United States General Accounting Office

GAO

Report to the Chairman, Subcommittee on Superfund, Ocean and Water Protection, Committee on Environment and Public Works, U.S. Senate

October 1991

INDOOR AIR POLLUTION

Federal Efforts Are Not Effectively Addressing a Growing Problem

GAO/RCED-92-8

GAO

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

Resources, Community, and
Economic Development Division

B-245313

October 15, 1991

The Honorable Frank R. Lautenberg
Chairman, Subcommittee on Superfund,
Ocean and Water Protection
Committee on Environment and
Public Works
United States Senate

Dear Mr. Chairman:

With the increased emphasis on energy conservation in the 1970s, and the identification of radon and asbestos as causing serious health problems, public concern about indoor air pollution has increased. Elevated levels of indoor pollutants—such as second-hand tobacco smoke, formaldehyde used in pressed wood products, molds in ventilation systems, and paint strippers and other solvents containing methylene chloride—can cause headaches, fatigue, respiratory diseases, and cancer. In the early 1980s the Congress began funding Environmental Protection Agency (EPA) programs to identify indoor air pollution sources—in addition to radon and asbestos—and conduct research on the health effects of such pollutants. In 1986 the Congress enacted title IV of the Superfund Amendments and Reauthorization Act (SARA), which directed EPA to develop an indoor air research program, disseminate the results of the research, establish an advisory committee comprised of federal agencies to assist EPA in carrying out the program, and report to the Congress on federal indoor air activities.

As you requested in January 1990, this report discusses EPA's indoor air pollution efforts and funding, the indoor air efforts of seven other federal agencies, and the efforts of eight states with active indoor air programs.

Results in Brief

In implementing title IV of SARA, EPA issued a report to the Congress in 1989 that described four courses of action directed at research and two at developing guidelines and disseminating information on actions that can be taken to reduce indoor air pollution.[1] EPA has made progress in all six areas, but it believes more research is needed to better define the health effects of indoor air pollutants and develop control measures for these pollutants. Furthermore, since 1986 EPA has increased the funds

[1] Report to Congress on Indoor Air Quality, August 1989.

allocated to indoor air pollution; however, funding levels have not been commensurate with the high health and environmental risks of such pollution. In a 1987 report EPA ranked indoor air pollution fourth among 31 environmental issues,[2] and in a 1990 study, EPA's Science Advisory Board advised EPA to give higher priority to funding high-risk environmental problems such as indoor air pollution.[3]

Federal agencies other than EPA have programs that affect indoor air quality, and title IV of SARA required EPA to work with these agencies to address indoor air issues. The Interagency Committee on Indoor Air Quality (CIAQ) was established for this purpose, but there has been limited commitment from the other agencies. Furthermore, CIAQ has not been as effective as it could be primarily because it lacks a clear charter that defines the roles and responsibilities of other federal agencies and how the agencies will work together to address indoor air issues. Without such a charter, some indoor air activities are not being accomplished because a national agenda has not been established for indoor air that determines what projects need to be completed, which agencies should be responsible for the projects, and what the time frames are for their completion.

Most of the states with active programs that we contacted concentrate on mitigating indoor air pollution through increased ventilation. Six of the state programs we visited were in the two EPA regions that work actively with the states to develop indoor air programs. Given the success of such programs, EPA plans to initiate indoor air programs in its eight other regional offices.

Background

In the 1970s increased emphasis on energy conservation measures, such as using more energy-efficient building materials and reducing the air exchange rates of ventilation systems, resulted in increases in indoor air pollution in offices and homes. For example, energy efficiency measures sometimes result in lower air exchange rates for ventilation systems and cause pollutants, such as second-hand tobacco smoke, dust mites, carbon monoxide, benzene, and pesticides, to remain indoors and contribute to indoor air problems. Additionally, certain materials used in carpets, insulation, and home and office furniture contribute to the overall

[2]Unfinished Business: A Comparative Assessment of Environmental Problems, February 1987.

[3]Reducing Risk: Setting Priorities and Strategies for Environmental Protection, September 1990.

indoor air problem by giving off chemical emissions. Therefore, the elevated levels of such pollutants increase the health risks—headaches, fatigue, respiratory diseases, and cancer—for building occupants when such materials, along with air exchange rate reductions, are employed.

By the early 1980s research began demonstrating the significance of indoor air pollution, and between fiscal years 1984 and 1986, the Congress appropriated approximately $2 million annually for EPA to conduct indoor air research. However, according to EPA there was considerable debate and uncertainty among federal agencies about the appropriate government role. For example, questions were raised about whether federal agencies could implement policies or regulations that would infringe on the rights of citizens in private residences.

