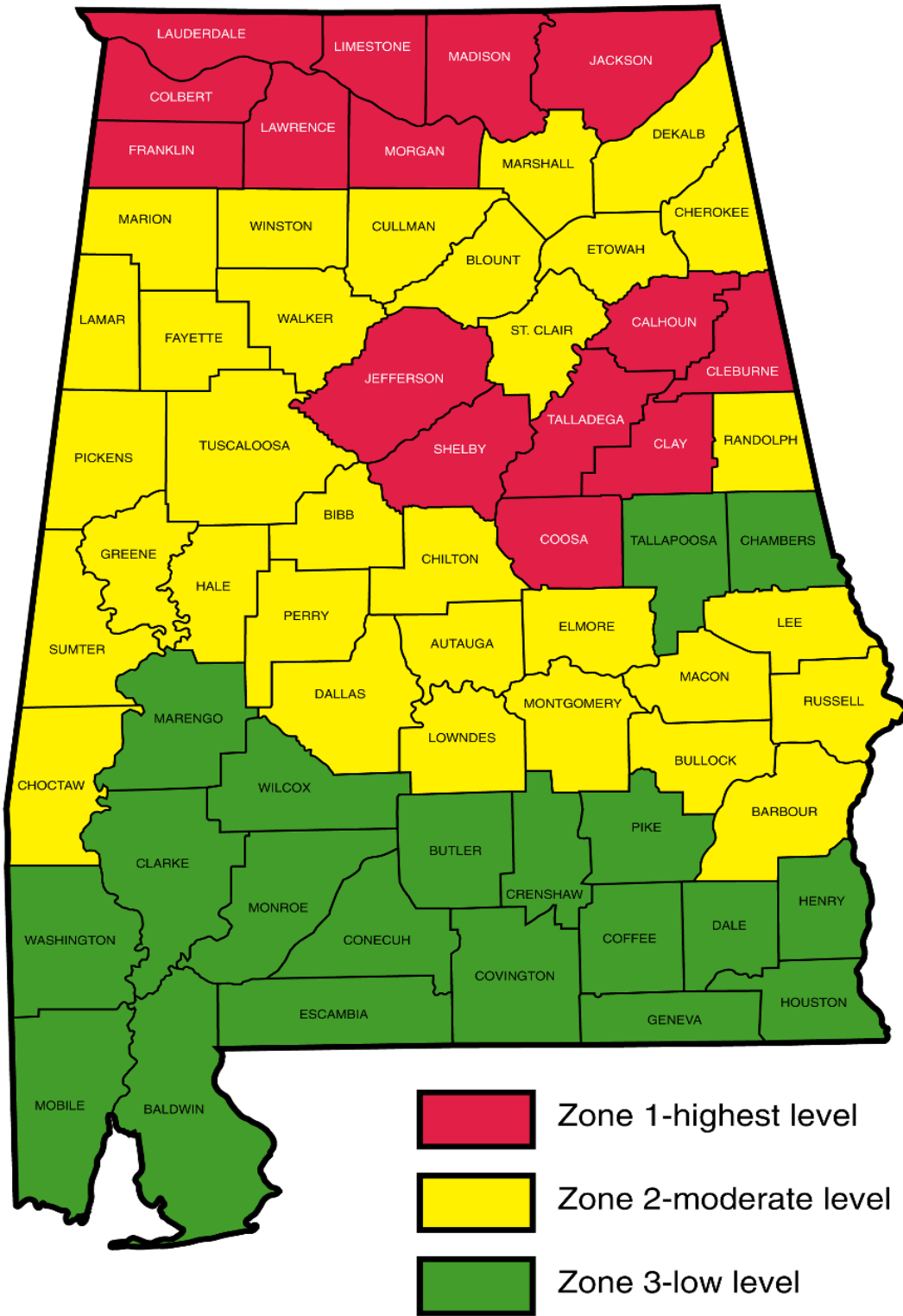


ALABAMA RADON MAP



1998

RADON

"Radon! What's the big deal? Why should I be concerned?"

"What do you mean? Why should I spend money on a radon test kit?"

"I've been tired lately; is it because of radon?"

"My family has been sick a lot this year; is it from radon in my house?"

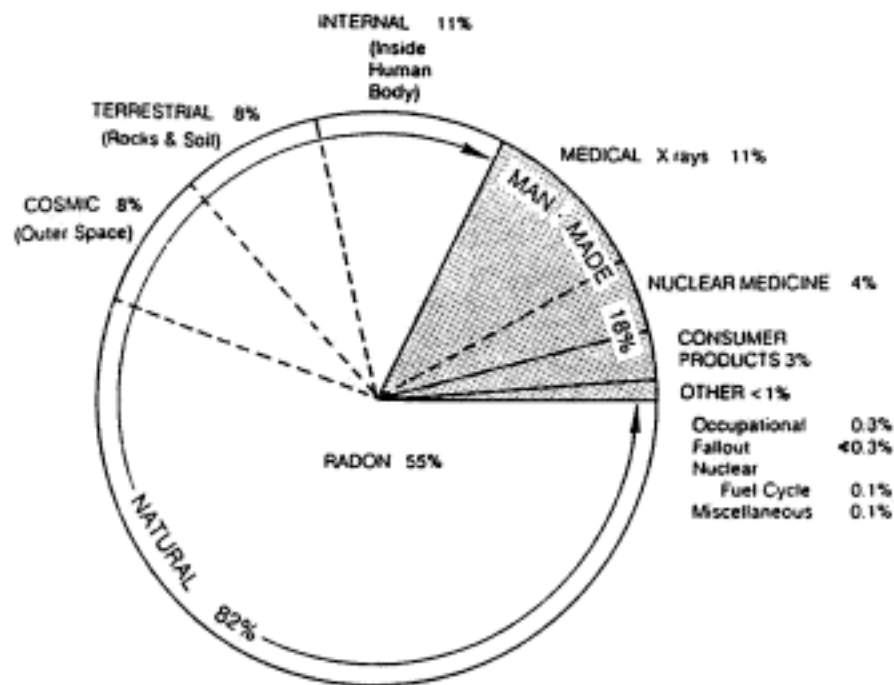
These might be some of your questions when the subject of radon is raised. This booklet is designed to answer those questions and others concerning radon. It is produced by the Division of Radiation Control, Alabama Department of Public Health (ADPH). If you have questions or need additional information, you can contact us at **1-800-582-1866**.

