

GAO

Report to the Honorable
Frank R. Lautenberg, U.S. Senate

April 1988

INDOOR RADON

Limited Federal Response to Reduce Contamination in Housing



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

Resources, Community, and
Economic Development Division

B-223233

April 6, 1988

The Honorable Frank R. Lautenberg
United States Senate

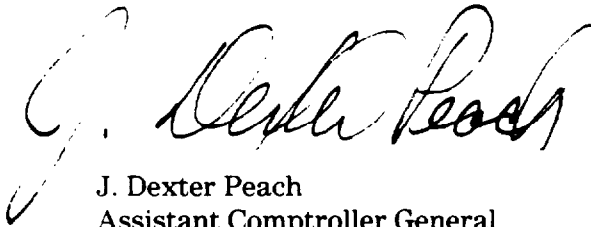
Dear Senator Lautenberg:

In response to your April 1, 1987, letter, this report describes the efforts to reduce radon contamination in housing by the Department of Housing and Urban Development; the Farmers Home Administration, U.S. Department of Agriculture; the National Park Service, U.S. Department of the Interior; and the Veterans Administration. The report also discusses the Environmental Protection Agency's work in identifying and resolving elevated radon levels and comments on the potential for federal government liability regarding indoor radon hazards in federally owned or assisted housing. The report contains recommendations for the Department of Housing and Urban Development, the Environmental Protection Agency, and the Department of the Interior.

As agreed 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 interested parties and make copies available to others upon request.

This work was conducted under the general direction of John H. Luke, Associate Director. Major contributors are listed in appendix V.

Sincerely yours,



J. Dexter Peach
Assistant Comptroller General

Executive Summary

Purpose

Potentially hazardous levels of radon—a radioactive gas linked to lung cancer—have been discovered in houses throughout the United States. In 1987, the Environmental Protection Agency (EPA) reported that elevated radon levels may be present in one out of every eight houses in the United States.

In an April 1987 letter, Senator Frank R. Lautenberg expressed concern about the efforts of federal agencies to deal with radon contamination in American homes. In response to this concern, GAO

- identified the status of EPA's efforts to detect radon and develop methods to reduce radon contamination;
- identified actions taken by four federal agencies involved with civilian housing—the Department of Housing and Urban Development (HUD), the Farmers Home Administration (FmHA), the Veterans Administration (VA), and the National Park Service—to respond to potential radon hazards; and
- studied the potential for federal government liability regarding indoor radon hazards in federally insured or assisted housing.

Background

Radon is an invisible, radioactive gas produced by the decay of radium, itself a byproduct of decaying uranium. Radon occurs naturally in almost all soils and rocks. It can seep indoors through cracks, foundation openings, and other entry points, and accumulate to hazardous levels that can cause lung cancer. EPA has estimated that from about 5,000 to 20,000 lung cancer deaths a year in the United States may be attributable to radon.

The Superfund Amendments and Reauthorization Act of 1986 assigned EPA a number of specific radon responsibilities, including the responsibility to conduct and report to the Congress on a national radon assessment. Among other things, the act requires that EPA conduct research, in conjunction with HUD, on methods to assess the potential for radon contamination in new construction and design measures to avoid indoor air pollution. GAO found no other law that specifically addresses actions to be taken by HUD or the other agencies in response to the radon problem. However, other statutes have general requirements that provide protection against hazardous housing conditions.

Results in Brief

EPA has a number of major program efforts aimed at identifying and mitigating radon problems. One of its major radon identification efforts is a

planned national assessment, but it has encountered delays, and the assessment is still years from completion. EPA's initial tests of various mitigation techniques have demonstrated significant radon reductions, but the techniques still need to be tested in a larger number of houses.

HUD, FmHA, and VA, which finance and insure civilian housing, have radon activities ranging from responding to a few site-specific problems to not being involved with indoor radon issues at all. One of the primary reasons cited for limited involvement with radon is the lack of a specific legislative mandate for an agency radon program. Only the National Park Service, which provides housing to some of its employees, has a radon program or policy in place.

Courts have not addressed whether the federal government is required to compensate for or mitigate radon in housing when it acts as a seller, insurer, or landlord.

Principal Findings

EPA—Much Work Remains

EPA is responsible for identifying and developing techniques to mitigate indoor radon problems. It plans to acquire data on houses with elevated radon levels through a national assessment, but this assessment has been delayed and is not expected to be finished until fiscal year 1991. In the mitigation area, EPA estimates that mitigation techniques will need to be tested on at least 600 existing houses and 125 houses under construction. Through the end of fiscal year 1987, mitigation work on 80 of the 600 existing houses had been scheduled, and results, available for 70 of the 80 houses, showed significant radon reductions. In fiscal year 1988, EPA anticipates expanding this effort to houses under construction, as well as increasing the number of existing houses.

HUD's Radon Response Is Piecemeal

HUD has reacted to radon hazards in a limited, piecemeal manner. Currently, HUD requires that applicants of HUD-insured mortgages be notified of the potential for high radon levels in 3 areas: (1) Butte and Anaconda, Montana; (2) Edgemont, South Dakota; and (3) certain portions of Florida. However, such notification is not provided to mortgage applicants in other areas, such as Colorado, where a state survey of 900 houses indicated about 40 percent had elevated radon levels.

Similarly, radon reduction techniques will be incorporated during construction of a HUD-assisted public housing project in Bethlehem, Pennsylvania. However, such techniques may not necessarily be considered for other HUD-assisted new construction projects, as there is no HUD requirement or policy that radon reduction techniques be incorporated in new construction projects financed by HUD.

EPA and HUD are both required to conduct research for the purpose of developing methods for assessing the potential of radon contamination in new construction and design measures to avoid indoor air pollution. However, they have not reached an agreement on their respective roles. Instead, EPA is carrying out the lead role in responding to this requirement, and a HUD role remains unclear.

Other Agencies' Responses

FmHA and VA officials said their agencies are unaware of any radon problems in the housing their agencies finance or insure. FmHA is now formulating an air pollution policy that is expected to include radon. Consequently, it is unknown to what extent, or how, potential radon hazards will be addressed. FmHA officials said the radon part of the expected policy may be based on guidance that was provided to two FmHA state offices.

This planned FmHA action contrasts with the VA, which considers radon to be a state and local government issue and takes the position that the VA is not required to address potential radon problems in houses it insures. Consequently, the VA has no policy relating to insuring houses that may have hazardous radon levels.

The National Park Service has tested nearly 3,000 permanent housing units, as well as some seasonal housing and administrative buildings. As a result of testing, the Park Service plans to perform mitigation work on 352 buildings with elevated radon levels.

Federal Government's Potential Liability

Courts have not addressed whether the federal government is required to compensate for or mitigate radon in housing when it acts as a seller, insurer, or landlord. Under the Housing and Community Development Amendments of 1978, however, recent decisions of lower federal courts have required the government as landlord to correct or eliminate various aspects of habitability, such as water leakage and rat infestation. The courts' rationale is an implication, found in the 1978 Amendments, of a warranty of habitability in public housing leases.

HUD currently is defending a suit by public housing tenants for alleged exposure to asbestos. Whether the concept of implied warranty will be held under the 1978 Amendments to embrace asbestos or radon, at some undetermined threshold of exposure, is an issue that will not be resolved without litigation.

With regard to the liability of the federal government as seller or insurer, other cases suggest that, except in unusual circumstances, courts will not imply a warranty to assure that housing is free of hazardous levels of radon.

Recommendations

GAO recommends that the Secretary of HUD and the Administrator, EPA, define their respective responsibilities and planned actions in response to their shared legislative research mandate under the Superfund Amendments and Reauthorization Act of 1986. Other recommendations to the Administrator, EPA, appear in chapters 2 and 4, and to the Secretary of the Interior in chapter 4.

Matters for Consideration by the Congress

With the exception of the legislative research requirement HUD shares with EPA, HUD, the VA, and the FmHA do not have any specific statutory mandate to address indoor radon hazards, and these agencies have generally assumed a limited radon response. The Congress may wish to change this situation by specifying or outlining the expected radon responsibilities of these federal agencies. Responsibilities the Congress may wish to specify could include, for example, providing prospective applicants of federal housing assistance with general radon information through a disclosure notice. In considering such responsibilities, the Congress should be attentive to any implications the statutory language has regarding possible government liability to private parties.

Agency Comments

GAO discussed the report's contents with responsible agency officials, and they generally agreed with the information presented. Their comments have been included where appropriate. As requested, however, GAO did not obtain official agency comments on this report.

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Abbreviations

CDC	Centers for Disease Control
CIAP	Comprehensive Improvement Assistance Program
CLAQ	Committee on Indoor Air Quality
CIRRPC	Committee on Interagency Radiation Research and Policy Coordination
EPA	Environmental Protection Agency
FHA	Federal Housing Administration
FmHA	Farmers Home Administration
HHS	Department of Health and Human Services
HUD	Department of Housing and Urban Development
pCi/l	picocuries per liter (of Air)
SAB	Science Advisory Board
SARA	Superfund Amendments and Reauthorization Act (of 1986)
VA	Veterans Administration
WL	working level

Introduction

Radon is an invisible, odorless, radioactive gas produced by the decay of radium in soil and rock. Radium, itself a product of decaying uranium, is most likely to occur where there are significant amounts of uranium. Outdoor radon levels generally are low because radon is diluted by the outside air. Indoors, however, radon can accumulate. Typical indoor levels are about 5 times higher than average outdoor levels and may be over 10,000 times higher, according to the Environmental Protection Agency (EPA).

In late 1984, a worker at an eastern Pennsylvania nuclear power plant triggered radiation detectors in the plant. Investigation showed that he was radioactively contaminated by high radon levels in his own home, not by any source at the plant. The incident brought national attention to the issue of naturally occurring indoor radon contamination.

EPA estimates that between 5,000 to 20,000 lung cancer deaths a year in the United States may be attributed to radon.¹ These estimates are based primarily on studies of workers exposed to varying levels of radon in underground mines. As we reported earlier, Air Pollution: Hazards of Indoor Radon Could Pose a National Health Problem (GAO/RCED-86-170, June 30, 1986), at least 15 studies of radon exposure, conducted in the United States, Canada, and other countries, have reported excess lung cancers among miners.

Concerned about the potential hazard that indoor radon poses. Senator Frank R. Lautenberg asked us to review the efforts of federal agencies to deal with radon contamination in American homes. As a result, we (1) identified the status of EPA's efforts to detect radon and develop methods to reduce radon contamination, (2) identified actions taken in response to potential radon hazards by federal agencies involved with civilian housing, and (3) studied the federal government's potential liability for indoor radon hazards in federally insured or assisted housing.

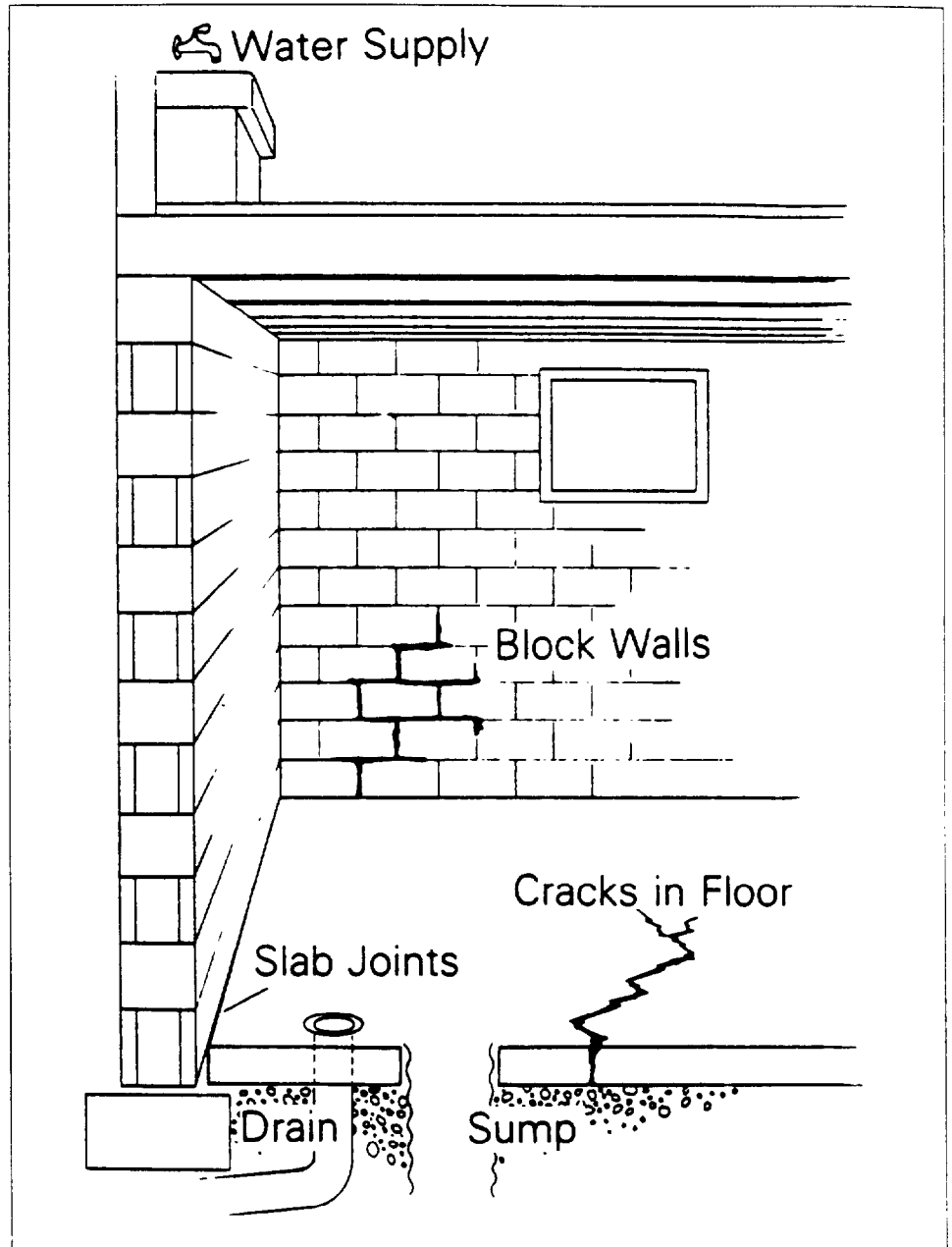
Indoor Entry

As a gas, radon is mobile and can get indoors in a variety of ways. It can seep into a house through floors, cracks in concrete floors and walls, open areas around drainage pipes, tiny cracks or pores in hollow-block walls, and other openings in the foundation or walls. Radon can also enter a house through water supplied by underground wells. Common