As concern over the risks to human health from indoor air pollutants increased, the Congress enacted title IV of SARA in 1986. Title IV directed EPA to develop an indoor air research program, disseminate the results of the research, establish an advisory committee comprised of federal agencies to assist EPA in carrying out the program, and report to the Congress on federal indoor air activities. One reason for establishing the advisory committee was that a number of federal agencies, other than EPA, have programs affecting indoor air quality. Federal agencies with the largest indoor air program responsibilities, other than EPA, are the Consumer Product Safety Commission (CPSC), National Institute of Occupational Safety and Health (NIOSH), Occupational Safety and Health Administration (OSHA), and Department of Energy (DOE). For example, NIOSH estimates that about 30 percent of its health and safety inspections involve indoor air problems. Furthermore, DOE is conducting research on the impact on indoor air quality of energy conservation materials and reduced air exchange rates of ventilation systems. Appendix II discusses the indoor air pollution activities and resources of these and the other federal agencies that we contacted.

In 1989 and 1990 indoor air legislation was introduced in the Congress that called for more direct focus on indoor air by establishing a national program to reduce the human health threat caused by such pollution. Although the Senate passed its indoor air bill, the Congress did not enact any of the proposed legislation. Similar legislative proposals were introduced in both houses of the Congress in 1991. These legislative proposals go beyond research and require more emphasis on source control and mitigation of indoor air pollution.

EPA's Indoor Air Pollution Activities

As required by SARA, EPA, with information from other federal agencies, reported to the Congress on federal efforts to address indoor air pollution in 1989 and recommended six courses of action that the federal government could take to address the problem. The recommendations included the following:

- Conduct research to (1) determine the extent of exposure and the effects on health of chemical pollutants found indoors, (2) identify and mitigate the effects of biological pollutants found indoors, (3) identify and control the sources of indoor air pollutants, and (4) determine the health effects of indoor air pollution in commercial and public buildings and residences.
- Establish guidelines for designing, operating, and maintaining buildings and ventilation systems.
- Provide assistance and disseminate materials concerning indoor air pollution.

To address the recommendations, EPA has conducted research to identify indoor air pollutants and pollution sources and develop control measures for these pollutants. EPA has also disseminated information and provided training and technical guidance on indoor air pollution.

Although EPA has made progress in addressing the recommendations, it believes a significant amount of research still needs to be conducted to determine the full magnitude of the indoor air problem and the control strategies that will work the best. Appendix I discusses in more detail the progress that EPA has made in addressing the recommendations as well as the actions that EPA believes still need to be done.

EPA's Office of Research and Development (ORD) conducts indoor air research—the primary focus of title IV. ORD's efforts involve identifying the health effects of pollutants, measuring the concentrations of various pollutants, and developing methods for reducing or eliminating the pollutants. ORD has completed research projects on the health effects of some pollutants and compounds found indoors, such as second-hand tobacco smoke, formaldehyde, and carbon monoxide. Research projects are also being conducted to (1) determine the sources of indoor air pollution from carpets, office furniture, and room partitions and (2) develop control measures for other pollutants such as molds, tobacco smoke, and dust mites. ORD's engineers are also studying large buildings to determine how ventilation systems and other factors affect the indoor environment. According to ORD, the other areas that need to be addressed include the impact that unhealthy indoor air has on the productivity of

office workers and the health effects of biological contaminants found indoors.

Even though it has grown, ORD's indoor air budget has been significantly less than the $10 million that EPA officials believe is needed annually to undertake the necessary research. ORD's indoor air funding has increased gradually from $2.3 million in fiscal year 1986 to $3.9 million in fiscal year 1990. ORD's fiscal year 1991 indoor air budget was initially authorized for $5.8 million. However, according to EPA officials, when the Congress reduced EPA's overall research budget for fiscal year 1991, ORD reduced its indoor air budget to $4.3 million, causing a number of research projects to be suspended. For example, the $600,000 budgeted for fiscal year 1991 for research related to biological pollutants, such as molds and bacteria, was eliminated because it was a new research effort, which was easier to delay than other ongoing projects. Because ORD considered biological research to be a critical part of the agency's overall indoor air research effort, it took innovative steps during fiscal year 1991 to fund much of this research from other research areas. EPA has also supplemented its limited indoor air research funding by working with industry to accomplish some indoor air research. For example, a cooperative agreement between EPA and Dow-Corning resulted in research related to cleaning biological pollutants from ventilation systems.

Even though EPA has completed a number of research initiatives and has others ongoing, ORD officials see many unanswered questions relative to indoor air pollution. EPA officials recognize the need for additional indoor air research funding, but the lack of a legislative mandate with specific time frames for addressing indoor air problems has limited the resources that the agency has dedicated to indoor air research.

EPA's Indoor Air Division (IAD) is responsible for distributing information on indoor air quality to the public, state and local governments, and the private sector and for providing training materials to building managers, state and local indoor air programs, and school officials. IAD is also drafting guidelines for such groups as building owners and managers, homebuilders, architects, and engineers to identify and deal with indoor air problems. For example, the technical guide for architects and engineers will discuss the principles of indoor air quality and their application in the design and construction of new buildings. IAD's budget for disseminating information and coordinating other activities on indoor air pollution has steadily increased from $50,000 in fiscal year 1986 to $2.3 million in fiscal year 1991. IAD believes a budget more on the order

of $25 million annually will eventually be needed to effectively carry out its indoor air role.

