2) provide federal oversight of state programs, and (3) enforce regulations if states do not control toxic air pollutants.

Industry Location Decisions

According to some organizations and individuals, the differences in state toxic air pollution regulations raise the question of whether states with fewer or less stringent environmental controls could become "pollution havens" and attract more industry than more stringently regulated areas. On the basis of existing studies and its own analysis, GAO found that environmental regulation is generally not a significant factor in industry location decisions. Instead, such decisions are primarily influenced by such factors as access to transportation, cost and availability of labor, and proximity to raw material.

Matters for Congressional Considerations

Although the Clean Air Act does not require state and local toxic air pollutant standards to be consistent, organizations representing state and local air pollution control officials believe that more consistency is needed.

The 100th Congress may consider legislation reauthorizing the Clean Air Act. During its reauthorization deliberations, the Congress may wish to consider whether it wants EPA to exercise more control over state toxic air pollutant programs, in order to achieve greater consistency. Added control could take the form of one or more of the following:

-
- mandating a minimum level of control for sources of certain toxic air pollutants such as known carcinogens,
 - establishing criteria for what represents a good state program,
 - carrying out regular federal oversight of state toxic air pollutant programs, and
 - providing for federal enforcement in the event that states do not adequately discharge their responsibilities.

Agency Comments

GAO discussed implementation of the air toxics strategy with EPA officials and included their comments in the report where appropriate. As requested, GAO did not obtain official agency comments on this report.

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Abbreviations

ALL	Acceptable Ambient Level
ACGIH	American Conference of Governmental Industrial Hygienists
ALAPCO	Association of Local Air Pollution Control Officials
AN	Acrylonitrile
EPA	Environmental Protection Agency
GAO	General Accounting Office
NIOSH	National Institute of Occupational Safety and Health
NRDC	Natural Resources Defense Council
NESCAUM	Northeast States for Coordinated Air Use Management
OSHA	Occupational Safety and Health Administration
RCED	Resources, Community, and Economic Development Division
STAPPA	State and Territorial Air Pollution Programs Administrators
TLV	Threshold Limit Value
TWA	Time-Weighted Average

Introduction

Hundreds of chemicals that are routinely emitted into the nation's air may present public health risks including cancer and heart disease. The Environmental Protection Agency (EPA) estimates that more than 60,000 chemicals are used in the United States, and that at least 15,000 of them should be assessed for toxicity. Toxic substances are emitted into the air from industrial and manufacturing facilities, sewage treatment plants, and hazardous and municipal waste landfills and incinerators, as well as wood stoves, household solvents, dry cleaning fluid, and carpet cleaning fluids.

The Clean Air Act Amendments of 1970 required EPA, under section 112, to identify, investigate, and promulgate national emissions standards for hazardous air pollutants when the Agency determined that a pollutant would result in increased mortality, serious irreversible illness, or incapacitating reversible illness.¹ Since 1970 EPA has promulgated national standards for only seven air toxics. Reductions in air toxics emissions, however, have resulted from enforcement of other Clean Air Act provisions and other federal environmental laws. In addition, some states have or are developing air toxics programs of their own.

In June 1985, after conducting a broad study of the health risks associated with exposure to selected air toxics, EPA announced a new strategy for addressing the issue. One component of the strategy delegated major responsibility for regulating air toxics to the states and called for EPA to refer to the states air toxics that needed regulation, but which the Agency believed did not need national standards.

EPA Has Experienced Delays in Implementing Section 112 of the Clean Air Act

EPA is required under section 112 of the Clean Air Act to (1) develop a listing of hazardous air pollutants for which it plans to establish emission standards, (2) propose standards for regulating emissions of those pollutants within 180 days of the date a pollutant is listed, and (3) publish final standards applicable to both new and existing sources within 180 days of the proposal. As of October 1986, EPA had promulgated standards for only seven hazardous air pollutants. EPA is currently developing standards for eight additional hazardous air pollutants. Proposed standards are expected to be published in the Federal Register in 1987, with final standards to be announced in 1988.

¹Section 112 contains the statutory definitions of "hazardous" air pollutant. EPA collectively refers to air pollutants that may be harmful to human health and the environment, however, as "air toxics."

EPA's Air Toxics Listing Process

To determine which chemicals it will list as hazardous (and later regulate), EPA established a multi-step process to review an air pollutant before deciding whether to regulate it. The first step is to screen chemicals to identify those that are likely to pose health risks and prepare preliminary health and source assessment summaries. From these assessments, the Agency makes a preliminary exposure/risk assessment decision. If it is determined that a chemical is likely to pose significant health risks, the chemical moves to a detailed assessment phase.

Under the detailed assessment phase EPA prepares a document which assesses the health effects of the air pollutant. The health assessment document is then reviewed by the Science Advisory Board—a group of independent scientists who review the quality and sufficiency of scientific data underlying regulatory development of some EPA actions.

At the same time it prepares the health assessment document, EPA prepares a detailed source assessment and an exposure/risk assessment to determine whether the air pollutant being examined is emitted, and if so, whether the emissions result in people receiving significant exposure to the pollutant. Using the source/exposure assessment, EPA also estimates the consequent health risks.

Finally, EPA uses the health assessment, the source assessment, and the exposure/risk assessment to determine whether or not to list the air pollutant in question and regulate its various emission sources.

Reasons for the Delay and Recent Progress in Implementing Section 112

In August 1983, we reported on the major factors that had contributed to delaying the listing and standard setting process.² (At that time, EPA had listed only seven substances and established emissions standards for four of them.) Among the major contributing factors to delays were various EPA policy shifts, as well as EPA's uncertainty about the type and amount of scientific data that would be needed to support regulatory action. The time consumed in developing technical and cost information and analyzing public comments also contributed to delays in proposing emission standards after air pollutants were listed.

At congressional hearings held in November 1983, EPA agreed to improve the Agency's progress in this area, to complete its review of 20 to 25 individual chemicals, and to make regulatory decisions on them by the

²Delays in EPA's Regulation of Hazardous Air Pollutants, (GAO/RCED-83-199, Aug. 26, 1983)

end of 1985. EPA developed a strategy in which the Agency issues preliminary notices of intent to list or regulate specific chemicals that EPA deems may warrant regulation. EPA uses the notice of intent to announce tentative conclusions about possible regulation. EPA estimates that formal listing could take from 2 to 4 years after notices of intent to list or regulate are published.