¹Radon naturally breaks down and forms radioactive decay products. As a person breathes, the radon decay products can become trapped in the lungs and lead to lung tissue damage. Throughout this report the term radon is used synonymously with radon gas and radon decay products.

radon entry points are shown in figure 1.1. In some unusual situations, radon may also be released from materials, such as brick and concrete, used to construct a house.

Figure 1.1: Common Radon Entry Points



Source: A Citizen's Guide To Radon, EPA and the Department of Health and Human Services (HHS), August 1986.

Measuring the Risk

Radon levels are measured in terms of picocuries per liter of air (pCi/l), and radon decay products are expressed in terms of working levels (WL). One WL is equal to approximately 200 pCi/l of radon.

Figure 1.2 indicates how exposure over a lifetime to various radon levels compares with the risk of developing lung cancer from smoking and chest x-rays. It also compares various radon levels with the average indoor and outdoor concentrations.

Figure 1.2: Radon Risk Evaluation Chart

pCi/l	WL	Estimated number of lung cancer deaths due to radon exposure (out of 1000)	Comparable exposure levels	Comparable risk
200	1	440—770	1000 times average outdoor level	More than 60 times non-smoker risk 4 pack-a-day smoker
100	0.5	270—630	100 times average indoor level	20,000 chest x-rays per year
40	0.2	120—380		
20	0.1	60—210	100 times average outdoor level	2 pack-a-day smoker
10	0.05	30—120	10 times average indoor level	1 pack-a-day smoker
4	0.02	13—50		5 times non-smoker risk
2	0.01	7—30	10 times average outdoor level	200 chest x-rays per year
1	0.005	3—13	Average indoor level	Non-smoker risk of dying from lung cancer
0.2	0.001	1—3	Average outdoor level	20 chest x-rays per year

Source: A Citizen's Guide To Radon, EPA and HHS, August 1986.

When to Take Action

EPA has reported that it lacks clear statutory authority to prescribe what homeowners should do about radon. In addition, EPA has stated that a regulatory approach establishing radon standards for an acceptable risk level does not appear suitable to deal with a naturally occurring health hazard.² However, EPA and the Department of Health and Human Services (HHS) in August 1986 published guidelines advising homeowners that the higher the radon level the sooner action should be taken. The guidelines state that EPA believes the radon levels in most houses can be reduced to about 4 pCi/l. Given the level of current technology, EPA believes reductions to levels lower than 4 pCi/l may be difficult or impossible to achieve. Table 1.1 summarizes the guidelines.

Table 1.1: Radon Action Guidelines

Radon level	Suggested reduction level	Time frame for taking action
200 pCi/l or higher	Reduce levels as far below 200 pCi/l as possible. If this is not possible, consider temporary relocation.	Within several weeks
About 20 pCi/l to about 200 pCi/l	Reduce levels as far below 20 pCi/l as possible.	Within several months
About 4 pCi/l to about 20 pCi/l	Lower levels to about 4 pCi/l or below.	Within a few years, but sooner for the upper level of the range

Because radon cannot be seen, smelled, or tasted, a number of testing methods have been developed. Two of the most common are the charcoal canister and the alpha track detector. Both devices are exposed to

²However, EPA proposed standards for radon in drinking water under the Safe Drinking Water Act

the air within a house for a specified period of time and sent to a laboratory for analysis. Essentially, the charcoal canister works by absorbing dust and accompanying radon. The alpha track detector contains a piece of treated plastic, and radiation entering the monitor etches "tracks" on the plastic. The number of tracks appearing on the plastic indicates the level of radon.

If testing discloses elevated radon levels, a mitigation technique, or combination of mitigation measures, can be taken. The choice depends on a number of factors, including the characteristics of the house, the level of radon, and the way or ways radon is entering the house. Among the mitigation measures available are: (1) seal off radon entry routes; (2) ventilate a house; and (3) prevent radon from entering a house by drawing the gas away from the foundation before it enters (soil ventilation).

Objectives, Scope, and Methodology

In his letter of April 1, 1987, Senator Frank R. Lautenberg requested that we review certain federal agency actions and the federal government's potential liability concerning radon. In response to this concern, we

- identified the status of EPA's efforts to detect radon and develop methods to reduce radon contamination,
- identified actions taken by four federal agencies, involved with civilian housing—the Department of Housing and Urban Development (HUD); the Farmers Home Administration (FmHA), the Veterans Administration (VA), and the National Park Service—to respond to potential radon hazards.
- studied the potential for federal government liability for indoor radon hazards in federally insured or assisted housing.

To accomplish the first two objectives, we performed work at (1) HUD; (2) the VA; (3) the FmHA, U.S. Department of Agriculture; (4) the National Park Service, Department of the Interior; and (5) EPA. Except for EPA, these federal agencies act, at least in part, as a housing lender, insurer, subsidizer, or owner.

We performed work at EPA, a federal agency responsible for radon detection and mitigation work, to gain an understanding of the current state of the art in identifying and resolving elevated radon levels. We reviewed EPA's (1) radon publications, including reports to the Congress; (2) preliminary design for a national radon survey; (3) information on EPA's state survey program; and (4) success in reducing elevated radon

levels. We interviewed officials from EPA's Office of Radiation Programs and Office of Research and Development on their efforts to identify and correct radon problems.

We performed work at the headquarters offices of HUD, the VA, FmHA, and the Park Service to review past and present radon activities and factors that may have limited their radon activities. (See app. I for background information on the agencies.) At all of the agencies, we interviewed responsible agency officials. Our other review activities varied according to the extent and length of agency involvement with radon issues. Where applicable, we reviewed radon files, testimony by agency officials, agencies' budgetary and program information, and documents used to train and alert federal agency field officials to radon hazards. One radon activity cited by some agency officials was their participation on interagency committees, such as the Committee on Indoor Air Quality. Therefore, we reviewed the various radon activities of such committees.

In analyzing the potential for federal government liability, we reviewed statutory and case law pertaining to federal housing responsibilities, and legal treatises discussing this topic. We also discussed the matter with officials of various federal agencies, including the Department of Justice, HUD, and EPA.

We conducted our audit work between May and December 1987. We discussed the results of our work with responsible agency officials, and they generally agreed with the information presented. Their views and comments were incorporated as appropriate. However, as you requested, we did not obtain official comments from agencies on this report. Our review was conducted in accordance with generally accepted government auditing standards.

EPA's Efforts to Identify and Correct Indoor Radon Problems

In 1984 the indoor radon problem captured national attention when a Pennsylvania nuclear power plant worker was found to be highly radioactive. His exposure was traced to his home, where radon was coming from the soil on which his house was built. Subsequent investigations disclosed that other houses located on a geological formation that extends through Pennsylvania, New Jersey, and New York were also contaminated by the naturally occurring radon.

In response to increasing public concern, EPA established a Radon Action Program in September 1985. Generally, the goals of the program were to determine the extent of the problem and to reduce or prevent radon problems in housing. These goals were supported by the passage of the Superfund Amendments and Reauthorization Act of 1986 (SARA), which assigns specific indoor radon responsibilities to EPA.

This chapter discusses EPA's legislative responsibilities for radon and its efforts to identify and correct radon problems. EPA's major identification efforts include (1) a national assessment, expected to be completed by fiscal year 1991; (2) assistance to states for conducting radon surveys; and (3) planned use of data from private radon testing firms. EPA's efforts to correct the problem center on mitigation techniques that are being tested under a development and demonstration program and a joint effort with selected states.

EPA's Legislative Mandate to Address Indoor Radon Problems

EPA's initial radon activities were carried out under the authority of the Clean Air Act. Briefly, section 103, in part, directs the Administrator, EPA, to establish a national research and development program for the prevention and control of air pollution. Although section 103 does not direct or require EPA to establish a research and technical assistance program for indoor radon problems, it does provide EPA with broad discretionary authority to implement a radon strategy through its efforts to control air pollution.

Specific radon requirements were included in SARA in section 118(k) and title IV. First, section 118(k) requires EPA to conduct a national assessment and prepare a report to the Congress which includes information that (1) identifies locations in the United States where radon is found in structures where people normally live or work, including educational institutions; (2) assesses the level of radon present in such structures; and (3) determines the level of radon that poses a threat to human

health. Section 118(k) also requires EPA to conduct a demonstration program to test methods and technologies of reducing or eliminating radon where it poses a threat to human health.¹

Second, title IV of SARA addresses radon and indoor air pollution. Program requirements assigned to EPA under title IV include: (1) research and development concerning the identification, characterization, and monitoring of the sources and levels of indoor air pollution, including radon; (2) research and development relating to control technologies or other mitigation measures to prevent or abate indoor air pollution; and (3) research, to be carried out in conjunction with the Secretary of HUD, to develop methods for assessing the potential for radon contamination in new construction, and design measures to avoid indoor air pollution.

To carry out its radon responsibilities under section 118(k) and title IV, EPA was appropriated \$7.6 million in fiscal year 1987.

EPA Efforts to Identify Problem Locations Will Take Years to Complete

In April 1987, EPA estimated that 12 percent of the approximately 85 million houses in the United States may have radon levels greater than 4 pCi/l—the level at which it recommends corrective action. The estimate is based on the uranium content of rocks found near the land's surface and is used to indicate where there is a greater potential for indoor radon problems. But, as EPA notes, indoor radon levels may be affected by a number of factors, including soil permeability, the uranium content of nearby rock and soil, and house construction characteristics.

We were told by EPA officials that additional information on areas with elevated radon levels is anticipated through a national assessment, which EPA expects to finish by fiscal year 1991. In the meantime, EPA is assisting with state surveys aimed at identifying high risk areas. These states had applied for and were selected by EPA for assistance.

EPA officials said EPA intends to make use of private firms' testing results. But, EPA has not set a time frame for performing this effort, or requested funds for such work in its fiscal year 1988 budget.

¹The October 17, 1986, legislation provided that the report should be submitted to the Congress no later than 1 year after passage of the act. The report was sent to the Congress in April 1987.

Completion of National Assessment Delayed

A national assessment was one of the requirements established by SARA. Before this legislation was enacted in October 1986, however, EPA recognized the need to acquire data on radon exposure nationwide and began planning this work. As we pointed out in our June 1986 report,² EPA was planning a national survey to determine (1) radon levels in residential structures across the country and (2) whether an association exists between geological conditions and radon levels in residential structures. EPA anticipated completing work on the survey design by October 1986 and following it with a pilot test. At the time of our 1986 report, the survey and data analysis was expected to be completed by October 1989.

However, an EPA radon division official explained to us that the effort has been delayed, and an important factor in the delay were comments received from an EPA Science Advisory Board (SAB).³ EPA had requested the SAB's Radiation Advisory Committee to review the design of the national radon survey. The committee accepted the request and formed a subcommittee. Generally, while the subcommittee found that EPA's survey design presented a valid approach to designing a national radon assessment, it came to a number of conclusions and made recommendations to EPA in areas such as limitations in the types of houses to be surveyed. It was concerned that rental housing was not included because EPA planned to focus the assessment exclusively on owner-occupied housing.