EPA's Emphasis on Indoor Air Pollution Is Not Commensurate With the Health Risks

Even though EPA recognizes that indoor air pollution represents a serious health risk with symptoms ranging from eye irritation, headaches, and fatigue to respiratory diseases and cancer, funding levels have not been commensurate with these health risks. In its Unfinished Business report, EPA ranked indoor air pollution fourth among 31 environmental problems in terms of the risk it poses to human health and the environment based on the opinions of a task force of 75 EPA scientists, engineers, and managers. Similarly, in a 1990 study EPA's Science Advisory Board advised EPA to give higher priority to funding high-risk environmental problems, such as indoor air pollution.

EPA's indoor air program budget for fiscal year 1991 was $6.6 million, less than 4 percent of EPA's overall air program budget. EPA's overall budget has remained essentially level for over a decade, but its program responsibilities have increased significantly. According to EPA officials, one of the primary reasons that indoor air programs have not received more funding is that they compete in EPA's constrained budget process with other air quality programs that have legislative mandates. For example, EPA's air quality programs with legislative deadlines, such as those aimed at regulating toxic air emissions, attaining national air quality standards, and reducing automotive emissions, are given higher priority when budget decisions are made. Although title IV of SARA requires EPA to establish an indoor air research program, it does not set time frames or require EPA to take any specific measures to control indoor air pollution. In contrast, programs that have legislative mandates—such as attaining national air quality standards, ranked 22nd in EPA's Unfinished Business report—are given higher funding priority. In fact, in fiscal year 1990 the research funding for the national air quality standards was $18.4 million, more than four times greater than the $4.3 million for indoor air research.

Better Coordination Needed Among Federal Agencies

In passing title IV of SARA, the Congress expected EPA to work with other federal agencies that have programs affecting indoor air quality and to develop a national program addressing indoor air pollution. Although CIAQ was established for this purpose, it has not been as effective as it could be because of the limited commitment of other federal agencies. Furthermore, CIAQ lacks a clear charter that establishes the roles and

responsibilities of all federal agencies and defines how the agencies will work together to address indoor air issues.

Limited commitment to CIAQ is reflected in other agencies' lack of participation in the Committee. For example, even though CIAQ is co-chaired by EPA, CPSC, DOE, and the Department of Health and Human Services, EPA provides leadership for the Committee and usually develops the agenda for and chairs the quarterly CIAQ meetings. While other agencies do make some presentations at the meetings, comprehensive discussions of what each agency is doing, and more importantly what each agency should be doing, are usually not part of the agenda.

Limited commitment could result from no clear mandate from the Congress. Although EPA has a legislative mandate to develop an indoor air program, other federal agencies have no clear legislative mandate to guide their indoor air efforts or provide a basis to prioritize funding for these efforts. For example, OSHA is responsible for ensuring the health and safety of employees in all workplaces; however, OSHA's primary focus is on the health and safety hazards of industrial and manufacturing workplaces because it does not consider indoor air pollution risks in an office to be as significant. Additionally, the National Institute of Environmental Health Sciences, which is responsible for conducting research to determine the health effects of harmful chemicals and substances, has no real focus on indoor air pollution. In terms of funding, four of the seven agencies we contacted did not identify indoor air pollution programs separately in their budgets. Funding for indoor air at the other three agencies represented an average of 1.7 percent of the agencies' overall budgets.

CIAQ lacks a clear charter because the roles and responsibilities of each member agency are not adequately defined to ensure that the Committee realizes the full benefit of the agencies' expertise and resources. The lack of clearly defined roles is demonstrated by the fact that both CPSC and EPA have conducted research on the safety and health of kerosene heaters. Furthermore, CIAQ has not established a national agenda for indoor air, determined what projects would be needed to meet that agenda, determined which agencies would best be responsible for the projects, or set time frames for their completion. Rather, CIAQ simply publishes a list of federal agencies' indoor air projects.

State Indoor Air Efforts

At the time of our review, 2 of EPA's 10 regional offices —Region I located in Boston, Massachusetts, and Region X located in Seattle, Washington—had active indoor air programs. These two programs have played an important role assisting states to establish and maintain effective, viable indoor air programs. The two regions sponsor meetings with state and federal agencies to discuss indoor air pollution issues, distribute EPA publications and other information on federal indoor air activities, and set up lines of communication from state to state.

Eight of the 10 states in the two regions have initiated state programs. These efforts are directed at providing information and assistance to building owners and managers on ways of reducing pollution levels by increasing air exchange rates, properly maintaining ventilation systems, and testing for and controlling certain indoor air pollutants. However, these state programs have been hampered by difficulty in identifying what constitutes harmful indoor concentrations of known pollutants and by lack of funding. Efforts to address indoor air pollution by the eight states we visited are discussed in appendix III.