As of December 31, 1985, EPA had made tentative or final decisions on 23 chemicals it had agreed to review in the 1983 congressional hearings. The Agency had decided not to regulate 12 of the chemicals and had issued notices of intent to regulate the other 11. Since then, EPA has issued standards for one of the 11 chemicals and plans to issue standards on eight more by August 1988. The Agency decided not to regulate the other two pollutants.

EPA's Study Estimated Cancer Risks From Air Toxics

Before the November 1983 congressional hearings, EPA acknowledged that it had not defined well the size nor the causes of the health problems resulting from exposure to air toxics. EPA decided that it should conduct a broad study of the air toxics problem before considering changes in the national regulatory program.

The EPA study, The Air Toxics Problem in the United States: An Analysis of Cancer Risks for Selected Pollutants, was issued in May 1985 and contained three major analyses, covering a total of some 45 selected pollutants. The study sought to

- estimate the annual incidence of cancer and the lifetime risks of contracting cancer associated with long-term exposure to toxic air pollutants;
- identify the nature of the problem, in terms of pollutants, sources, and their relative significance;
- examine the geographical variability of the air toxics problem; and
- develop a comprehensive data base on air toxics.

Results of the Study

Estimates from the three analyses showed a range of 1,300 to 1,700 cancer cases annually nationwide for the pollutants examined. Maximum lifetime individual cancer risks of 1 in 10,000 or greater in the vicinity of major point sources were estimated for 21 pollutants, about half of those studied. Maximum lifetime individual cancer risks of 1 in 1,000 or greater were estimated for 13 of the pollutants examined.

The study showed that no one dominant source of air toxics risks exists. Such risks come from many diverse sources and many different pollutants—including metals, such as chromium, cadmium, and arsenic; products of incomplete combustion, such as smoke and soot; and organic vapors, such as benzene, chloroform, carbon tetrachloride, and other solvents.

Large industrial, or “point”, sources—including chemical manufacturing plants, steel mills, and power plants—accounted for about 25 percent of the estimated cancer incidence from the compounds examined. These sources also frequently seemed to create pockets of high individual cancer risk.

Widespread but individually small, or “area”, sources accounted for over 75 percent of the national cancer incidence caused by pollutants examined in the study. Area sources included home heating (wood, coal, oil), motor vehicles, solvent users, and gasoline service stations.

The study also indicated that “nontraditional” sources of air toxics—such as publicly-owned treatment works and hazardous waste treatment, storage, and disposal facilities—may pose important risks in some locations.

For those cities with sufficient data for analysis, large city-to-city and neighborhood-to-neighborhood variation in pollutant levels and sources was found. However, EPA pointed out that the existing air toxics data base was inadequate to accurately characterize most local air toxics problems.

EPA also cautioned the study’s readers that the cancer risk estimates were highly uncertain, due to the poor quality of much of the available data. In addition, EPA pointed out that the study covered only some 45 compounds and, therefore, did not provide information on many other toxics that may exist in significant quantities in the ambient air.

EPA’s New Air Toxics Strategy

EPA announced its new air toxics strategy—A Strategy to Reduce Risks to Public Health from Air Toxics, in June 1985. In the report, EPA pointed out that public exposure to air toxics presents risks to human health that require an aggressive and measured response. EPA called for a national effort to target those controllable air toxics that present the greatest health risks. EPA concluded that while current controls have

already made significant inroads in addressing the problem, much remains to be done by EPA, the states, and the private sector.

EPA's new strategy proposed programs to address both routine and accidental releases of air toxics, including local areas in which multiple sources of toxic air pollution pose risks. A major component of the strategy addressed state air toxics control programs. EPA proposed that states regulate air toxics and source categories that did not represent a national problem. To implement that effort, EPA proposed a program of financial and technical assistance to help states build strong air toxics control programs of their own and, when appropriate, to refer problems of specifically local concern to the states for evaluation and appropriate action. (EPA subsequently discontinued the referral program, for reasons discussed in ch. 3.)

Reaction to the new strategy by members of Congress, state and local agencies, and environmentalists varied. The component of the strategy calling for increased delegation to the states of responsibility for air toxics control programs was particularly controversial. Some perceived the increased delegation to be illegal, while others believed it could have negative public health and economic implications.

Objectives, Scope, and Methodology

In April 1985, the Chairman, Subcommittee on Oversight and Investigations, House Committee on Energy and Commerce, requested us to review EPA's emerging air toxics strategy. In subsequent discussions with the Subcommittee staff, we agreed to examine

- certain legal issues related to states establishing emission standards,
- the status of state air toxics programs and how their approaches differ, and
- whether differences in the relative stringency of toxic air pollution emission standards set by states will create "pollution havens" in some states.

We performed our work at EPA Headquarters offices in Washington, D.C.; EPA's Office of Air Quality Planning and Standards in Durham, N.C.; the New Jersey Department of Environmental Protection; the New York State Department of Environmental Conservation; and the Texas Air Control Board. (We chose New Jersey, New York, and Texas because they have had ongoing programs for a number of years.) Because we did not have current information on their programs, we contacted 32 other

states by telephone to update the status—ongoing or under development—of their air toxics programs, or, in the case of four states, to determine why those states neither had nor were developing programs. We also obtained information from the Association of Local Air Pollution Control Officials (ALAPCO); EPA's Air Toxics Clearinghouse; the Natural Resources Defense Council (NRDC); the New Jersey Chemical Industry Council; the New Jersey Department of Commerce and Economic Development; the New York Department of Commerce, Division of Economic Development; the State and Territorial Air Pollution Program Administrators (STAPPA); the Texas Chemical Council; and the Texas Economic Development Commission.

To respond to issues involving the legality of the referral program, states' authority to regulate if EPA does not, and whether the Clean Air Act mandates consistency among state programs, we reviewed several documents. These included the legislative history of the Clean Air Act, a position paper prepared by EPA, and documents filed by NRDC and others in a current lawsuit which indirectly challenges the legality of the referral program.