EPA's rationale for including only owner-occupied residences was twofold. It decided that (1) owners must authorize the monitoring and (2) owner authorization would be too difficult and costly to obtain for rental units. EPA said it needs the owner's permission to test because hazardous levels of radon may reduce the market value of the structure or require expensive mitigation measures.

If only owner-occupied housing is sampled, the subcommittee stated, bias may occur. According to the 1980 Census of Housing, about 40 percent of the dwelling units (single-family, two-family and multifamily housing) in the United States are other than owner-occupied housing. Consequently, the subcommittee stated that rental units should be included in the national survey. But if this is not possible, for legal or

²Air Pollution: Hazards of Indoor Radon Could Pose a National Health Problem (GAO/RCED-86-170).

³The SAB is an independent group of scientists brought together to advise EPA on various scientific matters.

other reasons, data should be collected through questionnaires to permit comparison with the dwelling units for which EPA has radon measurements. As of December 1987, EPA was in the process of preparing a response to the subcommittee.

By the end of fiscal year 1988, the Director of EPA's Office of Radiation Programs expects the pilot phase of the survey to start when radon measurement devices are placed in a limited sample of houses.⁴ Thereafter, the national assessment would begin with the measurement devices being placed in a nationwide sample of houses for 1 year to obtain the average annual radon concentration. This official expects the national assessment and data analysis to be finished by fiscal year 1991.

States' Radon Activities

On August 4, 1987, EPA announced that elevated radon levels were found in 21 percent of the houses tested in 10 states. This overall percentage was based on radon tests in 9,690 houses, but an additional 1,900 houses were tested that were not considered in the percentage calculation. These states were participating in an EPA program aimed, in part, at helping states conduct surveys to identify high risk areas.⁵ A high risk area is usually described as one where a high percentage of the houses have radon levels greater than 4 pCi/l. EPA helps the states by providing and analyzing charcoal canisters, and assisting in areas such as survey design, canister mailing, and training.

EPA selected states that it determined had resources that were ready to be used for radon detection, according to an acting EPA radon division branch chief. For the winter of 1987, 10 states participated in the program: Alabama, Colorado, Connecticut, Kansas, Kentucky, Michigan, Rhode Island, Tennessee, Wisconsin, and Wyoming. The state surveys differed in terms of sampling method and number of houses surveyed. (See app. II for additional details on the surveys in these states.)

For the winter of 1988, EPA agreed to assist seven additional states—Arizona, Indiana, Massachusetts, Minnesota, Missouri, North Dakota,

⁴Although SARA requires EPA to identify work and educational institutions, EPA's national assessment is devoted exclusively to residences. EPA noted in a June 1987 report that it plans to look at what data exist for nonresidential buildings and to conduct a feasibility study of what more needs to be done to provide some indication of the level of radon in these buildings.

⁵The national assessment and the state survey program are intended to complement one another, but there are important differences. For instance, a short-term testing method is used in the state survey program, but long-term testing is planned for the national assessment.

and Pennsylvania—in conducting surveys to identify areas with elevated radon levels. EPA also agreed to assist HHS's Indian Health Service in testing houses on Indian reservations in Michigan, Minnesota, and Wisconsin.

In addition, EPA has collected information about all states' radon programs. In cooperation with the Conference of Radiation Control Program Directors,⁶ EPA prepared a report in 1987 entitled Summary of State Radon Programs. This report provides information on the range of state radon activities underway, the administrative and legislative mechanisms used to support radon activities, and the resources devoted to them.

Although the report's authors found it difficult to categorize the different approaches taken by the states, they did make observations about the general levels of activity. Therefore, they placed state programs into activity levels, depending on the extent of the problem as perceived by the state and its response. (App. III shows the categories of the states' program.)

According to the report, at least 18 states have appropriated a total of \$20 million for radon activities. Approximately 120 state employees are working on indoor radon problems. However, three states (Pennsylvania, New York, and New Jersey) account for about 88.5 percent of the funds and 55 percent of the employees.

EPA Intends to Use Private Test Results

A 1987 EPA report lists nearly 300 radon testing firms, and officials of EPA's Office of Radiation Programs estimated that about 300,000 radon measurements have been made by private firms.⁷ These officials said about 30 firms are considered major testing firms and are thought to account for a significant, though unknown, number of the estimated 300,000 radon measurements.

EPA intends to request the major testing firms to submit their test results to EPA for consolidation and analysis, thus adding to the existing knowledge base on radon problem areas. However, no time frame for performing this task has been set, and EPA headquarters officials said no funds

⁶The conference was formed in 1968 to serve as a common forum for the many and varied activities in radiation protection at the federal, state, and local levels of government.

⁷The number of measurements is not equal to the number of houses tested since more than one detector is often used in each house.

are available. These officials said funds have not been reprogrammed or requested for such work in fiscal year 1988. These EPA officials estimated that if a contractor performed this work it might cost about \$200,000. Further, the effort devoted to carrying out other radon responsibilities has resulted in the postponement of this task.

EPA Is Working on Mitigation Techniques

There are several primary ways to reduce radon levels in houses, according to EPA: (1) remove the source of the radon, (2) ventilate indoor air or remove radon from indoor air, and (3) prevent radon from entering a house. EPA concluded, however, that the first alternative is often not practical. Similarly, the second alternative only treats symptoms of the problem and may not be practical on a year-round basis. Consequently, EPA stated in an April 1987 report to the Congress that mitigation efforts should focus on preventing radon from entering the house. There are two principal EPA mitigation programs, a Development and Demonstration Program and a House Evaluation Program.

EPA's Development and Demonstration Program— Much Work Remains to Be Done

EPA's Development and Demonstration Program is designed to research, develop, and demonstrate cost-effective radon reduction and prevention methods for houses. EPA developed a matrix to determine the number of houses that need to be tested to ensure that all key variables in housing and mitigation technology are adequately tested.

About 600 existing houses and 125 houses under construction will have to be tested, according to EPA.⁸ By the end of fiscal year 1987, with New York, New Jersey, and Pennsylvania participating in this program, 80 houses were scheduled for testing, but results were only available for 70 houses at the time of our review. Table 2.1 shows the original radon level for the 70 houses.

⁸EPA officials said these estimates were influenced mostly by their assessment of the variability of housing, design details, and construction methods used in this country, and the fact that elevated radon levels have been found in all types of housing, and in widespread areas in the United States

Chapter 2
EPA's Efforts to Identify and Correct Indoor
Radon Problems

Table 2.1: EPA's Development and Demonstration Program—Houses' Original Radon Level

Original pCi/l level	No. of houses
20 or less	10
21-50	16
51-100	14
101-200	9
201-500	11
501-1000	5
Over 1000 ^a	5
Total	70

^aThe radon levels ranged from 1,190 pCi/l to 2,254 pCi/l
 Source: EPA.

Regarding the original radon levels, table 2.1 shows that only 10 of the 70 houses had an original radon level of 20 pCi/l or less. EPA explained in its 1987 research plan that its program focuses on houses with elevated radon levels (20 pCi/l and above) because these present a more urgent need. Further, the plan stated that work in houses with initial concentrations below 20 pCi/l will probably not be extensive until fiscal year 1989.

EPA was successful in reducing the short-term radon levels in most houses to 4 pCi/l or less. The results are considered short-term because follow-up studies will be needed to assess long-term results, according to an EPA research official. As table 2.2 shows, 42 of the 70 houses had a short-term level of 4 pCi/l or less. Another nine houses had a level of 5 pCi/l. With a few exceptions, the remaining houses had short-term levels of between 6 and 20 pCi/l.

Table 2.2: EPA's Development and Demonstration Program—Houses' Short-Term Radon Level After Mitigation

Short-term pCi/l results	Number of houses
1	7
2	12
3	12
4	11
5	9
6-10	10
11-20	6
21-30	2
31-40	1
Total	70

Source: EPA.

As EPA has noted, the effectiveness of any mitigation method will depend upon factors such as the unique characteristics of each house, the routes of radon entry and the level of radon. Further, EPA has reported that sometimes a single method may be sufficient, but often (especially where levels are high) several methods will need to be combined to achieve acceptable results. This proved to be the case in regard to the mitigation work performed on the 70 houses through EPA's development and demonstration program. A common technique used, however, was some form of soil ventilation, which prevents radon from entering a house by drawing the gas away from the foundation before it enters. Two EPA publications contain information on the type and cost of various mitigation techniques. One pamphlet is entitled Radon Reduction Methods, A Homeowner's Guide, and the second, more detailed technical publication is entitled Radon Reduction Techniques for Detached Houses.

Through fiscal year 1987, EPA's development and demonstration program focused exclusively on existing houses. However, in fiscal year 1988, EPA anticipates expanding the program to houses under construction, as well as increasing the number of existing houses. Preliminary plans provide for work on 70 existing houses in Alabama, Tennessee, Florida, Ohio, Maryland, Washington, and Montana; 40 houses under construction in New York and New Jersey; and an undetermined number of houses under construction in Maryland and Virginia.

Prior to starting planned mitigation work for new construction in fiscal year 1988, EPA published in August 1987 an interim guide on radon reduction in new construction. It was designed, in part, to introduce

methods that can be used during construction to minimize radon entry and facilitate its removal after construction. EPA reported that, in most cases, it is cheaper to install radon-resistant features during construction than it is to "fix" a house after it is built. EPA estimates that radon-resistant building techniques may cost from \$400 to \$600 per house, while the cost of installing the same features in an existing house could be four to five times higher, or \$1,600 to \$3,000.

EPA's House Evaluation Program

To complement initial testing of mitigation techniques under their development and demonstration program, EPA officials said wider scale application and evaluation of the techniques is being promoted through its House Evaluation Program.

Under this program, EPA and a state jointly diagnose a house with elevated radon levels and then develop and offer the home owner several alternative reduction techniques. The home owner must decide whether to undertake the mitigation work and is generally responsible for selecting and paying the contractor. The state and EPA obtain data on radon levels after the control techniques are completed.

In the first year (fiscal year 1986), Pennsylvania was the only participating state. Work was performed on 130 Pennsylvania houses in fiscal years 1986 and 1987, according to an EPA radon division branch chief. This official said the program was expanded in fiscal year 1987 to include about 100 more buildings in other areas. This assistance was provided to New Jersey, New York, Tennessee, Ohio, Virginia, the National Park Service, and the Seneca Indian Health Service of New York.⁹

As of the end of calendar year 1987, over 200 buildings were included in the program, according to this EPA radon division branch chief. This official said information on resulting radon levels for about 60 of the houses was being compiled and would be presented in a 1988 report to the Congress. The report is expected to be issued in the spring of 1988.

⁹EPA is planning on extending the program to Arizona and six to eight more states in fiscal year 1988, according to this radon division branch chief.

EPA's Mitigation Work Directed at Single-Family Housing

HUD environmental officials have expressed concern because EPA's mitigation work focuses largely on single-family housing and excludes two-family and multiple-family residences. These officials noted that approximately one-third of 87 million residences (based on 1980 census of housing data) are other than single-family dwellings, and of these housing units, slightly over 4 million units, or 5 percent, have 4 or more floors. These HUD officials are concerned that measures for reducing the potential for radon hazards in buildings with four or more floors, particularly those with elevators, may require techniques not being considered by EPA in its current mitigation work.

Several EPA officials said they are aware of the need to broaden the type of housing structures in the program because this issue was raised in December 1986 by an EPA internal review panel. However, given the current level of resources, they do not anticipate addressing other types of housing until fiscal year 1989, or later. EPA officials cited the following reasons for concentrating initial efforts on single-family detached houses:

- The radon risk is greatest for those parts of houses in contact with the soil, thus the risk would be less for upper floors in a dwelling.
- Mitigation techniques developed for single-family detached houses are expected to be generally applicable to other types of housing structures.
- There are practical considerations. For instance, common walls in attached housing units could require multiple homeowners to agree to have radon mitigation work performed.

Conclusions

EPA has a lead indoor radon role that was assigned through SARA. It has several efforts underway aimed at identifying areas that have potential for indoor radon problems, but completion of these efforts is years away. One such effort is its planned national assessment, which EPA expects to complete by fiscal year 1991. A second is survey assistance to states, which varies among participating states in terms of methods for selecting houses for testing, as well as the number of houses tested. In the winter of 1987, 10 states received survey assistance, and 7 states plus houses on Indian reservations in 3 states will receive assistance in the winter of 1988.

Another radon identification effort is planned, and it relates to a growing body of radon information that is presently available through measurement results made by private radon testing firms. EPA plans to ask

the major firms to submit their indoor radon test results to EPA for consolidation and analysis. We believe this data may measurably add to existing radon knowledge. EPA officials estimate the cost at about \$200,000. However, no funds have been reprogrammed or requested for such an effort, and EPA officials were unable to tell us when this work will begin.