Sharing information among states about specific indoor air problems can have positive results. During an indoor air meeting sponsored by EPA Region I, Rhode Island's indoor air pollution officials discussed a problem with carbon monoxide levels in ice skating rinks that they had identified and measures that they had implemented to correct the problem. After learning about the carbon monoxide problem in Rhode Island's ice-skating rinks, Connecticut indicated its interest in initiating similar measures to address the same problem.

EPA's active participation also has overcome coordination problems created by organizational differences in states' indoor air programs. Even though most states consider indoor air pollution to be a health or multiagency issue, EPA's regional programs have recognized these state differences and developed networks that accommodate individual state structures. For example, Region I invites representatives from the Massachusetts Departments of Public Health and Labor and Industry to attend the quarterly meetings since both agencies have some responsibilities for indoor air pollution in Massachusetts.

Recognizing the important role that these two regional offices have played in coordinating states' activities, EPA plans to set up active indoor air pollution programs in its other regional offices during fiscal year 1992.

Conclusions

While EPA has made progress in addressing the six recommendations contained in its 1989 report to the Congress, it recognizes that more needs to be done, particularly in research directed toward (1) identifying additional sources and materials that emit harmful indoor air pollutants and (2) developing control strategies for biological pollutants, such as molds, bacteria, and dust mites.

EPA's research has been, and likely will be, constrained by lack of funding. Contributing to this situation is the fact that EPA's overall program responsibilities have increased greatly over the last 10 years while its budget has essentially remained level. In this constrained budget environment, EPA should consider health and environmental risks as well as the legislatively mandated time frames and goals of other programs when allocating its limited air program resources among indoor air and other air programs.

With respect to the indoor air efforts of other federal agencies, a national program based on federal agencies working together as envisioned in title IV of SARA has not materialized. While CIAQ appears to be a good starting point for such an endeavor, limited participation by other agencies and lack of a clear CIAQ charter have inhibited its effectiveness. We believe that CIAQ member agencies could ensure a better coordinated federal indoor air pollution effort and prevent duplication of their efforts if they identified and prioritized needed projects; established specific indoor air pollution projects; assigned responsibilities for the projects; set time frames for accomplishing the projects; and shared the results with each other. Furthermore, legislatively established mandates that require federal agencies to take a more active role in addressing indoor air pollution issues within the purview of their existing program objectives would help ensure that the indoor air program competes on an equal basis for funding with other legislatively mandated programs.

EPA's regional offices offer the agency an excellent opportunity to foster the development of state indoor air programs, and the two regions with active programs have been successful in developing active state programs. We believe that EPA's plans to initiate similar programs in other regions will help to initiate programs in other states.

Recommendations to the Administrator, EPA

We recommend that the Administrator, EPA, examine the agency's indoor air research budget to ensure that funding for the indoor air pollution program is consistent with its high health and environmental risk.

To elevate the attention given to indoor air pollution and to leverage EPA's influence with other federal agencies, we recommend that the Administrator work with other members of CIAQ to develop a clear charter that capitalizes on the indoor air expertise of each federal agency and clearly defines the roles and responsibilities of each agency to improve coordination and information sharing among EPA and the other agencies responsible for indoor air issues.

Matters for Consideration by the Congress

Legislative proposals to strengthen the federal response to indoor air pollution have been introduced in both houses of the Congress. We believe that strengthening CIAQ will help EPA and other agencies focus their indoor air efforts even without additional legislative authority. Nevertheless, given the many priorities of the other federal agencies that have roles in addressing indoor air pollution and the increasing competition for limited funding, the Congress, in debating the Indoor Air Quality Act of 1991, may wish to consider giving other federal agencies more specific mandates in this area. The mandates could require these agencies to take more active roles in addressing indoor air pollution issues within the purview of their existing program objectives and coordinate their indoor air efforts with other federal agencies.

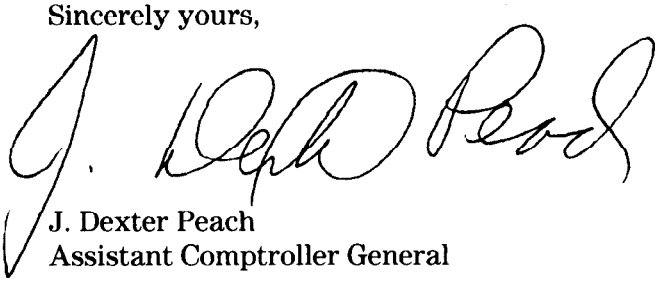
Our work, which was conducted between July 1990 and May 1991, was performed in accordance with generally accepted government auditing standards. Appendix IV discusses the full scope and methodology for the assignment and identifies the agencies that we visited.

As requested, we did not obtain official agency comments on a draft of this report. We discussed the facts contained in our report with officials from EPA and seven other federal agencies. EPA and five of the other agencies generally agreed with the facts as presented, and we included their comments where appropriate. NIOSH and OSHA provided updated information on their indoor air programs, which we have included in the report.