To determine how the states are approaching the regulation of toxic air pollutants, we compiled statistics on the number of states that have or are developing air toxics programs. We obtained information on how state programs vary and how states set acceptable limits for toxic air pollutants. Some of this information was obtained during onsite work in the states of New Jersey, New York, and Texas. We obtained information on other states from studies made by STAPPA/ALAPCO, EPA, and the Radian Corporation. We also summarized the reaction to the referral program and the overall delegation of increased responsibility to the states from members of Congress, states, environmental groups, and EPA management. This included obtaining information on the evolution and status of a pilot referral project and the results of project workshops describing progress and problems.

To address the question of whether industry would move to states with less stringent environmental controls, we reviewed prior studies on the subject. We identified factors that are important to location decisions and assessed the relative significance of environmental regulation in the decisionmaking process.

Our review work was conducted between May 1985 and June 1986. We discussed the results of our work with EPA officials and have included their comments where appropriate. However, in accordance with the

requester's wishes, we did not obtain official agency comments on a draft of this report. Except as noted above, this review was conducted in accordance with generally accepted government auditing standards.

Increased Delegation to the States Raises Legal Issues

One component of the air toxics strategy EPA announced in June 1985 called for the states to regulate air toxics and their sources that do not represent a national problem and, in some cases, for EPA to specifically refer such air toxics and sources to the states. This approach raised the following legal issues:

- Is EPA's referral of standard setting and regulation for air toxics to the states legal under EPA's existing Clean Air Act authority and responsibilities?
- Do states have the authority to regulate air toxics that EPA decides not to regulate?
- Does the Clean Air Act mandate consistent regulation of air toxics under state programs?

EPA's Referral of Regulations to States Is Under Litigation

The legality of EPA's proposal to refer the regulation of toxic air pollutants to states instead of issuing national regulations under section 112 of the Clean Air Act is currently under litigation (NRDC v. Thomas, 86 Civ. 0603(CSH)), filed Jan. 21, 1986). In the lawsuit, NRDC is challenging EPA's failure to list and regulate eight pollutants under section 112. For one of the pollutants, acrylonitrile,¹ EPA had announced in the Federal Register that because the estimated national aggregate cancer risks were relatively low and emissions appeared to be localized, the pollutant was being referred to states for evaluation and if they deemed necessary, emissions should be curtailed.

NRDC contends that once EPA has made the judgment that a pollutant is or may reasonably be anticipated to be causing increased mortality or the types of serious illness described in the statutory definition of a hazardous air pollutant, the Administrator must place the pollutant on the list of hazardous air pollutants maintained under section 112. According to NRDC, EPA's proposal to let state and local controls govern sources of pollutants such as acrylonitrile does not satisfy this mandatory requirement.

EPA and a group of private industry interveners in the lawsuit, however, maintain that EPA's obligation to list a pollutant under section 112 is discretionary. In this view, EPA may exercise its discretion as to the substance and timing of its listing decisions. They assert that with respect

¹ Acrylonitrile is an organic chemical used as a raw material in manufacturing plastics and synthetic fibers. It is suspected to be cancer-causing.

to the referral of acrylonitrile to states, the Administrator has essentially decided that a national standard under section 112 is not appropriate and that such a decision is a proper exercise of his discretion.

The legality of EPA's referral of acrylonitrile and other air toxics to states will depend on whether the court decides that EPA's listing decisions under section 112 are mandatory or discretionary and, if discretionary, whether EPA's actions were an abuse of that discretion. These issues await resolution by the court.

EPA dropped the element of its strategy of formally referring pollutants and source categories to states for regulation, on the basis of reaction to the concept and experience with a pilot referral project. It is still encouraging states to evaluate pollutants and sources that the Agency has determined do not warrant national regulation, but may be high risk point sources of local concern. Under the current approach, EPA identifies the sources and furnishes the state and local agencies with the results of preliminary screening studies for their review. If states desire it, financial and technical assistance is available to assist them in further evaluation of the sources. In fiscal year 1986, EPA identified 10 sources under this approach and provided approximately \$10,000 to the states for each one. It is estimated that, in 1987, 30 more sources will be presented to states for evaluation.

Clean Air Act Does Not Preclude State Regulation of Air Toxics That EPA Does Not Regulate

The Clean Air Act does not preclude states from regulating sources of air toxics in cases where EPA does not regulate such sources. (The Clean Air Act also does not preclude states from regulating air toxics even if EPA is regulating them, as long as the state standard is no less stringent than the federal standard.) A 1983 STAPPA survey disclosed that the majority of states have air toxics programs based on authority contained in state laws. While an earlier STAPPA survey determined that more than half of the states have laws or policies that preclude them from adopting regulations more stringent than existing federal standards, EPA has indicated that its experience with the acrylonitrile pilot referral project disclosed that these state laws do not preclude the state from taking action if EPA decides not to regulate an air toxic. In fact, many states have programs regulating air toxics that are not covered by federal standards.

Clean Air Act Does Not Require Regulations to Be Consistent Among States

EPA's strategy of delegating regulatory responsibility to the states can result in inconsistencies among state regulations. Critics of the strategy say that such inconsistencies might result in adverse health and economic consequences. (These criticisms are discussed in detail in chaps. 3 and 4.) These critics contend that without minimum standards for controlling toxic emissions, people in one state could have less protection than those in another state. Likewise, critics suggested that states with less stringent regulations could become "pollution havens" as compared to more stringently controlled states. From a legal perspective, however, no provisions in the Clean Air Act require consistent regulation of air toxics among state programs.

Conclusions

One component of EPA's new air toxics strategy delegated to the states the responsibility to regulate sources of toxic air pollutants that do not pose national problems, including chemical plants and other industrial facilities. This component of the strategy included a program whereby EPA would formally refer specific air toxics and their sources to states for regulation.

The legality of the referral concept is currently the subject of litigation. Although EPA maintains that the referral program is legal, it has discontinued the formal referral program because of negative reaction to the concept and its own pilot referral project experience. This, however, does not change the role of the states in regulating air toxics on their own. In that regard, nothing in the Clean Air Act precludes states from regulating pollutants for which no national standard exists. The act does not require, however, that there be consistency among such state programs.