In the mitigation area, short-term results were available for 70 of the 80 houses in EPA's development and demonstration program. The results are considered short-term because follow-up studies will be needed to assess long-term results, according to an EPA research official. The short-term results indicate success in reducing the short-term radon levels to 4 pCi/l or below in 42 of the 70 houses through radon mitigation measures. The remaining houses exceeded 4 pCi/l—the level at which EPA recommends corrective action be taken. But a number of the houses were only slightly above 4 pCi/l, and there were significant reductions for all houses, including a few where the short-term results were in the 21 to 40 pCi/l range. Of note is the fact that the original radon levels in 5 of 70 houses were over 1,000 pCi/l, and 1 of these 5 houses had an original radon level of 2,254 pCi/l.

Despite these initial successes, much more mitigation work remains to be done. EPA estimates that about 600 existing houses and 125 houses under construction should be included in its program to help ensure that key variables, such as different types of housing and mitigation techniques, are adequately tested. There were 80 existing houses that had or were scheduled to participate in EPA's development and demonstration program through the end of fiscal year 1987, representing 13 percent of the estimated work needed on existing houses. Further, plans are for EPA's development and demonstration program to include houses under construction in fiscal year 1988, but work on other than single-family detached houses is not planned until fiscal year 1989 or later.

Recommendation to the Administrator, EPA

We recommend that the Administrator, EPA, provide for timely consolidation and analysis of private firms' test results on indoor radon measurements.

HUD's Radon Responsibilities Are Unclear

HUD has a basic mission to provide adequate housing, promote community and economic development for urban areas, and eliminate discrimination in housing markets. The department administers nearly 80 programs, 3 of which dominate financially. These are: a mortgage insurance program, a lower income housing assistance program, and a public and Indian housing program. These programs are discussed in appendix I.

HUD has been involved with radon hazards in only a few known problem areas. Initial involvement at these few locations generally started many years ago. In each instance, some other agency identified a radon problem and alerted HUD to a potentially dangerous situation.

Under Title IV of SARA, EPA and HUD are required to conduct research on radon contamination in new construction and measures for avoiding indoor air pollution. EPA has taken the lead in responding to this requirement; however, HUD's role remains unclear.

HUD faces a number of unresolved and emerging radon issues. For instance, HUD has held seven Edgemont, South Dakota, houses with elevated radon levels in its inventory since about 1980. While HUD officials have discussed actions to take on these houses, they have not developed official policy on the disposition of houses with elevated radon levels. HUD officials cite a number of reasons for not developing radon policy for these types of houses and for other radon issues. Two HUD regional offices, however, have asked HUD headquarters for radon guidance or policy.

Early Radon Efforts Were Site-Specific

HUD first became involved with radon in the mid-1970s as part of a federal-state advisory panel formed in response to elevated radon levels in houses in Grand Junction, Colorado. Other early HUD involvement with radon hazards occurred in (1) Butte and Anaconda, Montana; (2) Florida; and (3) Edgemont, South Dakota. While HUD's actions dealing with radon problems varied, they were limited to these locations.

Grand Junction, Colorado

Until about the mid-1960s, little was known about the long-term health effects of low-level radioactivity present in uranium mill tailings. Tailings, essentially finely crushed rock, are the waste material from the uranium mill process. Tailings contain approximately 85 percent of the radioactivity present in unprocessed uranium ore.

In August 1966, the Colorado Department of Health and the U.S. Public Health Service discovered that uranium mill tailings were used as fill material during construction in Grand Junction, Colorado. The tailings were used in the construction of houses, streets, driveways, swimming pools, and sewer lines. As a result, these areas have high radon levels.

To limit the exposure of individuals to radiation emanating from these tailings, in 1972 the Congress authorized the Atomic Energy Commission (its successor is the Department of Energy) to enter into a cooperative agreement with the State of Colorado under Public Law 92-314. Under this legislation, the federal government agreed to pay up to 75 percent of the costs of this effort, and Colorado is to pay the remaining 25 percent. A federal-state advisory panel, on which HUD participated, was also established. A primary panel function was to keep various federal and state agencies apprised of the status of the program.

Butte and Anaconda, Montana

In early 1979, the Montana State Department of Health and Environmental Sciences requested EPA assistance in conducting tests of selected housing in the Butte and Anaconda areas because radon is a natural phenomenon of the native geological environment. After being notified of the radon in this area, HUD provided \$65,000 to the Montana Department of Health and Environmental Sciences to conduct radiation testing on HUD-assisted housing.

EPA and the state agency tested 36 structures, including a public housing complex. The results showed that most structures exceeded the EPA-suggested corrective action level of 4 pCi/l. For instance, the radon level in a HUD-assisted public housing complex, a 190-unit apartment project, was from 2 to almost 4 times above EPA's acceptable level of 4 pCi/l. After being notified of the elevated radon levels, HUD responded by providing about \$250,000 for mitigation work.

In 1979, as a condition for receiving HUD mortgage insurance on single-family houses in the Butte and Anaconda areas, HUD required that such houses be tested for radon. Basically, this requirement meant all applications for HUD-insured financing had to be submitted with radon test results. Test results with radon concentrations of 4 pCi/l or less were considered acceptable for HUD insurance. Houses with radon concentrations above 4 pCi/l were ineligible for HUD-insured financing.

Only 2 single-family houses exceeded the 4 pCi/l level in the 452 houses tested between the fall of 1979 and March 1985, according to the Montana State Department of Health and Environmental Sciences and a HUD field office. A HUD environmental engineer said few houses showed high radon levels because home owners discovered that the tests could easily be compromised by airing out the house.¹

HUD considered discontinuing radon testing in Butte and Anaconda, Montana, in 1982 for the following reasons:

- HUD was the only agency, including state and local governments, to require the test. The VA and FmHA considered the same procedure and decided not to participate. Local building codes do not require such tests as a condition of sale.
- The tests are of little value, since they are affected by weather conditions, and the property can be temporarily cleared of radon by opening doors and windows and airing out the property just before the test.
- There is little agreement on a standard for conducting the test.

Further, in a September 27, 1983, memorandum, a HUD assistant secretary stated that HUD should not be a policeman for another agency's guideline that is not enforceable by that agency.

HUD discontinued radon testing in Butte and Anaconda, Montana, in June 1985. In lieu of testing, HUD now requires that a radon disclosure notice be issued to applicants of HUD-insured mortgages at these locations. The disclosure notice warns that the radon levels in the Butte and Anaconda areas are unusually high and can cause indoor radon levels greater than 4 pCi/l. HUD requires that prospective buyers (1) be furnished with a copy of the notice and (2) certify that they have received and read it before a mortgage insurance application will be accepted by HUD.

Florida

In June 1975, EPA, in conjunction with two Florida state agencies, initiated a pilot study to examine possible hazards of living in houses built on reclaimed phosphate land. These are land areas restored after phosphate mining activity. Phosphate is not radioactive, but it is laced with

¹The testing method that was used is referred to as grab sampling. The radon grab sample is collected by opening a valve on a special flask and drawing air into the flask through a filter. The test takes from 1 to 2 minutes. Because the grab sample is a short-term measurement, it requires windows and doors to be closed 12 hours before and during the test.

traces of uranium that emit radon gas and can lead to lung cancer if indoor concentrations are inhaled over a prolonged period of time.

The EPA and Florida study was initiated because Florida's phosphate deposits, which extend over large areas of central and northern Florida, contain high concentrations of uranium. The study disclosed elevated radon levels in buildings constructed on land reclaimed from phosphate mining. Subsequently, HUD refused to insure mortgages for new construction on reclaimed Florida phosphate lands. HUD also denied mortgage insurance on the sale of existing houses in Florida. While HUD continues its policy of not insuring mortgages for new construction on reclaimed phosphate land, it stopped denying mortgage insurance for existing houses in late 1985.

HUD began to provide mortgage insurance for existing houses on reclaimed Florida phosphate land after a HUD regional official questioned the feasibility of continuing to deny insurance for existing houses, particularly since HUD was insuring, but issuing disclosure notices for, houses in Butte and Anaconda, Montana. Consequently, in late 1985, HUD decided to use the same warning method for Florida. The Florida disclosure notice was based on the notice used in Butte and Anaconda, Montana.

According to a HUD environmental official, HUD is considering approving mortgage insurance for new construction on the reclaimed lands, if construction techniques applied in a recent Florida demonstration project are incorporated by the state into the building codes.

Edgemont, South Dakota

In 1978 EPA conducted a radiation survey of Edgemont, South Dakota, at the request of the Nuclear Regulatory Commission. This request followed an earlier EPA survey of Edgemont that raised radiological concerns, according to an official of South Dakota's Department of Water and Natural Resources. In combination, this state official noted the 2 surveys disclosed a total of 60 locations where uranium mill tailings were suspected of being used in construction.² Thereafter, this state official said additional surveys revealed high radon levels in structures where mill tailings were not present.

²In 1985, the Congress authorized funding to clean up uranium mill tailings. However, federally funded cleanup was limited to properties that were contaminated by uranium mill tailings.

In 1980, after being notified by state officials of high radon levels in Edgemont, HUD consulted with EPA and planned to require radon tests as a prerequisite for obtaining HUD insurance in Edgemont. HUD planned to deny insurance on Edgemont houses for which the radon level exceeded 4 pCi/l—the level suggested by EPA. Before the testing requirement could be instituted however, Edgemont city officials filed suit and obtained a restraining order preventing HUD from initiating the tests. The law suit was dismissed in July 1980, when an out-of-court settlement was reached.

Under the terms of the settlement agreement, HUD could perform radon tests but could not deny mortgage insurance on houses with excessive radon levels if remedial action was planned. According to a HUD housing official, HUD dropped the radon testing requirement in Edgemont, South Dakota in June 1985. In lieu of testing, HUD now requires that a radon disclosure notice be issued to all applicants of HUD-insured mortgages in Edgemont, South Dakota.

Present Efforts

HUD headquarters officials said HUD continues to require that a radon disclosure notice be given to prospective applicants for mortgage insurance in Butte and Anaconda, Montana, certain portions of Florida,³ and Edgemont, South Dakota. However, these officials said such notices are not required in any other area of the country. Department officials also participate on interagency committees that address radon hazards and have recently conducted a 10-state survey to determine the type of radon activities being performed at the state level. In addition, HUD headquarters officials have provided general radon information to regional offices.

HUD environmental officials participate on the Committee on Interagency Radiation Research and Policy Coordination (CIRRPC) and HUD research officials participate on the Committee for Indoor Air Quality (CIAQ). Both of these committees address indoor radon as one of a broad range of issues within their charter. CIRRPC has an overall charge to coordinate radiation matters between agencies, and CIAQ focuses on various indoor air pollutants. (See app. IV for additional information on these committees.)

HUD's Office of Environment and Energy surveyed 10 states in fiscal year 1987 to determine, for HUD's general informational purposes, the

³Pertains to existing houses in Florida built on reclaimed phosphate land.

Chapter 3
HUD's Radon Responsibilities Are Unclear

types of radon activities being performed at the state level. The questions that were asked the states dealt with radon issues, such as state legislation, mapping, and disclosure requirements. Table 3.1 provides a sample of the 14 survey questions and responses by 9 of the 10 states; 1 state did not respond.

Table 3.1: States' Response to HUD's 1987 Radon Survey

Question	Alabama	Colorado	Connecticut	Kansas	Kentucky	Maryland	New Jersey	New York	Pennsylvania
Is state legislation existing or pending for radon detection, testing, contractor licensing, or home-owner financing?	None	Denied	None	Pending	None	None	Yes	Yes	Yes
Has the state been mapped or is being mapped for major radon areas?	Partially ^a	No ^a (plan to map EPA's State Survey results)	Underway ^a	Underway ^a	Underway ^a	No	Underway	No	Partially
Does the state have an adopted radon standard?	Yes (probably EPA)	No	Yes (EPA)	Yes	No	Yes (EPA)	Yes	Yes (EPA)	Yes (EPA and CDC)
Does the state have a requirement for using disclosure statements?	No	No	No	No	No	No	No	No	No
Does the state have licensing requirements for testers or contractors?	No	No	No	No	No	No	No (legislation pending)	No (plan to develop)	No (proposed legislation)

^aThe state was included in EPA's State Survey, see ch. 2.
Source: HUD Summary Analysis, February 1987

In addition, HUD has distributed radon information to its regional offices. For example, HUD environmental officials distributed radon information to regional environmental officers at a training session held at the end of fiscal year 1987. The information included EPA documents, such as a map indicating areas with a greater potential for radon problems, determined solely by the uranium content of rocks near the land surface; preliminary data from EPA's state survey effort; and general background information on radon.