As arranged with your office, unless you publicly announce its contents earlier, we plan no further distribution of this report until 30 days from

the date of this letter. At that time, we will send copies to the Administrator, EPA, and other interested parties and make copies available to others upon request. This report was prepared under the direction of Richard L. Hembra, Director, Environmental Protection Issues, who can be reached at (202) 275-6111. Major contributors are listed in appendix V.

Sincerely yours,



J. Dexter Peach
Assistant Comptroller General

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Abbreviations

CIAQ	Interagency Committee on Indoor Air Quality
CPSC	Consumer Product Safety Commission
DOE	Department of Energy
EPA	Environmental Protection Agency
GSA	General Services Administration
HUD	Department of Housing and Urban Development
IAD	Indoor Air Division
NIEHS	National Institute of Environmental Health Sciences
NIOSH	National Institute of Occupational Safety and Health
ORD	Office of Research and Development
OSHA	Occupational Safety and Health Administration
SARA	Superfund Amendments and Reauthorization Act

Recommendations From EPA's 1989 Report to Congress on Indoor Air Quality

The report describes the Environmental Protection Agency's (EPA) efforts to implement a national indoor air program. It is comprised of three volumes and an executive summary and includes six recommendations that EPA deemed to be the appropriate steps for establishing a comprehensive, coordinated program to address indoor air pollution. To date, EPA has initiated research and program activities to address each of the recommendations. The following is a list of the six recommendations, EPA's primary activities addressing each, and the Office of Research and Development's (ORD) assessment of some of the research that needs to be done.

1. Significantly expand research to better characterize the extent of exposure and effects on health of chemical contaminants and pollutant mixtures commonly found indoors.

EPA has

- constructed test chambers to conduct exposure studies to measure human responses to low levels of emissions of chemicals from building materials and chemicals used as indoor cleaning solvents;
- initiated an animal studies program to permit testing of volatile organic compounds to evaluate respiratory, immune system and neurological responses and to assess the additive or interactive effects of mixing the compounds;
- funded a workshop to develop a research agenda to explore issues on the additive or interactive effects on human health of exposure to multiple chemicals in the indoor air; and
- conducted studies to determine health effects of a number of chemical contaminants and mixtures, including second-hand tobacco smoke, carbon monoxide, nitrogen dioxide, and other particles.

EPA sees need for

- research to identify new and improved monitoring and analytical methods, especially for second-hand tobacco smoke, volatile and semi-volatile organic compounds, and biological pollutants;
- research to identify behavioral, physiological, neurophysiological, inflammatory, and allergic reactions which characterize health effects through study of comparative irritancy and thresholds of individual or mixtures of pollution products; and
- continuous improvement of indoor air models to realistically evaluate human exposures.

2. Develop research to characterize and develop mitigation strategies for biological pollutants in indoor air.

EPA has

- developed plans for assessing biological pollutants in indoor environments and, with funding obtained from EPA's Cincinnati lab, has begun a study of biological pollutants.

EPA sees need for

- performing a formal health assessment of biological pollutants found indoors to address the sources and species of biologicals found indoors;
- developing specific objectives for monitoring biologicals and making them a part of EPA's compendium of indoor air sampling methods; and
- understanding the effect of environmental and source conditions on biologicals' growth and survival indoors, especially those found in ventilation and air-handling systems.

3. Significantly expand research to identify and characterize significant indoor air pollution sources and to evaluate appropriate mitigation strategies.

EPA has

- developed testing procedures for evaluating the emission characteristics of building materials and consumer products;
- conducted a number of studies on second-hand tobacco smoke, which is a major source of indoor air pollution, including determining the appropriate methods for measuring the direct effects on the human body from the exposure of children in homes;
- conducted a lung cancer study to estimate the number of cancer deaths each year caused by second-hand tobacco smoke exposure;
- initiated fundamental research to determine the behavior of indoor materials that absorb organic compounds; and
- led initiatives to promote the concept of materials that emit less hazardous chemicals in the building industry.

EPA sees need for

- research to emphasize the effects of volatile organic compounds mixtures on neurological behavior and physiologic effect in humans and the

establishment of an animal inhalation exposure facility to assist in evaluating volatile organic compounds from indoor sources;
- research focusing on hypersensitivity, neurological toxicity, and annoying properties of chemical mixtures; and
- continuation of research to assess human response to mixtures, including assessments of the genetic toxicity of emissions from various indoor combustion appliances and associated mitigation strategies.

4. Develop a program to promote, in conjunction with appropriate private sector organizations, guidelines covering ventilation, as well as other building design, operation, and maintenance practices for ensuring that indoor air quality is protective of public health.

EPA has identified seven target areas for initial guidance development on building design and performance. The documents are

(1) a guide for owners and operators of public and commercial buildings on preventing indoor air quality problems;

(2) a guide for homebuilders on basic concepts of home design influencing indoor air quality;

(3) a guide to workplace smoking policies;

(4) an introduction to indoor air quality for personnel handling health and safety in schools;

(5) an introduction to indoor air quality for physicians;

(6) problem-solving approaches for owners and operators of public and commercial buildings with existing indoor air quality problems; and

(7) introductory principles of indoor air quality for architects and engineers.