State Air Toxics Programs Vary in Scope and Stringency

The overall lack of progress on the federal level has led a growing number of states to begin regulating air toxics on their own. As of May 1986, a total of 46 states either had air toxics programs in place or under development. These programs vary considerably, however, in terms of the specific air toxics and source categories regulated, control strategies employed, and methods used to determine acceptable levels of toxic pollutants in the ambient air. Such differences from state to state could result in uneven public health protection from toxic air pollutants around the nation.

A major criticism of the part of EPA's June 1985 strategy that proposed increased delegation of responsibility to the states for air toxics regulation was that such an approach would, in fact, result in inconsistent regulation from state to state. While EPA has discontinued the program whereby it planned to formally refer specific air toxics and their sources to states for regulation, it still plans to allow states to set standards and regulate air toxics that it believes do not present national problems.

Status of State Air Toxics Programs

As of May 1986, 17 states had air toxics programs in place and 29 states had such programs under development. Table 3.1 identifies the specific states in each category.

Chapter 3
State Air Toxics Programs Vary in Scope
and Stringency

Table 3.1: Status of State Air Toxics Programs as of May 1986

Program in place	Program under development
Alabama	Arizona
California	Arkansas
Illinois	Colorado
Louisiana	Connecticut
Michigan	Delaware
Minnesota	Florida
Montana	Georgia
Nevada	Idaho
New Jersey	Indiana
New York	Iowa
Oregon	Kansas
South Carolina	Kentucky
Texas	Maine
Vermont	Maryland
Virginia	Massachusetts
Washington	Mississippi
Wyoming	Missouri
	New Hampshire
	North Carolina
	North Dakota
	Ohio
	Oklahoma
	Pennsylvania
	Rhode Island
	South Dakota
	Tennessee
	Utah
	West Virginia
	Wisconsin

Source: State and Territorial Air Pollution Program Administrators, January 1984, EPA National Air Toxics Information Clearinghouse, September 1985, and GAO contacts with selected state environmental agencies, May 1986.

Environmental officials in the four states without programs either in place or under development—Alaska, Hawaii, Nebraska, and New Mexico—informed us that either the issue of air toxics was not significant enough to warrant a program, or that resource constraints precluded the state from establishing a program.

State Programs Vary

State programs in place and under development vary considerably in terms of (1) what air toxics are regulated, (2) what control strategies are used, and (3) what represents an acceptable level of a toxic in the ambient air. A key difference among state programs involves how states set acceptable ambient levels (AAL) of toxic air pollutants.¹ As a result, pollution control varies from state to state.

State Approaches to Regulation

When states regulate pollutants not otherwise regulated by EPA, their methods of controlling and deciding what substances to control may vary. Differences include toxics regulated, control strategies used, and choices of acceptable levels of toxics, as shown in the following examples.

1. Some programs are or will be limited to a specific list of pollutants while others have no specific list of pollutants. For example, New Jersey's air toxics regulatory program lists 12 pollutants, Connecticut's program lists 853 pollutants, but Texas' program has no specific list of pollutants.
2. Some states restrict the types of sources to which air toxics policies apply. New Jersey's program, for example, regulates dry cleaners while Texas' program specifically exempts those sources. In New York, dry cleaning facilities whose construction commenced before May 10, 1981, and whose annual emissions of volatile organic compounds are 15 tons per year or less are exempt.
3. Some state air toxics regulations apply or will apply to new and modified sources only, while some state regulations also apply or will apply to sources that were in existence when the regulations were enacted. Texas' program falls into the former category while the program in New Jersey regulates both new and existing sources.
4. Some states have developed minimum emissions cutoffs and exempt sources emitting less than a specific amount of a pollutant. New Jersey, for example, exempts sources that emit .1 pounds per hour or less of a listed air toxic
5. Some states use or plan to establish levels of acceptable ambient concentrations. Other states set requirements for the technology a source

¹An AAL is the maximum concentration of an air toxic to which a member of the general public could be continuously exposed without any expected adverse health effect

will use to control pollution (control technology). Others use a combination of ambient concentrations and control technology. New Jersey requires state-of-the-art control technology for regulated sources of listed air toxics; however, the Deputy Director, Division of Environmental Quality, concedes that the use of state-of-the-art control technology alone as a control strategy may result in underregulation in some cases and overregulation in others. Texas, on the other hand, requires state-of-the-art control technology but also conducts a health effects assessment of the projected emissions from the source to determine if AALs would be exceeded, according to a permit engineer and the chief of the effects evaluation group of the Texas Air Control Board.

**State Approaches to Setting
Acceptable Ambient Levels
Vary**

A key difference among state programs involves how AALs for toxic air pollutants are set. Most states use or plan to use AALs in their air toxics programs. Under one of EPA's air pollution control programs, national ambient air quality standards have been established for six pollutants.² The same consistency is not present with respect to AALs developed by states under their own air toxics programs. Since health data on many toxic air contaminants are limited, and gathering and analyzing this data would be costly and resource-intensive, most state-developed AALs are derived from workplace (occupational) standards issued by various organizations. The states then apply varying safety and other factors in arriving at final AALs. The result: inconsistent AALs and uneven protection from toxic air pollutants from state to state.

In developing AALs, states use workplace standards published by the American Conference of Governmental Industrial Hygienists (ACGIH), the National Institute of Occupational Safety and Health (NIOSH), and the Occupational Safety and Health Administration (OSHA). For the same chemical, ACGIH, NIOSH, and OSHA frequently set different standards, often reflecting varying analyses and interpretations of essentially the same data, according to a 1984 study done by staff of the Massachusetts Department of Environmental Quality Engineering. The occupational standards most commonly used by the states are the Threshold Limit Value-Time-Weighted Averages (TLV-TWAs) established by the ACGIH. The TLV-TWA represents the average concentration to which nearly all workers can be exposed, 8 hours per day, 5 days per week, without adverse effects. The 8-hour average standard is designed to protect a worker from chronic (long-term) effects of exposure to a substance. To protect against more immediate effects from short-term exposure to a

²Carbon monoxide, lead, nitrogen dioxide, ozone, particulate matter, and sulfur dioxide

substance, the ACGIH may also provide a ceiling value not to be exceeded during any 15-minute period.