EPA's and HUD's Legislative Mandate for Radon Research

Under title IV of SARA, EPA, in conjunction with HUD, is to conduct research on (1) methods for assessing the potential for radon contamination of new construction and (2) design measures to avoid indoor air pollution. EPA is carrying out the lead role in responding to this requirement. HUD's role remains unclear, and the agency has not been actively engaged with EPA in the pursuit of research for determining new construction's radon potential and measures for avoiding indoor air pollution. However, at the time of our review, a HUD policy development and research director stated that HUD was considering funding a radon research project at a cost of \$40,000 for fiscal year 1988. The proposed project was for radon site-testing and measurement. If funded, it is to be carried out by the National Research Center of the National Association of Home Builders and the State of New Jersey.

In joint hearings on April 2, 1987, before two subcommittees of the Senate Committee on Environment and Public Works,⁴ an EPA official was asked why HUD and EPA had not entered into any agreement to meet their joint mandate under SARA. An EPA official responded that as a direct result of SARA, EPA had started to lay out the framework for an agreement with HUD that would accomplish the objectives of the law.

No agreement has been reached, however, and HUD officials told us the outlook is not good for one because (1) HUD officials perceive EPA as willfully assuming the lead responsibility for the shared mandate and (2) funds are generally associated with these types of agreements. These HUD officials stated that HUD has no funds available for radon work and none have been requested. However, as noted above, HUD was considering funding a radon research project at a cost of \$40,000.

At the time of our review, HUD and EPA officials told us no progress was being made in reaching agreement between the two agencies. Further, they could not tell us when an agreement would be reached.

Unresolved and Emerging Radon Issues

HUD faces several unresolved and emerging radon issues: (1) what to do with seven HUD-owned houses with elevated radon levels, (2) what action to take at one new construction site, and (3) what response to make to elevated radon levels found in about half of the HUD-assisted houses tested on two Indian reservations in New York. EPA is planning to

⁴The Subcommittee on Environmental Protection and the Subcommittee on Superfund and Environmental Oversight.

assist in a radon survey of Indian housing in a three-state area, which may disclose elevated radon levels in other HUD-assisted housing.

In the past 2 years, HUD's Philadelphia and Denver regions have requested policy guidance from headquarters. However, HUD headquarters officials said HUD has no radon policy, and none is expected for a variety of reasons. For example, these officials pointed out that there is no federal radon standard.

HUD-Owned Houses With Elevated Radon Levels

In Edgemont, South Dakota, which has a known radon problem, HUD acquired seven houses with elevated radon levels through mortgage foreclosure. Generally, HUD would not know whether a house it acquires and holds in its inventory has an elevated radon level unless the house was previously tested and the results known. Other than the seven Edgemont houses, HUD does not know how many of the approximately 44,000 single-family houses in its inventory have a radon problem.

In January 1983, HUD's Denver region asked HUD headquarters for guidance on what to do with houses in Edgemont with elevated radon levels. Specifically, the acting regional administrator asked if the region

- must remove the contaminant or otherwise mitigate the contamination before selling the houses,
- was permitted to take corrective measures on contaminated houses under the current "as is" approach for sales, or
- should continue to hold these houses off the market.

In February 1983, the Assistant Secretary for Housing advised the region that it could take action to reduce the radon levels in the houses, but the region should not market the houses until policy recommendations have been decided on by the Secretary.

About 5 years later, a HUD regional official said the region has not received additional policy guidance. Consequently, they have continued to hold the seven houses in inventory. A regional housing director said HUD plans to evaluate each of the seven houses to determine if mitigation work is warranted, based on the value of the house. If feasible, the region will conduct the mitigation work. If the mitigation work is successful, the region will then sell the houses through the agency's regular property disposition program.

A headquarters housing official stated, however, that contrary to the 1983 interim guidance, the region should do no mitigation work on the houses prior to sale, as this would establish an "unacceptable precedent." Instead, he said HUD headquarters plans to advise the region that the houses should be sold "as is," using a disclosure notice to warn potential buyers of the radon hazard. HUD headquarters officials said these instructions were being drafted at the time of our review.

Radon Problem Found at Public Housing Construction Site

An April 1986 radon test report confirmed the presence of radon gas at a proposed site for a 100-unit public housing project in Bethlehem, Pennsylvania. The Bethlehem Housing Authority had the proposed site tested because it is located in an area known for high radon levels.

Because no other appropriate building sites are available for the project, the Philadelphia regional office plans to have radon mitigation measures installed during the project's construction. These measures were prepared on behalf of the public housing authority, reviewed by EPA, and forwarded to HUD headquarters for concurrence. In September 1986, HUD headquarters authorized project construction to proceed with the mitigation measures included. Although HUD headquarters authorized project approval in this case, these officials told us radon mitigation measures are not required to be incorporated in new construction projects financed by HUD. A regional official expects construction to begin in the spring of 1988.

A HUD regional official told us the Philadelphia region plans to have EPA test the project before occupancy to insure that radon levels are at an acceptable level. In addition, this official stated the region plans to warn potential tenants of the radon prevalent in the area and tell them that steps have been taken to reduce levels in the project to an acceptable level. Further, the regional office plans to offer housing vouchers to those qualified applicants who do not wish to live in the project because of the potential radon hazard. A housing voucher is a rent subsidy paid to landlords on behalf of low-income households.

According to a regional official, incorporating radon mitigation measures during construction, warning potential tenants about radon, and offering housing vouchers because of a potential radon hazard is not an agency policy, since the agency has no radon policy. This official stated that the Bethlehem approach is an informal agreement between the region and the Bethlehem Housing Authority.

Radon Identification Efforts in Indian Housing

Radon hazards in Indian housing receiving HUD assistance have been discovered on two Seneca Indian reservations in New York State. In addition, EPA is planning to assist with a three-state survey on Indian lands that may identify additional radon hazards in Indian housing.

Preliminary radon testing of Indian houses on two Seneca reservations has revealed elevated radon levels in a large number of the houses tested. For instance, on one reservation about 100 houses were tested, and about 50 percent had indoor radon levels over 4 pCi/l. Of the houses with elevated radon levels, about 10 percent exceeded 20 pCi/l. The houses tested are HUD-owned, according to a Seneca Nation Health Department official. The Executive Director for the Seneca Nation Housing Authority told us a proposal, which included a request for radon mitigation assistance, was submitted to HUD. This request was for HUD comprehensive improvement assistance program funds,⁵ but it was not approved by HUD, according to this Seneca Nation Housing Authority official. Funds were not denied because the request included radon mitigation funding, according to a representative of the housing authority. This official stated the service plans to resubmit a request that will include radon mitigation work next fiscal year.

Another radon survey of houses on reservation lands is planned by the Indian Health Service of HHS for Michigan, Minnesota, and Wisconsin. EPA will provide assistance through its state survey effort for fiscal year 1988. HUD headquarters officials told us it is premature to discuss HUD's involvement until the survey results are known.

Regional Radon Requests

In the past 2 years, two HUD regional offices have asked headquarters for radon guidance or policy. The first request, from the Denver region, in July 1986, stated that much of this region is located in an area considered to have a high potential for radon contamination. It noted that EPA is uncovering substantial sources of radon gas in that region outside the Butte and Anaconda area. Consequently, the region asked for advice to enable it to proceed with HUD programs in affected areas. HUD headquarters environmental officials said general radon background information has been provided to its regional offices, but no advice or policy has been developed concerning radon hazards and HUD programs.

⁵Section 14 of the U.S. Housing Act of 1937, as amended, established the Comprehensive Improvement Assistance Program and authorized HUD to provide financial assistance to public housing agencies to improve the physical condition and upgrade the management and operation of existing public housing projects.

The second request, from the Philadelphia region, in November 1986, noted that, in a very short span of time, the Philadelphia region had become uniquely aware of and sensitive to the growing public concern with radon gas. Much of the local and national media attention has centered on eastern Pennsylvania, in an area known as the Reading Prong. However, the former Regional Administrator stated in the request that other areas in his region, notably sections of Maryland, have also been identified as containing high radon levels, and indications are that radon is probably much more widespread than had previously been thought. In addition, one of the major results of the region's experience in reviewing the proposed public housing project in Bethlehem, Pennsylvania, had been the realization that HUD does not have clearly stated policies or procedures that address radon detection, measurement, and mitigation.

This former Regional Administrator also stated that HUD has approached the radon problem as a fairly isolated, limited issue. However, he added that the rather sudden emergence of radon as a potentially nationwide problem clearly suggests the need for a departmental policy that recognizes and responds to growing public awareness and concern. Therefore, he strongly urged headquarters to develop such a policy. Further, since EPA work is underway, this official recommended that an interim HUD position be developed pending the results of EPA's work.

During HUD's Senate appropriation hearings for fiscal year 1988, held in April 1987, HUD was asked whether it had an indoor radon policy. A HUD general deputy assistant secretary said that HUD is in the process of developing a policy on radon issues related specifically to HUD-assisted programs. However, at the time of our review, HUD headquarters told us that HUD had not yet developed and is not currently developing a radon policy or an interim radon position for the reasons discussed below.

Reasons for Lack of Radon Activity

Environmental officials at HUD headquarters cited a number of factors that limit the agency's radon activities and have prevented the development of a policy. The six primary factors are: (1) with one exception, HUD has no direct statutory mandate; (2) a federal radon standard has not been established; (3) HUD has no designated funds for radon work; (4) an adequate methodology for surveying broad areas with potentially high radon levels is not available; (5) an adequate methodology for predicting radon levels at new construction sites does not exist; and (6) short-term radon tests can be manipulated.

First, with the exception of the SARA research requirement that HUD shares with EPA, we found no statute requiring specific HUD action on radon. HUD's general authority, however, would appear to be sufficient to allow HUD to respond to radon hazards. The Housing Act of 1949, for example, requires HUD to exercise its powers and duties so as to "assist the production of housing of sound standards of design, construction, livability."

Although HUD is not specifically required to take any action with respect to radon, failure to respond to actual radon hazards found in HUD-assisted housing might expose HUD to liability, as has happened with respect to other conditions found in public housing determined to be hazardous. We discuss this possibility in chapter 5.

In regard to the second factor, the lack of a federal radon standard, HUD environmental officials believe that such a standard is needed before HUD can establish a radon policy. As previously mentioned, HUD did use EPA's suggested guideline of 4 pCi/l in testing houses in Butte and Anaconda, Montana. However, as a HUD assistant secretary stated, HUD should not be a policeman for another agency's suggested radon level when it is not enforceable by that agency.

EPA has not developed a radon standard and has stated that it does not appear that a regulatory approach is suitable to deal with this naturally occurring health hazard. Moreover, EPA has taken the position that it lacks clear statutory authority to prescribe what homeowners should do about radon. EPA believes that the primary line of response to the problem should be state and local governments and the private sector. Consequently, EPA is pursuing its objectives, not by the usual regulatory means, but rather by trying to ensure that needed technical knowledge exists and that homeowners, contractors, and state and local officials have access to it. This effort has included the issuance of radon guidelines for use by the general public. The EPA guidelines note how quickly action should be taken, based on differing levels of radon contamination. The guidelines state that radon levels in most houses can be reduced to about 4 pCi/l, given the level of current technology.

On the third point, no designated funds for radon work, HUD had not requested specific radon research funding in its fiscal year 1987 and 1988 budget proposals. However, according to a HUD policy development and research director, HUD was considering reprogramming \$40,000 in fiscal year 1988 to fund a radon site-testing and measurement project. No decision had been made at the time of our review.

With respect to the fourth primary factor, the inadequate methodology for surveying broad areas with potentially high radon levels, HUD environmental officials explained that this is essentially a dual problem because there is no completely reliable way of surveying broad areas for radon or of determining if individual houses within a large area are contaminated without testing each house.

EPA officials agree that the location of high radon levels cannot presently be predicted with certainty, as levels may be affected by a number of factors including (1) soil permeability, (2) the uranium content of nearby rock and soil, and (3) house characteristics. As EPA stated in a September 1987 guide—Radon Reduction Methods—the first lesson to learn in dealing with radon reduction is that no two houses are alike. Even houses that look the same have small differences in construction that can affect radon entry. In addition, underlying soils may also vary, even among houses that are close together.

On the fifth reason, lack of an adequate method to predict radon levels at new construction sites, EPA has stated it has performed some preliminary work on the use of soil gas measurements to predict the radon potential for individual parcels of land. However, an EPA official cautioned that this research effort is in its infancy, and further progress depends on future funding and personnel.

The sixth factor, manipulation of short-term radon tests, was a problem HUD environmental officials encountered in their radon testing for Butte and Anaconda, Montana. The tests were discontinued after officials learned that they were easily compromised by “airing out” the house prior to the radon test.