These drafts are in varying stages of development.

5. Develop a program of technical assistance, and information dissemination, similar in scope to the agency's radon program, to inform the public about risks and mitigation strategies, and to assist state and local governments and the private sector in solving indoor air quality problems. Such a program should include an indoor air quality clearinghouse.

EPA has

- developed a training course on indoor air quality information that state and local health people need to enable them to respond to inquiries and other indoor air quality problems;
- drafted a self-paced training module containing introductory information and in-depth reference material for state and local health people;
- developed indoor air outreach programs in two of its regional offices;
- written and distributed a number of publications for both specific audiences and the general public on various indoor air quality issues, including second-hand tobacco smoke, ventilation, and office air quality;
- developed two draft documents on second-hand tobacco smoke—a Guide to Workplace Smoking Policies and an assessment of the risk to non-smokers from second-hand tobacco smoke—which were reviewed by EPA's scientific advisory panel called the Science Advisory Board; and
- developed a draft plan for an indoor air quality clearinghouse, but as of April 1991, the clearinghouse was not operational; it is a high priority to have an operational clearinghouse in fiscal year 1992.

6. The federal government should undertake an effort to characterize the nature and pervasiveness of the health impacts associated with indoor air quality problems in commercial and public buildings, schools, health care facilities, and residences, and develop and promote recommended guidelines for diagnosing and controlling such problems.

EPA has

- conducted big-building studies on the Library of Congress and the EPA building, in conjunction with the Department of Energy (DOE) and the National Institute of Occupational Safety and Health (NIOSH), to explain health effects associated with pollution concentrations and to evaluate personal complaints in relation to environmental parameters and
- planned a joint program with NIOSH, DOE, and other federal agencies to begin in 1992 for more building studies, one objective of which is to extend the development of scientifically valid plans for the scientific investigation and characterization of public and commercial buildings for use by government agencies.

EPA sees need for

- an expansion of its capability to study buildings by developing a building study program that will apply diagnostic procedures developed by the research program and will integrate the monitoring and health

resources of the agency in a coordinated effort to explain and evaluate environmental conditions and status of health found indoors, especially in large buildings, and

- studies to evaluate the productivity of office workers exposed to unhealthy indoor air.

Indoor Air Efforts of Select Federal Activities

Consumer Product Safety Commission (CPSC)

CPSC recognizes that some consumer products contribute to indoor air pollution, and the agency has identified specific hazards presented by a number of these products. However, CPSC's primary interest is in products that pose the greatest danger to the public. CPSC looks for opportunities to address indoor air pollution as it seeks to ensure the safety of consumer products. In fact, CPSC has a number of projects under way addressing indoor air pollution, including

- formaldehyde emissions from pressed wood products;
- carbon monoxide, nitrogen dioxide, and other dangerous emissions from un-vented space heaters, kerosene heaters, and wood burning stoves;
- biological pollutants emitted from humidifiers;
- methylene chloride and benzene emissions from paint removers and other products;
- trichloroethylene used as an organic solvent;
- glycol ethers used in household cleaning products; and
- volatile organic chemical emissions from a number of household products.

Even though CPSC has conducted a number of studies, the funds budgeted for indoor air pollution are a small part of the agency's budget and are decreasing. CPSC's fiscal year 1991 budget for the Hazard Assessment and Reduction Program that includes its indoor air efforts is only 4.8 percent of the Commission's total budget. Furthermore, between fiscal years 1989 and 1991, the program's budget declined by 14 percent from $2.1 million to $1.8 million. CPSC's 1991 budget request attributes this decline in its Hazard Assessment and Reduction Program budget primarily to the elimination of contract funds in recent years.

Occupational Safety and Health Administration (OSHA)

OSHA has statutory authority to address indoor air quality issues in the workplace. OSHA recognizes the impact of indoor air pollution on all workplaces but concentrates on industrial and manufacturing workplaces because they are more dangerous than offices. While OSHA has established permissible exposure limits for about 600 air contaminants, OSHA officials believe that more stringent standards are needed to assess exposure to pollutants normally found in the office workplace rather than trying to make the current OSHA industrial standards apply. OSHA plans to solicit additional information on indoor air quality issues and the hazards of certain contaminants, such as second-hand smoke, before deciding whether to set specific standards applicable to the office workplace. OSHA also offers training for its inspectors to help them identify indoor air pollution problems in workplaces. While indoor air pollution

is of concern to OSHA, it does not consider the risks that have been identified to be significant enough to justify larger expenditures at this time. OSHA could not provide any indoor air budget information because indoor air is integrated into OSHA's existing programs and therefore not broken out separately in the budget.