Most states rely primarily on the ACGIH standards, while some use NIOSH criteria, OSHA standards, or a combination of these occupational limits. New York, for example, uses ACGIH standards whenever available, while Texas selects whichever agency limits it considers most appropriate on a case-specific basis. Mississippi uses the median of several occupational guidelines for substances not believed to cause cancer.

To derive an AAL from whichever workplace standard is used, the state generally applies a safety factor and an averaging time for determining the acceptable exposure level. Safety factors are fractions applied to standards to account for sensitive populations (e.g., infants, senior citizens) as opposed to "healthy" workers, as well as for continuous as opposed to workplace (8-hour) exposure. Some states and localities apply different factors to different categories of pollutants, depending on toxicity or cancer-causing capacity. Generally, the smaller the fraction used to adjust the occupational limit, the more stringent is the ambient level. The averaging time over which the concentration is computed is also important; the shorter the averaging time, the more difficult it is for a source to meet the acceptable ambient level.

Because safety factors and averaging times vary significantly from state to state, state and local air pollution programs may not provide their citizens equal protection from air pollutants for which EPA has not set national standards, according to a 1986 study by two New Jersey Department of Environmental Protection scientists. A staff member of the Illinois Environmental Protection Agency reached a similar conclusion in an earlier study. That study compared the TLV-derived approaches used by five states and two organizations and found that the various approaches differed markedly in stringency. The study researcher concluded that it was disturbing that the approaches varied so greatly from state to state and organization to organization, and that a better consensus was needed to identify and solve the problems involved in using TLVs.

**Study Done to Increase
Consistency of AALs**

To increase regional consistency and reduce duplication of effort in setting standards, the Northeast States for Coordinated Air Use Management (NESCAUM) (composed of the six New England states plus New Jersey and New York) undertook a pilot effort to develop an acceptable AAL for the chemical perchloroethylene (a suspected carcinogen found

in cleaning fluids). The pilot project used a risk assessment to develop the AAL. Previously, NESCAUM had supported adopting interim guidelines using ACGIH TLVs divided by a factor of 420. EPA also participated in the pilot project, which began in May 1985. Staff members from EPA's Office of Air Quality Planning and Standards attended meetings, provided information on EPA risk assessment procedures, and reviewed areas of concern the NESCAUM committee may have missed. The committee also submitted the results of their work to members of the scientific community for review.

The pilot project represents NESCAUM's first effort to use a joint risk assessment process in setting an AAL. NESCAUM believes that the question of whether additional regional air toxics standards are developed in the future depends on how well the first risk assessment is received by the various state regulatory agencies, and/or how each state intends to proceed in conducting risk assessments and establishing regulations for toxic air pollutants.

Increased Delegation and the Referral Program Met With Negative Reaction

EPA's strategy of delegating increased responsibility to the states and the state referral component of the strategy met with negative reaction from various sources, including members of Congress, state and local officials, and environmental groups. Inconsistency among state pollution controls was a major source of criticism. Criticisms applied both to the pilot referral project and the general approach of delegating more air toxics regulatory responsibility to the states.

Objections to EPA's strategy to increased delegation of regulatory responsibility to the states were based on such concerns as the proper federal role in controlling air pollution, the potential economic impact of delegation, and state and local resources available to run the regulatory programs. The issue of inconsistency relates to several of these objections. For example, one concern was that state regulation is contrary to the premise that control of air pollution is an interstate problem which critically affects the public health and the economy, and that air pollution problems require a national solution. Two members of Congress argued that inconsistencies among state regulations might pit jobs against health by starting a race for attracting new jobs and industrial facilities, in which less regulated states might attract more industry. (This issue is discussed in detail in ch. 4.)

Other reactions included the following:

- Some critics were concerned that the program represented an abdication of federal responsibility to the public to set minimum health protection standards.
- The Conservation Foundation—a nonprofit environmental research organization—reported that, with delegation, states face inadequate funding and duplication of effort in health effects research assessment and standard setting.

Recommendations to Reduce Inconsistencies

STAPPA and ALAPCO believed that state and local agencies should handle certain air toxics problems but that there should be reasonable consistency in carrying out the referral program. STAPPA/ALAPCO recommended that EPA adopt the referral program as follows:

- Develop formal criteria for determining when pollutants should be regulated by federal standards versus the state/local option, and consult with states, local agencies, and others when considering a decision to regulate. In December 1985, these organizations proposed limiting referrals to source categories located in fewer than five states, with an estimated lifetime cancer risk of more than 1 in 1 million for the most exposed individual, and a total annual cancer incidence of less than one estimated fatality per year.
- Require minimum standards, such as Best Available Control Technology, for air toxics referred to the states, and issue guidance to state and local agencies defining this control technology for specific sources of toxic air pollutants.³
- Develop criteria to judge the adequacy of state and local air toxics control programs.
- Subject regulatory actions referred to state and local agencies to federal oversight and enforceability.

Because EPA was unable to reach agreement with STAPPA/ALAPCO on these issues, and because of its experience with a pilot referral project, the Agency discontinued the referral program.

³Best Available Control Technology refers to state-of-the-art air pollution control devices

Acrylonitrile Pilot Project Development

EPA developed a pilot project involving 14 states and one local air pollution agency to test an approach for handling pollutants that relies on state/local agencies to evaluate and, if appropriate, regulate the emitting sources.⁴ The chemical involved was acrylonitrile (AN), which is suspected to cause cancer. Although EPA pointed to some positive outcomes of the pilot test, the Agency, participating states, and concerned private organizations criticized several aspects of the AN project.

In its strategy, EPA planned two types of referrals to states. Under the first type, EPA planned to refer those pollutants that it decides do not pose a national health threat or are not produced widely enough to be regulated under section 112 of the Clean Air Act. Under the second type, EPA planned to refer those pollutants that it has listed under section 112 provisions, but which have individual source categories that can be more efficiently regulated by the states.