Conclusions

Elevated radon levels are being recognized as a significant health problem in housing throughout the country. EPA estimates 12 percent of the approximately 85 million houses in the United States may have radon levels over 4 pCi/l—the level at which the agency recommends corrective action. HUD, however, as the lead federal housing agency, has yet to delineate a specific policy or course of action it will take in response to emerging radon issues.

HUD is presently responding to radon hazards in a limited, piecemeal manner. For instance, HUD is issuing radon disclosure notices to prospective applicants of HUD-insured mortgages in (1) Butte and Anaconda,

Montana; (2) Edgemont, South Dakota; and (3) certain portions of Florida. HUD does not issue disclosure statements in other areas where a large number of houses have been found to have elevated radon levels. For example, EPA state survey assistance indicated that 39 percent of 900 houses tested in Colorado, and 21 percent of 1,000 houses tested in Kansas had elevated radon levels.

In addition, radon reduction techniques will be incorporated into the construction of a HUD-assisted public housing project in Bethlehem, Pennsylvania. However, such techniques may not be considered for other new HUD-assisted construction projects.

Although HUD has responded to a few site-specific radon hazards that generally occurred years ago, HUD headquarters told us that HUD had not yet developed and is not currently developing a radon policy or an interim radon position primarily because HUD is not specifically required to respond to potential radon problems. With the exception of the SARA research requirement HUD shares with EPA, HUD has no direct statutory mandate to address radon issues. In addition, HUD officials have taken the position that the many outstanding issues associated with radon prevent the development of a radon policy. For example, there is no federal radon standard, and HUD officials question whether HUD should be taking action on the basis of a suggested action level of 4 pCi/l. Further, it is presently unknown which areas of the country, and specifically which houses, are affected by elevated radon levels.

We agree that the many outstanding radon issues make the development of a HUD policy more difficult. But, we do not believe that these outstanding issues should prevent HUD from developing policies and procedures based on current information, which can be revised as radon knowledge expands. It is not likely, according to HUD officials, that a HUD radon policy will be forthcoming for a number of reasons, unless HUD is specifically directed to do so by the Congress. Therefore, we believe that Congress should consider outlining HUD's expected indoor radon responsibilities.

As noted earlier, HUD's specific legislative radon responsibility is limited to a shared research responsibility with EPA through SARA to conduct research on (1) methods for assessing the potential for radon contamination of new construction and (2) design measures to avoid indoor air pollution. HUD and EPA have discussed the development of an agreement delineating each agency's responsibilities in fulfillment of this shared

mandate, but there essentially has been no progress in reaching agreement.

Matters for Consideration by the Congress

If the Congress wants HUD to assume a more active role in responding to elevated radon levels in housing, it may wish to consider outlining expected HUD indoor radon responsibilities. In addition, the Congress may wish to specify what activities should be conducted by HUD. Such activities could include, for example,

- providing prospective mortgage insurance applicants with general radon information through a disclosure notice;
- sending a notice to all or selected public and Indian housing authorities setting forth specific procedures by which tenants residing in federally assisted housing are to be notified of the possibility of indoor radon hazards and testing procedures;
- selling its properties only after it has (1) reduced elevated radon levels to the extent considered feasible by existing mitigation techniques, or (2) attached an addendum to the sales contract advising the purchasers that if a radon hazard is present, they have a responsibility to abate the hazard before occupancy;
- incorporating and evaluating, at least on a pilot basis, the effectiveness of radon mitigation techniques in new construction financed by the department; and
- reporting to EPA on the effectiveness of any radon mitigation techniques used in HUD-assisted housing.

Recommendation to the Secretary, HUD, and the Administrator, EPA

We recommend that the Secretary of HUD and the Administrator, EPA, define their respective responsibilities and planned actions in response to their shared legislative mandate.

Other Federal Agencies' Response to Radon Hazards

We also examined radon activities of several other agencies involved in civilian housing: FmHA, the VA, and the National Park Service. FmHA provides credit to individuals living in rural areas who are unable to obtain credit from other sources at reasonable rates and terms; the VA assists veterans and other qualified applicants in obtaining credit through guaranteed and insured loans. In addition, the Park Service has become aware of potential radon hazards because it houses a large number of employees in areas under its jurisdiction.

These agencies have differed markedly in their response to potential radon problems. For instance, VA and FmHA officials said they are unaware of any radon problems in the housing their agencies finance or insure, and neither has a radon policy. However, FmHA plans to develop a policy. On the other hand, the Park Service has already identified elevated radon levels in its housing and is working on reducing those levels. This chapter discusses the radon responses of the three agencies.

FmHA Plans to Develop a Policy

FmHA headquarters officials have provided FmHA state officials with radon information. In addition, when two FmHA state offices asked for additional radon information, FmHA headquarters responded with some guidance. Although this guidance was not provided to other FmHA state offices, headquarters officials said an indoor air pollution policy is being drafted and may be completed by late fiscal year 1988. Despite this policy formulation, which is expected to include radon, FmHA headquarters officials said there were several factors limiting their radon involvement.

Information and Identification Efforts

Representatives from FmHA state offices have received radon information through FmHA training and quarterly informational mailings on environmental, engineering, and architectural subjects. For example, information based on EPA's action guideline was provided to FmHA state officials.

Radon was one of a number of issues addressed at a spring 1987 training session for FmHA state officials. Background information on radon was provided to these officials, and they were advised that FmHA was consulting with HUD and EPA on what course of action to take. In the interim, they were asked to be "sensitive" to radon as a possible problem and to know the "hot spots" in their state, if any.

Similarly, all state officials were asked to recognize radon hot spots within a state in the instructions for updating the FmHA natural resource management guide. FmHA requires state directors to review and update this guide every 2 years. The guide is intended to address any new standards and requirements that apply to land use and environmental resources within a state, such as underground storage tanks, hazardous waste, and radon. A May 12, 1987, notice advising state directors of the requirement to review and update their guide states, in part:

"Concern over Radon is mounting in a number of States, as well as among officials of EPA, who recently identified indoor radon as a 'high risk' problem. Although EPA has not yet established exposure standards for the radioactive gas, many States are conducting studies to determine the level of radon contamination in structures. If applicable, State radon guidelines should be listed in the Natural Resource Management Guide. Mapping, if available from the State, would identify the 'hot spots' in your State and become part of your inventory"

FmHA provided us with a guide update for Ohio. The update includes general information on radon and its health effects. It notes that while most buildings are not likely to have a radon problem, a few do have highly elevated levels. The dilemma right now, the guide explains, is that no one knows which buildings have a problem, although Ohio and the federal government are working to identify areas that are likely to have indoor radon problems.

Radon Guidance Provided to Two FmHA State Offices

A FmHA headquarters director said FmHA state officials from Florida and Idaho specifically asked headquarters for radon information. Consequently, FmHA headquarters officials provided guidance and radon background information in 1986 to these two states on how to deal with radon problems. This FmHA director said the guidance, which was in the form of a memorandum, was not sent to other FmHA state officials because headquarters was waiting for the development of more radon information, such as a radon standard.

While a radon standard has still not been established, FmHA headquarters officials said an indoor air pollution policy is being drafted and may be completed by late fiscal year 1988. This policy is expected to address various indoor air pollutants, including radon and asbestos. The policy that is being developed for radon may be patterned after the guidance memorandum that was sent to Florida and Idaho, according to FmHA headquarters officials. The guidance memorandum provides the following advice according to various types of transactions:

- Purchase of new or existing structures. When a structure is known to have a radon problem, advise the eligible applicant of related disadvantages, such as low appraisal value and health hazards. Further, in financing the purchase of existing structures known to have radon, there should be no indication of residents having health problems associated with radon in the last year, or an air sample test should indicate that the level of radon present in the building is within acceptable health levels.
- Transfers. Follow the advice for the purchase of existing structures, except if a health hazard associated with radon is known to exist. In that case, the property may be transferred to an eligible borrower only if remedial measures are taken either to eliminate or to reduce the radon to an acceptable level.
- Inventory property.¹ Follow the advice for the purchase of existing property, except if a health hazard associated with radon is suspected. In that case, the air within the property should be tested. If test results indicate that unacceptable levels of radon are present, mitigation measures should be considered, if economically feasible, or the property should be declared unsuitable for occupancy.
- Construction of new buildings or improvements in existing buildings. The loan applicant should be advised of the disadvantages of radon when it is known to be present. Further, in determining whether FmHA will accept the site for financing, the degree of risk associated with the property should be analyzed along with mitigation methods.

We were advised that FmHA headquarters has no information on whether there has been a need for Idaho or Florida state officials to use this guidance.

We asked FmHA Florida and Idaho officials why they had requested the guidance. A FmHA official in Idaho said radon information was requested for use at a FmHA state training session. In Florida, a FmHA official said a construction inspector had asked what FmHA was doing in regard to radon, and this query led to the office's asking FmHA headquarters for the information. We were told by the FmHA state officials that the guidance has never been applied by the two state offices. Both FmHA state representatives told us they were not aware of any radon problems in FmHA-financed property. One noted that FmHA cannot be expected to test every house it finances for radon. According to the other state official,

¹ Refers to real and chattel (moveable) property and related rights to which the government has acquired title.

however, all federal agencies should be encouraging the installation of radon prevention techniques in new construction.

Limiting Factors

We asked FmHA headquarters officials what factors, if any, may have limited their radon activities or involvement. They told us that lack of a direct statutory mandate was obviously a primary factor.

We found no statute specifically requiring FmHA action with respect to radon. FmHA does have general authority, however, to establish standards for decent, safe, and sanitary dwellings and to require that residential buildings receiving FmHA assistance comply with these standards. No court has, as yet, outlined FmHA's responsibilities with respect to radon in FmHA-assisted housing. We discuss in chapter 5 the possibility of federal liability for radon.

Other primary factors mentioned were that (1) the extent of the radon problem has not yet been determined through a national assessment and (2) there is no federal radon standard. As mentioned earlier, EPA does not anticipate completing the national assessment until fiscal year 1991 and is not charged with developing a national standard.

Lack of a federal radon standard has a bearing on the radon role for the agency, according to FmHA headquarters officials. These officials explained that one potential FmHA role could be to find out whether radon levels for agency-financed residential properties were at the proper level, but no one agrees on what the proper level should be. Nevertheless, FmHA headquarters officials said they plan to consider EPA's action guidelines in developing policy that will include radon.

VA Is Not Involved With Radon Issues

The VA has no radon policy and essentially is not involved with the issue, according to officials of the VA's headquarters Loan Guarantee Service. Because the agency is not required by the Congress to address radon hazards, these officials told us no radon policies have been developed.

VA loan guarantee officials stated that the agency considers identified radon hazards to be a state and local issue. Further, these officials said they are not aware of any state or local radon requirements affecting the VA's loan guarantee program, with the possible exception of Florida. We contacted the VA's regional office in St. Petersburg, Florida, and were told that the VA is conducting business as usual in the state because it has no policies concerning radon.

VA loan guarantee officials said there were several primary reasons for their limited involvement with radon. Most importantly, the VA has no direct statutory mandate to address radon. However, the VA is directed not to approve loan guarantees unless the property that is the subject of the guaranteed loan meets minimum standards for construction as prescribed by the VA and is otherwise suitable for dwelling purposes. Failure of the VA to uncover a radon problem at VA-assisted housing might expose the VA to liability. In chapter 5, we discuss several instances where the FmHA was found liable for failure to discover defects in houses it inspected, but it is unknown whether the courts would reach similar findings in situations involving radon.

Other primary reasons VA officials noted were: (1) the extent of the radon problem has not been determined, (2) EPA and other federal agencies are assigned lead radon roles, and (3) any unrequired action might make the agency legally liable—unnecessarily—in a radon lawsuit.

The National Park Service Has Taken Action to Protect Its Employees

The Park Service differs from the other housing agencies considered because its housing is owned by the federal government and provided to Park Service employees. The Park Service administers an extensive system of national parks, monuments, historic sites, and recreation areas. At these areas, the Park Service has 5,070 housing units for its employees, of which 2,840 are considered permanent and 2,230 seasonal.

The Park Service started a radon program in January 1987 to meet the government's responsibility to provide safe, healthful housing for its employees, according to an August 1987 interim report on the program. Program objectives include developing a sound strategy for testing housing and administrative buildings, and the formulation of guidelines on needed mitigation work.

The Park Service and EPA have entered into an interagency agreement, "EPA Technical Assistance for NPS Radon Gas Detection Program." Under this agreement, EPA is to provide technical support, including (1) supplying detectors for radon testing, (2) making field visits to selected sites as requested by the Park Service, and (3) providing assistance in obtaining training on mitigation measures. The agreement provides that the Park Service will reimburse EPA for the radon detectors, as well as for any necessary travel by EPA employees. It does not, however, provide that EPA will receive information on the effectiveness of mitigation techniques used in Park Service housing. A Park Service official said such

information may eventually be provided to EPA, even though it is not part of the agreement.