National Institute for Occupational Safety and Health (NIOSH)

NIOSH is responsible for responding to employee complaints about unsafe working conditions. However, a NIOSH official stated that many of these workplaces are in industrial and manufacturing locations, where greater emphasis is placed on more dangerous health problems, such as death or injury in plant accidents, rather than on indoor air quality. NIOSH receives more inquiries regarding indoor air quality than any other single occupational safety and health topic. Currently, NIOSH estimates that about 30 percent of its health hazard inspections are related to problems of indoor air pollution. Furthermore, a NIOSH workgroup has identified six tactical areas for NIOSH to pursue relative to indoor air pollution. These are

- identifying methods for evaluating indoor air ventilation systems;
- developing techniques to detect the presence of chemical, biological, and physical agents and to characterize their association with indoor air problems;
- studying effects of chemical, biological, and physical agents;
- developing a survey assessment instrument for indoor air quality;
- disseminating information to the public in response to public inquiries; and
- providing indoor air training.

However, according to a NIOSH indoor air official, funds spent on indoor air pollution are limited. In fiscal year 1990 about $300,000 of discretionary money was spent to specifically address indoor air pollution—less than 1 percent of NIOSH's $84.7 million budget.

Department of Energy (DOE)

Energy conservation measures, such as additional insulation, sealed windows in office buildings, and reduced air exchange rates, have tightened buildings and contributed to indoor air pollution. While much of DOE's indoor air research relates to basic research on radon's health effects, DOE's Office of Conservation and Renewable Energy has conducted research to address the health effects of other dangerous indoor air pollutants and to identify ways to improve ventilation. DOE's Bonneville Power Administration, in its weatherization program, helps fund

alternative ventilation systems for homes that operate when concentrations of indoor air pollutants, such as carbon dioxide, reach certain levels. Bonneville's new-home program requires the use of building materials with limited formaldehyde emissions. In fiscal year 1990 Bonneville allocated $.3 million to indoor air in its residential and commercial energy conservation program. According to DOE officials, $1.6 million had been allocated to indoor air by its Office of Conservation and Renewal Energy for building energy research.

Department of Housing and Urban Development (HUD)

According to HUD officials, efforts to address indoor air pollution are focused primarily on taking action to ensure that specifically identified harmful substances are controlled in HUD's financed housing. For example, HUD has focused on reducing the amount of formaldehyde in building materials used for manufactured homes and on sponsoring research to mitigate the exposure to lead-based paint in HUD-financed housing. With the exception of special appropriations for radon and cleaning up lead-based paint, HUD does not have a line item in its budget for indoor air quality.

National Institute of Environmental Health Sciences (NIEHS)

Research by NIEHS focuses on demonstrating the health effects of the more dangerous substances, whether exposure to them occurs indoors or outdoors. According to Institute officials, its efforts to address indoor air pollution have been coincidental to its overall research, and indoor air is not a separate line item in its research budget.

General Services Administration (GSA)

GSA is conducting a one-time survey of federal facilities it manages to identify the presence and concentrations of indoor air pollutants, such as carbon dioxide and formaldehyde. GSA's indoor air efforts are only a minor part of the agency's responsibilities for managing federal buildings. According to GSA officials, the agency has investigated some complaints from building occupants about indoor air problems, but it has not fully defined indoor air pollution nor how it will address problems with such pollution. In fact, GSA's considerable emphasis on energy conservation—one responsibility of the agency—in some respects counters efforts to improve indoor air quality because some energy conservation measures contribute to indoor air quality problems. According to GSA officials, the agency's indoor air efforts are not identified as a separate line item in its budget.

Indoor Air Efforts of Selected States

In the states we visited (California, Connecticut, Massachusetts, Maine, North Carolina, Oregon, Rhode Island, and Washington) efforts to operate indoor air pollution programs have emphasized mitigating indoor air pollution by increasing air exchange rates, maintaining ventilation systems properly, and testing for certain indoor air pollutants. However, the states are having difficulty identifying indoor pollution concentrations that are harmful and obtaining the funds needed to operate the programs.

Emphasis on Mitigation Strategies

The states have generally emphasized correcting ventilation problems, which can reduce indoor air pollution more quickly and extensively than trying to identify and control individual indoor air pollutants. According to state officials, the proper design, installation, operation, and maintenance of ventilation systems and the control of air exchange rates are important means of reducing indoor air pollution. Improperly designed ventilation systems prevent routine maintenance, and poorly designed buildings limit air flow, which contributes to indoor air pollution. However, addressing such problems can usually be relatively simple. For example:

- The Massachusetts indoor air program identified a number of indoor air problems in schools that were the result of inadequate ventilation. Consequently, the state recommended that state building codes be updated to require inspection of ventilation systems.
- A task force for the state of Washington recommended increasing the air exchange rates and properly maintaining ventilation systems as primary ways of addressing indoor air pollution. It also recommended that rental and lease agreements be written to ensure proper design, operation, and maintenance of ventilation systems.
- California stresses ventilation efficiency, requiring annual inspections of ventilation systems in public buildings.