AN was referred to the states under the first referral option. In choosing this option, EPA decided that AN did not require national regulation. The decision was based on EPA's conclusion that estimated national cancer risks associated with AN were relatively low, and that AN emissions appeared to be localized and limited. EPA also believed that referring AN to the states would result in faster regulation and conserve EPA resources.

The AN pilot project involved 26 plants within four major AN source categories. EPA negotiated with each state and local agency to reach agreement on the responsibilities of both the involved agencies and EPA in assuring that each AN source in the four major source categories was properly analyzed. Specifically, these assurances were to determine if additional emission controls were necessary. Under the AN pilot project, the ultimate decision as to whether additional control would be required and the basis for requiring such control was the responsibility of the state or local air agency; it was not subject to the approval or disapproval of EPA.

EPA's Pilot Project Drew Varied Criticism

In a February 1986 workshop held to analyze the AN project's progress, EPA pointed to some positive results from the project. According to EPA

⁴The 14 states were Alabama, California, Connecticut, Delaware, Florida, Illinois, Iowa, Louisiana, Michigan, Ohio, S Carolina, Texas, Virginia, and West Virginia. The local agency was in Louisville, Kentucky.

the project had provided the focus for several states to initiate air toxics programs, and also spotlighted some of the country's major AN sources.

Other reactions to the project, however, were negative. These reactions varied from how long the program was taking to complete to concerns over whether AN had been an appropriate choice for state referral. Details of these reactions included the following.

1. STAPPA questioned whether AN was appropriate as a state regulated, rather than nationally regulated, chemical. The group suggested that if a chemical is emitted in 15 states, as is AN, it should not be considered a "local" problem that warrants no national standard. STAPPA also believed that if more AN source categories had been covered by the referral project, it would have been more national in scope.
2. The pilot project will take 3 years to complete, rather than the originally estimated 18 months, according to an EPA official. The same official estimated that final regulatory decisions on 15-20 of the 26 sources should be made by the winter of 1986, with the remainder being completed by the spring of 1987.
3. One EPA official was also disappointed that the participating states were moving toward general minimum standards, such as requiring state of the art controls, rather than regulations based on the estimated health risk for each plant.
4. The NRDC representative believed a shortcoming of the AN pilot referral was that it did not cover smaller sources of AN in the participating states or new sources that may come on line in the future.
5. States participating in the pilot project also identified several operational problems, including (1) insufficient EPA technical guidance on control techniques or risk assessment methods, (2) insufficient EPA financial support, (3) vagueness of EPA commitment to the AN pilot program, and (4) EPA's inability to provide guidance on appropriate levels of control following state evaluation of sources.

Conclusions

States have significant responsibilities for regulating air toxics under individual state law. This responsibility includes establishing AALs for air toxics emitted by facilities in their area, since few federal standards covering toxic air pollutants have been issued. While EPA provides financial and technical assistance to state air toxics programs, states have the

discretion—in the absence of federal standards—to decide which air toxics they will regulate and to what extent emissions will be limited. As a result, the AALs used in administering air toxics programs vary from state to state. This inconsistency could mean uneven protection of public health from exposure to air toxics. Under existing conditions, this inconsistency will likely continue.

Matters for Congressional Consideration

As discussed in chapter 2 of this report, the Clean Air Act does not require that state programs be consistent in regulating air toxics that are not federally regulated. Some concerns have been raised about the potential health effects of inconsistencies among state programs. During the reauthorization of the Clean Air Act, Congress may wish to consider the consistency issue and the options available to address it.

For example, the Congress may want to consider to what extent it wants EPA to be involved in and to monitor state programs. One option is to retain the status quo, that is, to continue to allow the states discretion in standard setting, compliance monitoring, and enforcement, but continue to provide financial and technical assistance to state air toxics programs. A second option would be for EPA to exercise more control over state air toxics programs. This added control on the part of EPA could take the form of one or more of the following actions:

- mandating a minimum level of control for sources of certain air toxics; e.g. those that emit carcinogens or suspected carcinogens;
- establishing criteria for what represents a good state program;
- carrying out regular federal oversight of state air toxics programs; and
- providing for federal enforceability in the event states do not discharge their responsibilities adequately.

Environmental Regulations Are Not Generally a Significant Factor in Industry Location Decisions

Some critics of delegating regulatory responsibility to states maintain that a state with fewer environmental controls could possess an advantage in attracting industry over a state with more stringent environmental regulations, thus creating "pollution havens." Environmental regulation is not usually a significant factor, according to studies of factors affecting industry location decisions. However, when other, more important factors balance, environmental regulation may play a decisive role in determining industry location choices.

Many Factors Jointly Influence Location Decisions of Industry

Many factors jointly influence the location decisions of industry. Industries generally select the location of their production activities in order to maximize profits. The costs of buying the necessary materials and transporting them to the production site and the costs of distributing the products to markets depend on this choice of location. As a result, when a profit-seeking firm chooses a location it is concerned with how production and distribution factors vary from region to region.

Different firms or industries will make different location choices because material, labor, transportation, and other input requirements vary among industries. For example, some industries may locate near a source of a raw material which is particularly important but which is costly to transport. In other industries, labor may be a particularly important factor, and thus firms will be sensitive to even small geographic variations in labor costs.

Although not a direct input to production, business regulations—including pollution abatement regulations—and state and local taxes also add to the cost of production. The extent to which fiscal and regulatory factors actually affect location decisions, however, has been debated. Some analysts claim that the types of policies controllable by state and local governments do not outweigh labor, materials, and transportation cost differences among areas. Others argue that favorable taxes and environmental regulations, financial incentive programs, and labor laws create a "business climate" which can cause a firm to choose one state over another in an otherwise close decision.

Business climate factors, however, including the stringency of environmental regulations, are best thought of as being of secondary importance in industry location decisions. That is, the differences in "business climate" among neighboring states might make a difference to a firm already committed to locating in that region of the country, but not committed to a particular state within the region.