Consultation on the Park Service's indoor radon program is also being provided by the Centers for Disease Control. For instance, consultation includes guidance concerning the health effects from exposure to radon.

The Park Service is using a three-step measurement strategy for assessing radon levels in its employees' housing units. First, preliminary testing (a screening measurement) of permanent housing was made to determine whether a building had the potential for exposing occupants to high levels of indoor radon. Second, if preliminary testing indicated a radon level above a target limit of 4 pCi/l, additional follow-up measurements were to be made. Third, testing of administrative and seasonal housing was planned in areas where permanent housing measurements indicated potentially high radon levels. Selective testing in other geographical areas is also to take place.

Preliminary Testing Discloses Radon Hazards

The Park Service reported the preliminary test results on 2,839 of its permanent houses in an August 1987 interim report. As table 4.1 indicates, almost 20 percent of the houses tested were at 4 pCi/l or greater—the level recommended by EPA as a target for corrective action.

Table 4.1: Park Service—Preliminary Radon Testing Results for Permanent Houses

Preliminary testing results	Number of houses	Percent of houses
Less than 4 pCi/l	2,310	81
4-10 pCi/l	361	13
Over 10-20 pCi/l	100	3
Over 20-50 pCi/l	46	2
Over 50 pCi/l	22	1
Total	2,839	100

In addition, preliminary testing was performed on slightly over 300 seasonal houses and administrative buildings owned by the Park Service.

Mitigation Work Follows

Preliminary radon testing, according to the Park Service strategy, was followed by further measurements if the initial reading was more than 4

pCi/l. These measurements follow EPA's guidance in a pamphlet, "A Citizen's Guide to Radon—What It Is and What To Do About It." This pamphlet recommends follow-up measurements before the decision is made to undertake major efforts to correct a radon problem permanently.

The pamphlet states follow-up measurements should be made in at least two lived-in areas of the home. If a home has lived-in areas on more than one floor, EPA suggests measuring radon in a room on each floor. The results of the follow-up measurements should be averaged together.

Consequently, the Park Service followed these guidelines. Table 4.2 shows the results from the follow-up measurements and indicates the number of buildings requiring mitigation work.

Table 4.2: Park Service—Estimated Number of Buildings and Percent Requiring Mitigation

Region	Number of Buildings				Total	Percent
	4-10 pCi/l	Over 10-20 pCi/l	Over 20-50 pCi/l	Over 50 pCi/l		
Alaska (Anchorage)	9	6	0	0	15	4.3
Mid-Atlantic (Philadelphia)	19	6	0	1	26	7.4
Midwest (Omaha)	11	4	4	0	19	5.4
North-Atlantic (Boston)	17	1	0	0	18	5.1
National Capital (Washington, D.C.)	12	2	1	1	16	4.5
Southeast (Atlanta)	18	2	1	0	21	6.0
Southwest (Santa Fe)	13	0	1	1	15	4.3
Western (San Francisco)	26	1	1	1	29	8.2
Pacific Northwest (Seattle)	4	0	0	0	4	1.1
Rocky Mountain (Denver)	111	50	19	9	189	53.7
Total	240	72	27	13	352	100

The Park Service budget for fiscal year 1988 contains \$500,000 for radon mitigation work. The Park Service intends to use these funds to mitigate the 112 buildings having radon levels in excess of 10 pCi/l. Consequently, it notes that this leaves a balance of 240 buildings, with

radon levels between 4.0 and 10 pCi/l, to be mitigated in fiscal year 1989. The mitigation work is to be performed largely by its employees.

Conclusions

Unlike the Park Service, which provides employee housing, FmHA provides credit to individuals from rural areas who are unable to obtain credit from other sources at reasonable rates and terms. The VA administers a guaranteed and insured loan program for veterans, their surviving spouses, and service personnel. These agencies' housing responsibilities differ, as have their responses to potential radon hazards.

The Park Service is aggressively acting to protect its employees against radon hazards. We expect that considerable information will be gained by the Park Service as mitigation work is performed to reduce elevated radon levels in its housing. The Park Service and EPA have been closely working together. For instance, EPA supplies the Park Service with detectors for radon testing. Other responsibilities of the two agencies are spelled out in an interagency agreement. This agreement, however, does not provide that EPA receive information on the effectiveness of radon mitigation techniques used by the Park Service. Because we believe that valuable information will be acquired by the Park Service on a wide array of housing structures, we believe that the existing interagency agreement should be amended to help assure that EPA receives information on the effectiveness of mitigation techniques used by the Park Service.

FmHA and VA gave a number of reasons for their agencies' limited radon involvement. Primarily, they pointed to the lack of a direct statutory mandate to deal with radon. Although FmHA does not have a direct statutory mandate to deal with radon, FmHA headquarters officials said they plan to develop an air pollution policy that will include radon. Since this planned policy has just begun to be formulated, it is unknown to what extent, or how, potential radon hazards will be addressed. Likewise, it is unknown how this policy may parallel the response of other federal agencies to potential radon hazards. Nevertheless, FmHA provides a contrast with the VA, which assumes no radon responsibility because it views radon as a state and local government issue, not a federal problem.

If federal housing agencies respond differently to radon hazards, it could create problems and lead to a fragmented federal response. To prevent a fragmented federal housing response to the radon problem,

the Congress may wish to consider broadly outlining expected indoor radon responsibilities for federal housing agencies.

**Matters for
Consideration by the
Congress**

FmHA and VA have no specific statutory mandate to address indoor radon hazards. If the Congress decides to outline indoor radon responsibilities for HUD, it may wish to consider the same action for FmHA and VA.

**Recommendation to
the Secretary of the
Interior and the
Administrator, EPA**

We recommend that the Secretary of the Interior and the Administrator, EPA, amend their interagency agreement to require that Park Service information on the effectiveness of indoor radon mitigation techniques be provided to EPA for its use and consolidation with other mitigation data.

Case Law Does Not Specifically Address Federal Liability for Radon

Courts have not addressed whether the federal government is required to compensate for or mitigate radon in housing when it acts as a seller, insurer, or landlord. Under the Housing and Community Development Amendments of 1978, however, recent decisions of lower federal courts have required the government as landlord to correct or eliminate various other conditions affecting habitability. Whether the reasoning of the most recent of those decisions will be upheld upon appeal, or extended to embrace exposure to radon at some undetermined level, is an issue that must be resolved by litigation. With respect to the liability of the federal government as seller or insurer, other cases suggest that, except in unusual circumstances, courts will not require the government to assure that the housing it sells or insures is free of hazardous levels of radon.

The Federal Government as a Landlord

Only one federal appeals court has addressed the issue of an implied warranty of habitability in public housing leases. Although this court found that the housing project was infested with roaches and vermin and had electrical and plumbing problems, it refused to imply a warranty of habitability when it rendered its decision in 1977. It explained that the implication of such a warranty is an assurance by HUD that all of its leased housing meets the objectives of a statutory national policy. It concluded that the Congress, not the courts, should be responsible for deciding whether to establish a requirement for such assurances.

In more recent lawsuits against the government as landlord, lower federal courts have held the federal government liable for failing to provide public housing tenants with habitable housing. In a decision of a federal district court in Massachusetts, for example, the court found an implied warranty of habitability in a public housing lease with respect to such conditions as vermin infestation, faulty appliances, and doors, walls, and ceilings that were in disrepair. The court based its decision on federal housing statutes that, the court said, impose a duty on HUD to take reasonable steps to maintain safe, decent, and sanitary conditions in federally owned property. Such steps, the court concluded, included eliminating hazards to life, health, and safety.

The court pointed out that the 1977 decision of the appeals court, which refused to imply a warranty, was rendered before enactment of the Housing and Community Development Amendments of 1978. According to the lower court, it is these amendments, together with other housing statutes, requiring HUD to provide decent, safe, and sanitary housing,

that have been the basis of recent decisions holding HUD liable for providing its tenants with habitable housing.

HUD has appealed the Massachusetts case. Also, it is currently litigating in a district court in Florida a claim brought by public housing tenants alleging exposure to asbestos.

In a 1979 claim brought by public housing tenants against HUD, a federal district court in Connecticut also found an implied warranty of habitability. Housing inspectors found structural and other defects, such as insufficient insulation, exposed wiring, water leakage, faulty heating and rat infestation. The court stated,

“implication of a warranty of habitability is consistent with the goals that Congress has enunciated in the federal housing statutes. For nearly forty years, Congress unequivocally has stated that the primary goal of its national housing policy is to provide ‘a decent home and suitable living environment for every American family . . .’”

These courts, and others, have provided relief by ordering HUD to correct or eliminate the hazardous condition; they have not awarded monetary damages to tenants.

The Federal Government as a Seller

Because the federal government typically sells houses on an “as-is” basis, federal housing officials claim it is unlikely that the government will be held liable for failure to remove radon or reduce it to non-hazardous radon levels. Generally, when a buyer purchases a house on an “as is” basis, he or she accepts the house in the condition in which it is delivered. The terms of such a sales contract would generally preclude the implication that the seller, the federal government in this case, guarantees delivery of a house that is in a habitable condition.

In the early 1970s, however, one federal district court in Pennsylvania read an implied warranty of habitability into such a contract. In that case, HUD had sold a house that it had reconditioned. The court found that, even after reconditioning, the house contained unsafe quantities of lead-based paint.

HUD argued that because the sale was made on an “as-is” basis, no warranty of habitability could be implied. The court, however, found HUD in violation of its own regulations when it sold a reconditioned home on an

“as-is” basis. The court noted that HUD is in the business of reconditioning and reselling houses and holds itself out as having the expertise to do so in such a way that makes the house fit for habitation. The buyer justifiably relied on HUD’s expertise, according to the court. In addition, the court said

“we feel that the [buyers] are entitled to expect more from their own government than they are from a seller dealing at arm’s length. HUD is not selling houses for profit, but rather to provide ‘a decent home . . . for every American.’ ”

This decision, we should note, is restricted by its terms to HUD’s sale of a house it had reconditioned. The court did not address, for example, the sale of a house that, although it might be determined to be uninhabitable, was not reconditioned and was sold “as-is.” There is little case law on this issue. One reason may be the difficulty of buyers establishing federal responsibility in an “as-is” sale.

The Federal Government as a Lender or Insurer

The Federal Housing Administration (FHA) inspects houses as part of its appraisal for mortgage insurance purposes.¹ In a 1961 case before the Supreme Court, a homeowner argued that FHA had been negligent in its inspection because it failed to notice certain structural defects. The homeowner said that he had justifiably relied on the FHA inspection in purchasing the house. However, cracks developed in the walls and ceilings of the house after he moved in. Inspectors found that the cracks resulted from the fact that the house was built on subsoil containing a pliable clay, which, when moist, shifted beneath the house’s foundation.

The Court found that the basis for the homeowners’ action against FHA was his allegation that he was misled by FHA’s appraisal. In such a case, the Court stated that the appraisal, if incorrect, would constitute “negligent misrepresentation;” that is, the communication of misinformation upon which the recipient relies. The Court pointed out that the Federal Tort Claims Act prohibits suits against the federal government for misrepresentation.² It therefore found for FHA.

¹For FHA-insured loans, the National Housing Act requires the seller of a house to provide the buyer with a written statement setting forth FHA’s appraisal of the property.

²As a general matter, the federal government, under a legal principal known as “sovereign immunity,” cannot be sued. In the Federal Tort Claims Act, the Congress waived the federal government’s sovereign immunity defense in many situations. That act specifically does not extend the government’s waiver to acts of misrepresentation, whether willful or negligent. Consequently, a finding that the government misrepresented something does not result in liability.

In 1983, the Supreme Court held the FmHA liable for failure to properly inspect and supervise construction of a house financed through a FmHA loan. The buyer's contract for construction of the house granted FmHA the right to inspect materials and workmanship, in order that FmHA could supervise construction, and FmHA in fact exercised that right. The buyer alleged FmHA's failure to uncover certain structural defects during inspections constituted negligence for which FmHA was liable.

The Supreme Court agreed. According to the Court, the fact that FmHA voluntarily undertook to supervise the construction of the house did not absolve FmHA from a duty to use due care in doing so.

The Supreme Court opinion discussed its earlier FHA decision and observed that the two cases raised different issues. The Court acknowledged that, somewhat as in the FHA case, FmHA had misrepresented the quality and progress of construction. But, FmHA also undertook to supervise construction and did so negligently; it was this conduct, the Court said, not the misrepresentation, on which the homeowner based his claim against FmHA. In the FHA case, the homeowner's complaint was based only on FHA's misrepresentation.