Difficulty in Identifying Harmful Levels of Pollutants

Some state programs that we visited have had difficulty in identifying pollutant levels in offices and residences that are harmful to human health. Many indoor air pollutants found in the industrial workplace also occur in offices and residences, but at lower levels. As reported by the Washington State task force, levels of indoor pollutants may be 50 to 1,000 times lower than the levels permitted in the industrial workplace and still be harmful to office occupants and homeowners. According to a Maine official, many contaminants are harmful at significantly lower concentrations than the standards set by OSHA and NIOSH. State officials

believe that more research is needed to determine whether OSHA standards need to be revised for the office and residential environment. For instance, Rhode Island found that ice skating rinks meeting OSHA's carbon monoxide standard still had incidences of skaters becoming sick. Consequently, Rhode Island established its own carbon monoxide standard for ice rinks, which were lower than the allowable OSHA carbon monoxide levels.

Funding Problems

Of the states we contacted, only California had a significant amount of resources and staff devoted to its indoor air program. Most of the states were operating their programs with small staffs and limited funding. For example, Connecticut has only 25 percent of a staff year dedicated to indoor air, and Rhode Island and Massachusetts have also cut their indoor air programs.

Most state officials we talked to support the Indoor Air Quality legislation currently before the Congress because one section would provide grants to state indoor air programs. Also, some states are charging fees for indoor air pollution services, such as testing and diagnostic inspections. Maine, Massachusetts, and some local California agencies have already instituted user fees for testing residences and businesses for indoor air pollutants.

Objectives, Scope, and Methodology

Our review of federal and state efforts to address indoor air pollution was based on a January 1990 request from the Chairman, Subcommittee on Superfund, Ocean and Water Protection, Senate Committee on Environment and Public Works, and subsequent discussions with his staff. Our work, which was completed in May 1991, was done in accordance with generally accepted government auditing standards. We assessed the efforts of EPA, other federal agencies, and selected states to address indoor air pollution.

To assess EPA's efforts in addressing indoor air pollution, we identified EPA indoor air activities and discussed with EPA officials the specific indoor air activities they have undertaken and the resources they are devoting to the issue. We also determined the progress that EPA has made in implementing the six recommendations contained in its 1989 report to the Congress. We visited three EPA regional offices, including the two that have active indoor air programs, to discuss their efforts to disseminate information on indoor air pollution and coordinate indoor air activities of state indoor air programs in their region. Additionally, we obtained copies of studies, reports, and other documents related to EPA's indoor air activities.

To assess the indoor air activities of other federal agencies, we identified the agencies that are addressing indoor air pollution in some capacity. From these agencies, we selected seven that EPA officials and others identified as having active indoor air programs. For each, we interviewed the officials responsible for the agencies' indoor air programs to determine which indoor air issues they are addressing, the extent of their coordination with EPA and other federal agencies, and the resources devoted to indoor air. We also obtained studies, reports, and other documents pertaining to the agencies' indoor air efforts.

To determine the extent of state indoor air efforts, we visited eight states, located in three EPA regions, with active indoor air programs. In discussions with officials from these eight states, we determined the indoor air activities that the states are undertaking, the authorities that they use to address indoor air pollution, the resources that they devote to indoor air, and their interest in receiving federal funds to address indoor air pollution issues.

We contacted representatives of four organizations from the private sector that are involved with indoor air pollution in some way to discuss their views on how indoor air pollution should be handled and what the

appropriate federal and state roles should be. We also obtained documents pertaining to indoor air pollution from these organizations.

As instructed by the requester, we did not obtain official agency comments. However, we discussed the facts contained in the report with officials from EPA and seven other federal agencies. EPA and five of the other federal agencies generally agreed with the facts as presented and we included their comments where appropriate. NIOSH and OSHA officials provided updated information on their indoor air programs which we have included in the report.

Activities Visited During the Review

EPA Offices and Laboratories

Office of Air and Radiation, Indoor Air Division

Office of Research and Development, Environmental Criteria and Assessment Office

Office of Pesticide Programs

ffice of Toxic Substances

Office of Drinking Water

Health Effects Research Laboratory

Atmospheric Research and Exposure Assessment Laboratory

Air and Energy Engineering Research Laboratory

EPA Region I

EPA Region IX

EPA Region X

Other Federal Agencies

Consumer Product Safety Commission

	Occupational Safety and Health Administration
	National Institute of Environmental Health Sciences
	National Institute of Occupational Safety and Health
	Department of Housing and Urban Development
	General Services Administration
	Department of Energy
	Bonneville Power Administration
	Lawrence Berkeley Laboratories
States	California
	Connecticut
	Massachusetts
	Maine
	North Carolina
	Oregon
	Rhode Island
	Washington
Private Organizations	American Lung Association
	American Society of Heating, Refrigerating, and Air-Conditioning Engineers, Inc.
	Business Council on Indoor Air
	Chemical Manufacturers Association

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