Generally, at the national level the evidence suggests that there is little correlation between states' manufacturing growth rates and the availability of regulatory and fiscal incentives. At the regional level, however, state differences in business climate appear to be more strongly correlated with state differences in manufacturing growth. This is because intraregional differences in the cost factors that primarily influence location decisions—such as labor costs, energy costs, and transportation costs—are likely to be less distinct than interregional differences in these factors. Therefore, once an industry has chosen a region in which to locate, its choice of state location within that region is more likely to be influenced by remaining state differences in business climate factors, including environmental regulations.

New Jersey Department of Commerce officials provided us with an example of how differences in state regulation of a group of air toxics known as volatile organic substances may have influenced industry location in a region. In the case, New Jersey had attempted to convince a corporation to locate a manufacturing facility there. The firm manufactures dashboards for a major automobile manufacturer; New Jersey officials indicated that production and distribution factors restricted the firm's search to sites in New Jersey and neighboring Pennsylvania. The facility has the potential of emitting 80 pounds per hour of two solvents: methylene chloride and methyl chloroform. While New Jersey's volatile organic substance regulations limit the emissions of these solvents from industrial surface coating operations, Pennsylvania's regulations specifically exempt those two solvents from its requirements. The firm, therefore, decided to locate in Pennsylvania, according to a New Jersey official.

Finally, although production- and transportation-related factors, and fiscal and regulatory factors are most often important, some industries may be particularly concerned that the production location provide an acceptable quality of life for management and employees. If a clean environment and access to recreation areas serve to attract and retain employees, these industries may favor locations enforcing strict environmental standards. States may find themselves disadvantaged in attracting these industries if environmental regulations are relaxed.

Empirical Studies Have Identified and Ranked Factors Influencing Location Decisions

Numerous empirical studies have attempted to identify, isolate, and rank the primary factors influencing industrial location decisions. Generally, those studies that explicitly considered environmental factors did not find that such factors are of primary importance in industrial location decisions.

A recent study summarized the findings of 21 industrial location studies undertaken between 1949 and 1981.¹ Fourteen of those studies found that market access factors, including transportation, ranked among the top three locational influences or were otherwise regarded as important. Similarly, labor-related factors were found to be important in 14 studies, and natural resource factors were found to be important in six studies. On the other hand, taxes were found to be an important factor in only one study, but were found to be "not important" in 10 studies. Taxes are an important component of a state's business climate; the results of these studies suggest that, for industry location choices, business climate is less important than factors directly related to production and distribution.

Another recent study isolated the influence of environmental regulations on industrial location decisions.² The study examined 1,607 new manufacturing plants opened by Fortune 500 companies between 1972 and 1978. By controlling for state differences in characteristics that typically influence location choices, the study provided direct estimates of how environmental regulations affect location decisions. The study reported that data imprecisions prevented concluding that the effects were too small to be of any concern to state officials, but that current variations in state environmental regulations would reduce the number of new plants locating in that state by 3 to 8 percent. By comparison, a similarly large increase in a state's unionization rate would reduce the number of new plants locating in that state by 30 to 40 percent. The study reported that there was much more uncertainty surrounding the range of estimates for highly polluting industries, but the effects of increased stringency were probably larger.

¹Dang T. Tran, "Locational Factors in The Declining Industrial Competitive Advantage of the New York Urban Region" *Journal of Regional Science* Vol. 26, No. 1, (1986)

²Timothy J. Bartik, "The Effects of Environmental Regulation on Business Location in the United States," Department of Economics, Vanderbilt University, 1984

In 1983, a large-scale survey funded by the National Science Foundation focused specifically on the relative importance of environmental considerations on location decisions.³ Business decisionmakers responsible for making the location choices for new branch plants of large corporations were surveyed. The sample of firms included those thought to be especially affected by environmental issues and those deemed to be little influenced. The results were based on 54 in-depth interviews and 104 usable responses to a mail survey.

The study reported that environmental regulations had no systematic effect on either the size of a firm's search area for a new plant location, or on the number of sites considered. The study also suggested the idea that state differences in environmental regulations are more likely to influence the specific site choice when a regional choice has already been made. The study also found that firms do not want to install less costly abatement processes sufficient only to meet relatively lax environmental standards if they may have to undertake more costly procedures later in response to tighter regulations. Firms often construct new plants with state-of-the-art pollution abatement processes regardless of jurisdictional variations in regulations.

Another survey examined the location decisions pertaining to new branch plants and two other methods of increasing industrial capacity: expansion at an existing site, and relocation of the site of production.⁴ Of the reasons given by firms that chose a new location, environmental considerations were not prominent. Of plants that chose to open a new branch plant, only 3 of 158 firms mentioned environmental considerations as one of their reasons.

Analysis of Recent Trends

If industry expenditures to comply with environmental regulations are sufficiently important that state variations in them substantially influence business location decisions, then some relationship would be expected between changing industrial and regional fortunes and changing pollution abatement expenditure patterns. We examined trends in production, employment, and air pollution abatement expenditures across industries and across regions, though we did not hold all

³Howard A. Stafford, with Ethel A. Galzerano and James A. Kelley, The Effects of Environmental Regulations on Industrial Location, Department of Geography, University of Cincinnati, 1983

⁴Roger W. Schmenner, Making Business Location Decisions (Engelwood Cliffs, N.J.: Prentice-Hall, 1982)

other factors constant. If environmental regulations substantially influence location decisions, some relationship between abatement expenditures and production measures should nonetheless be evident. In fact, our analysis of trend data provides no indication that environmental regulations are a primary influence on industrial location decisions.

At the national level no clear cut relationship between air pollution abatement expenditure burdens across industries and industrial growth is apparent. We also did not find any clear relationship when we examined data at the state and regional levels. (See apps. I and II for detailed data.)

Pollution abatement costs, and state variations in them, may be a more important factor to those firms and industries that generate higher levels of pollution emissions. For example, the chemicals and allied products industry and the primary metals industry may be more responsive to geographic variations in abatement costs than most industries. Appendixes III and IV give detailed data on two industries particularly sensitive to pollution costs.