Conclusions

Courts have not addressed whether the federal government is required to compensate for or mitigate radon in housing when it acts as a seller, insurer, or landlord. Under the Housing and Community Development Amendments of 1978, however, recent decisions of lower federal courts have required the government as landlord to correct or eliminate various aspects of habitability, such as water leakage and rat infestation. HUD currently is defending a suit for alleged exposure to asbestos. Whether the concept of implied warranty will be held under the 1978 Amendments to embrace asbestos or radon, at some undetermined threshold of exposure, is an issue that will not be resolved without litigation. Other cases suggest that, except in unusual circumstances, courts will not imply a warranty by the federal government as seller or insurer to assure that the housing it sells is free of hazardous levels of radon.

Selected Background Information on the Agencies

HUD

HUD has a basic mission to provide adequate housing, promote community and economic development for urban areas, and eliminate discrimination in housing markets. The department administers nearly 80 programs, 3 of which dominate financially.

The three programs are: (1) The Home Mortgage Insurance program through which HUD insures lenders against loss on mortgage loans to individual homeowners; (2) the Section 8 Lower Income Housing Assistance program, which provides housing assistance payments to owners for the purpose of helping very low-income families live in decent, safe, and sanitary housing at rents they can afford; and (3) Public and Indian Housing, which has the objective of providing cost-effective, decent, safe, and sanitary housing through a Public Housing or Indian Housing Authority for families of low- and very low-income.

Total HUD obligations or loan guarantees for these three programs was expected to be about \$75 billion in fiscal year 1987. The Home Mortgage Insurance program alone accounts for over \$63 billion of this total. Of the remaining \$12 billion, the lower income housing assistance program was estimated to have fiscal year 1987 obligations totaling almost \$8 billion, and Public and Indian Housing obligations were estimated at over \$4 billion.

U.S. Department of Agriculture—FmHA

FmHA provides credit to individuals living in rural areas who are unable to obtain credit from other sources at reasonable rates and terms. Two of FmHA's principal housing programs are a rural homeownership program and a rural rental program.

The homeownership program, Section 502, provides loans to lower income families living in rural areas for purposes such as the construction, repair, or purchase of a house or building site. In fiscal year 1987, this program was expected to lend \$1.4 billion. The rural rental program, Section 515, provides loans to borrowers who are willing to build, purchase, repair, and operate low-rent multi-family housing projects. Fiscal year 1987 loan activity was estimated at \$700 million.

VA

The VA administers the Guaranteed and Insured Loan Program. This program is intended to assist veterans, surviving spouses of veterans, and service personnel in obtaining credit for the purchase, construction, or

improvement of homes on more liberal terms than are generally available to non-veterans. Credit is provided in the form of VA-guaranteed loans made by private lenders.

The VA guarantee protects the lender against losses in an amount not to exceed (1) in the case of any loan of not more than \$45,000, 50 percent of the loan; or (2) in the case of any loan of more than \$45,000, 40 percent of the loan or \$36,000, whichever is less, except that the amount of such guaranty for any such loan shall not be less than \$22,500. The average VA loan amount for fiscal year 1986 was about \$70,900. In fiscal year 1987, total VA loan guarantees are estimated to exceed \$25.8 billion.

**Department of the
Interior—The
National Park Service**

The Park Service is different from other housing agencies considered because the housing is owned by the federal government and is provided to Park Service employees. Park Service employees administer an extensive system of national parks, monuments, historic sites, and recreation areas.

EPA Radon Survey Assistance to Ten States

As noted in chapter 2, in the winter of 1987 EPA helped 10 states conduct radon surveys to identify high risk areas. Table II.1 shows the participating states and the number of houses tested.

Table II.1: Number of Houses Tested in the Winter of 1987 Through a Joint EPA and State Effort^a

State	Number of houses tested—considered in statewide computation	Number of houses tested—not considered in statewide computation
Rhode Island	190	•
Michigan	200	300
Colorado	900	•
Kentucky	900	•
Wyoming	800	100
Kansas	1,000	•
Connecticut	1,500	•
Wisconsin	1,200	500
Tennessee	1,800	•
Alabama	1,200	1,000
Total	9,690	1,900

Note: Includes random and non-random measurements

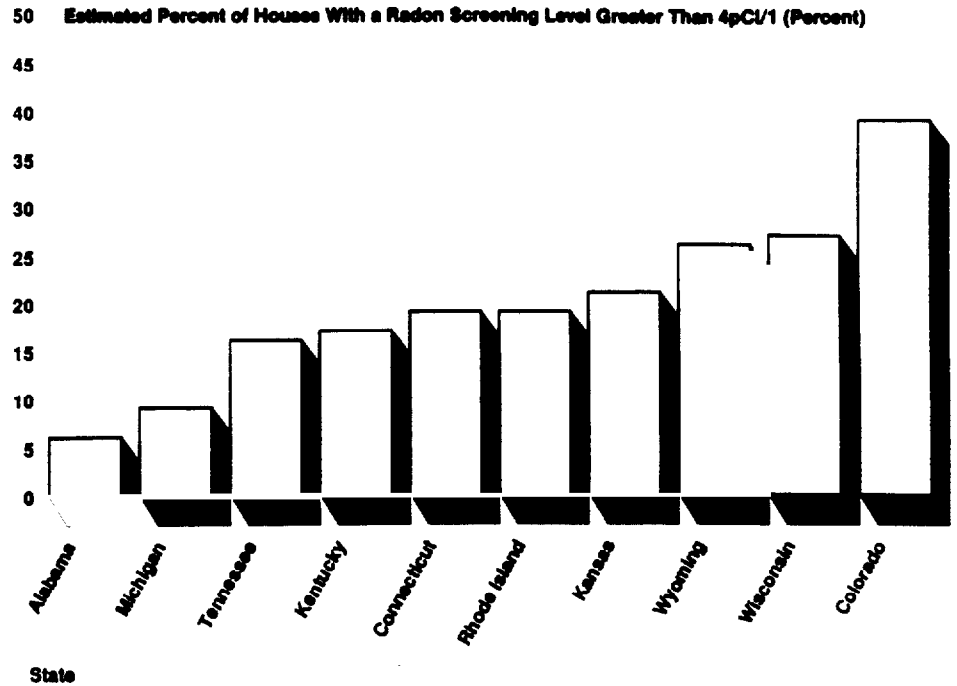
^aEPA reported the state surveys were not completed in Rhode Island, Colorado, and Kansas and additional measurements were planned.

Source: EPA.

EPA reported the surveys were done during the winter months, when houses are closed, to obtain measurements of the highest detectable radon levels. Radon levels, though, as several of the participating states noted, can vary greatly from season to season as well as from room to room. Consequently, the resulting screening measurements only serve to indicate the potential for a radon problem.

A screening measurement indicates a potential for a problem. To find out whether a problem does exist, EPA recommends additional measurements be conducted to better determine the average annual radon level, according to the EPA and HHS pamphlet "A Citizen's Guide to Radon." Despite the need for further measurements, figure II.1 showed potential radon problems in each of the 10 participating states.

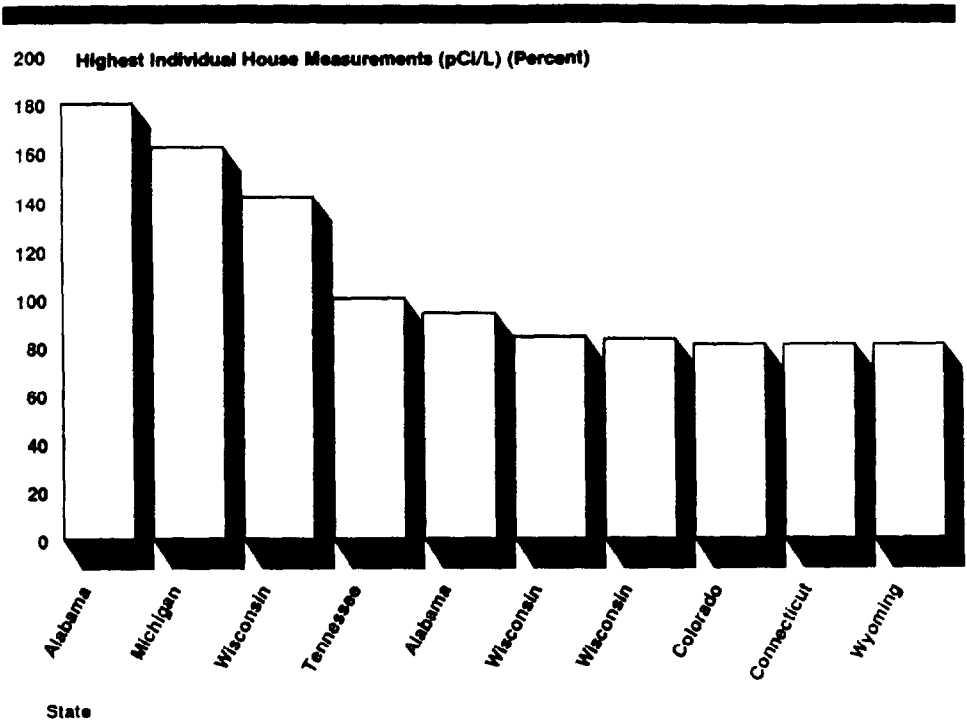
Figure II.1: 1987 State Indoor Radon Survey Results^a



^aEPA reported six of the states (Alabama, Kentucky, Michigan, Tennessee, Wisconsin, and Wyoming) had a sufficient number of measurements for the distribution to be statistically valid (95 percent confidence factor) over the entire state. But the surveys for Colorado, Kansas, and Rhode Island were incomplete, and additional measurements were planned for the winter of 1988. Also, Connecticut distributed measuring devices on a non-random basis.
Source: EPA

As figure II.1 indicates, the Alabama and Michigan state surveys showed a low percentage of houses with elevated radon levels. But, if only the highest radon levels in individual houses were considered, 3 houses in Alabama and Michigan tested among the highest 10 houses. In addition, three individual Wisconsin houses tested among the highest radon levels in the state surveys. Figure II.2 shows the highest 10 measurements in the survey effort.

Figure II.2: Ten Highest Radon Measurements in the State Surveys



Source: EPA

Level of State Radon Program Development as of July 1, 1987

As noted in chapter 2, EPA prepared a report, in cooperation with the conference of Radiation Control Program Directors, that provides information on state indoor radon programs. This 1987 report, Summary of State Radon Programs, was based on the work of a contractor—Putnam, Hayes and Bartlett, Inc. State programs, as shown below, were placed into one of four levels, depending on the extent of the problem as perceived by the state and its response.

Level 1—Information Programs

These states do not have an active program but do disseminate public information:

Arkansas	Mississippi	South Dakota
Hawaii	Nevada	Texas
Louisiana		

Level 2—Formative Programs

These states are actively beginning to address radon issues but have not begun extensive testing:

Alaska	Minnesota	Ohio
Arizona	Missouri	Oklahoma
California	Montana	Oregon
Delaware	Nebraska	South Carolina
Georgia	New Hampshire	Utah
Idaho	New Mexico	Vermont
Iowa	North Carolina	Washington
Massachusetts	North Dakota	West Virginia

Level 3—Developing Programs

Extensive statewide testing is taking place in these states:

Alabama	Kansas	Tennessee
Colorado	Kentucky	Virginia
Connecticut	Maryland	Wisconsin
Illinois	Michigan	Wyoming
Indiana	Rhode Island	

Level 4—Operational Programs

A radon problem has been reasonably confirmed, and the states are moving to address it. Some funding is available; all states have or have had task forces, and extensive testing has been completed in them.

Florida	Pennsylvania	New York
New Jersey	Maine*	

*Maine's program is operational for water but is developing for radon in air.

Summary of Two Interagency Committees Involved With Radon Issues

The Committee on Interagency Radiation Research and Policy Coordination (CIRRPC) was formed in 1984 with an overall charge to coordinate radiation matters among agencies, evaluate radiation research, and provide advice on the formulation of radiation policy. Membership consists of officials from virtually all the executive agencies. CIRRPC is chaired by an official from the Office of Science and Technology Policy, Executive Office of the President. CIRRPC addresses a broad range of radiation issues and has had subpanels address individual issues, such as indoor radon in more detail.

The Interagency Committee on Indoor Air Quality (CIAQ) was formed in December 1983 by congressional authorization.¹ The Congress' charge to CIAQ was threefold:

- to coordinate federal indoor air quality research;
- to provide for liaison and the exchange of information on indoor air quality among federal agencies, and with state and local governments, the private sector, the general public, and the research community; and
- to develop federal responses to indoor air quality issues.

The CIAQ consists of 15 organizations, of which 4 serve as co-chairs. The four co-chairs are EPA, the Consumer Product Safety Commission, the Department of Energy, and HHS. In addition to the full committee, there are eight standing work groups, which are charged with addressing indoor air quality issues, such as radon and health effects.

¹See H.R. 2899, Report No. 98-212, Part I, referred to the House Appropriations Committee

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