Delays in Permitting Process May Be Important

Empirical studies and examination of available data suggest no clear cut relationship between environmental regulations and location. However, assessing the importance of environmental regulations is difficult because variations among areas in how quickly an industry is formally permitted to build may be more important in the location decision than variations in direct abatement costs, especially if industries purchase and install only state-of-the-art abatement technologies in new plants. In one study, only 44 percent of respondents said that place-to-place variations in pollution control capital expenditures were influential, while 76 percent said that variations in uncertainties and anticipated delays in the permitting process were influential. Permit preparation and review may take 2 to 3 years in the case of a major new source. Thus, two states with identical regulations requiring identical levels of abatement expenditures for a proposed plant will nonetheless differ in attractiveness if one state offers a more streamlined permitting process and less uncertainty concerning the ultimate outcome.

Conclusions

Studies of industry location decisions generally indicate that stringency of environmental regulation does not significantly affect such decisions. Although environmental regulations become more important when other

Chapter 4
Environmental Regulations Are Not
Generally a Significant Factor in Industry
Location Decisions

factors are equal, inconsistency among state programs does not necessarily result in more industry—and more pollution—for states with less stringent regulations.

Relationship Between Air Pollution Abatement Expenditures and Value of Shipments for 11 Industries at the National Level

Industry	Percentage				
	Air pollution abatement expenditures' share of shipments		Industry's share of air pollution abatement expenditures		Industry's share of value of manufacturing shipments
	1972	1977	1982	1977	1982
All manufacturing	0.18
Textiles	0.03	0.49	0.43	2.98	2.44
Paper	0.26	5.96	5.98	3.83	4.06
Chemicals	0.33	14.98	16.09	8.70	8.67
Petroleum	0.57	26.84	34.58	7.17	10.69
Rubber	0.04	0.88	0.64	2.91	2.82
Stone	0.32	6.32	4.13	2.61	2.30
Primary metals	0.86	32.21	25.96	7.59	5.34
Fabricated metals	0.04	1.80	1.41	6.63	6.04
Electrical equipment	0.04	1.25	1.59	6.51	7.59
Transportation equipment	0.05	2.70	3.06	12.29	10.34
Instruments	0.03	0.40	0.37	2.13	2.64

Source: U.S. Bureau of the Census data, GAO calculations

Relationship Between Air Pollution Expenditures for Manufacturing Industries by Nine U.S. Regions and Value of Shipments

Percentage

	Air pollution abatement expenditures' share of manufacturing shipments		Region's share of air pollution abatement expenditures		Region's share of value of manufacturing shipments	
	1982		1977	1982	1977	1982
United States	0 18		•	•	•	•
New England	0 04		1 37	1 26	4 99	5 40
Mid Atlantic	0 17		17 30	14 67	16 25	15 02
East North Central	0 16		22 12	20 40	27 89	22 48
West North Central	0 08		3 51	3 62	8 03	7 93
South Atlantic	0 15		10 54	11 32	11 02	13 08
East South Central	0 16		6 92	5 54	6 39	6 19
West South Central	0 33		19 38	25 62	11 01	13 84
Mountain	0 26		5 41	4 23	2 45	2 90
Pacific	0 18		13 44	13 34	11 98	13 16

Source U S Bureau of the Census data, GAO calculations

Relationship Between Changes in Primary Metals Industry Air Pollution Abatement Expenditure Patterns and Changes in State's Employment and Value of Shipments

Selected states	Rank order			
	Value of shipments 1982	Change in employment 1977-1982	Change in value of shipments 1972-1982	Change in air pollution abatement expenditures 1977-1982
Pennsylvania	1	40 B	39 B	21 B
Ohio	2	39 B	36 B	3 T
Indiana	3	36 B	1 T	1 T
Illinois	4	37 B	37 B	2 T
Texas	5	5 T	2 T	5 T
Michigan	6	38 B	38 B	15
New York	7	35	35 B	6
California	8	33	4 T	16
Alabama	9	34	34	20 B
Washington	10	23	8	4 T
Massachusetts	16	14	3 T	18 B
Arizona	17	11	15	19 B
Connecticut	18	25	26	13
Georgia	21	15	30	•
Utah	22	•	•	•
South Carolina	24	1T	5T	10
North Carolina	25	1T	6	•
Oregon	27	16	16	•
Minnesota	35	20	25	•
Mississippi	36	4T	17	•
New Hampshire	38	3T	21	•
Number of states	42	40	39	21

T signifies that state is ranked in the top 5 states in this category
 B signifies that state is ranked in the bottom 5 states in this category

Source: U.S. Bureau of the Census data, GAO calculations

Relationship Between Changes in Chemical Industry Air Pollution Abatement Expenditure Patterns and Changes in States' Employment and Value of Shipment

Selected states	Rank order			
	Value of shipments 1982	Change in employment 1977-1982	Change in shipments 1977-1982	Change in air pollution abatement expenditures 1977-1982
Texas	1	1 T	1 T	1 T
New Jersey	2	43 B	2 T	19
Louisiana	3	8	4 T	2 T
Illinois	4	46 B	3 T	4 T
Ohio	5	38	7	11
California	6	30	6	13
New York	7	42 B	5 T	5 T
Pennsylvania	8	45 B	12	7
Tennessee	9	41	10	27 B
North Carolina	10	4 T	9	20
Georgia	17	2 T	16	6
Washington	32	3 T	28	28 B
Arkansas	29	5 T	29	15
Michigan	13	44 B	17	16
Idaho	34	11	33	•
Florida	15	10	13	3 T
Alabama	20	14	25	8
Delaware	27	36	31	31 B
Massachusetts	24	33	27	23
Connecticut	23	9	26	26
Minnesota	30	17	32	29
Number of states	47	46	46	31

T signifies that state is ranked in the top 5 states in this category

B signifies that state is ranked in the bottom 5 states in this category

Source U S Bureau of the Census data, GAO calculations

Major Contributors to This Report

**Resources, Community,
and Economic
Development Division
Washington, D.C.**

Hugh J. Wessinger, Senior Associate Director, 275-5489
William F. McGee, Group Director
Larry A. Goldsmith, Assignment Manager
Mehrzaad Nadji, Economist
Stephen M. Brown, Economist
Doreen S. Stolzenberg, Attorney
Leah B. Cates, Writer-Editor

**New York Regional
Office, New York, N.Y.**

James D. Van Blarcom, Evaluator-in-Charge
Allen W. Gendler, Evaluator

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