Radon may be our most under-estimated cause of cancer. According to the U. S. Environmental Protection Agency (EPA), this radioactive gas is responsible for more lung cancer deaths than any other single pollutant except tobacco smoke. In a comparative ranking of current environmental problems, the EPA listed radon as one of the two highest risks to human health. They estimate that between 7000 and 30,000 Americans die each year as a result of radon-induced lung cancer. Despite these facts about the risk to our health, few of us have made the effort and investment to test our homes for the presence of this gas.

What is radon? Radon is a colorless, odorless, and tasteless radioactive gas that occurs naturally in most rocks and soil.

Where does radon come from? Radon comes from the natural, radioactive decay of uranium. It is found in high concentrations in rocks and soil that contain uranium, radium, granite, shale, phosphate, and/or pitchblende. Radon may also be found in soils contaminated with some types of industrial waste, such as the byproducts from uranium or phosphate mining. Radon may also be found in water from wells or in water provided by small, rural type water systems.

How does radon affect me? Radon was determined to be a health problem based on studies about the health of underground miners. It was found that miners who were exposed to increased levels of radon suffered significantly higher rates of lung cancer than miners not exposed to high radon levels. These studies are among the few that have used humans as test subjects and clearly show that radon is a significant health hazard. However, radon does not cause illnesses or problems such as upper respiratory infections, colds, or allergic reactions. Its only known health effect is an increased risk of developing lung cancer. However, as with those who smoke, not everyone exposed to high levels of radon will develop lung cancer, and the time between exposure and the onset of cancer may be many years. But also like smoking, it is easy to reduce your risk from this health hazard.



Sources of radiation exposure to the U.S. population (NCRP87b).

Are scientists sure that radon is a hazard to my health?

As with the study of any health issue, there are some areas of disagreement between scientists about the magnitude of the health risk.

There is wide agreement that radioactivity can have a detrimental effect on one's health. It is widely recognized that radiation can have an adverse effect on the human body. This has been shown by the results of many different studies. We face the problem that each of us is subject to many sources of radiation in our daily lives. Some of this radiation is man-made such as x-rays, nuclear energy or nuclear medicine. Other sources are naturally occurring. These include chemicals inside our own bodies, cosmic radiation, and radon. Figure 1 shows the sources of radiation exposure to the U. S. population. (Source: BEIR V Report, 1990). Radon makes up 55% of the total radiation exposure in this country.

There is also wide agreement that underground miners have higher levels of lung cancer than the general population and that these higher levels of lung cancer are due to the effects of radon. The uncertainty and disagreements are over the questions "What is a safe level of radon?" and "What should be the maximum permissible level for a home?".

When did radon become a problem? Radon has always been present in the soil, rocks, and air around us. Underground miners have been dying from lung cancer for many years, but it was only in the 1950s and 1960s that these deaths were clearly linked to the presence of radon in the mines. Concern about elevated levels in homes arose in the late 1960s when homes were found in the Western U. S. that had been built with materials contaminated by waste from uranium mines.

In 1984, a worker in a nuclear power plant in Pennsylvania created problems because radiation alarms were repeatedly triggered when he was working. To everyone's shock and surprise, officials learned that he was bringing the radiation into the nuclear power plant on his clothes. When he tested his home, he discovered the highest level of residential radon ever found until that time, 2700 picocuries per liter of air (see page 9 for an explanation about how radon is measured). To provide a comparison, the average level of radon in homes in the United States is about 1.3 pCi/l and the average outdoor level is about 0.3 pCi/l.

This incident set off a nationwide study to determine the extent of the radon problem. Studies were made in every state and elevated levels of radon were found in literally every geographical location in the country. From these tests, U. S. officials agreed that radon is not just a problem in a few small areas of the country, but that it was indeed a national problem. Testing in Europe has shown that it is in reality an international problem. Radon is not a respecter of state, national, or economic boundaries.

Radon In Alabama During the period December 1986 through May 1987, the State Department of Public Health and the EPA conducted a study to determine the incidence of radon in Alabama. This study consisted of 789 tests made in residences of volunteers throughout the State. Additionally, a random sampling of residences resulted in an additional 1326 tests. All participants were asked to complete a 35 question survey. This project had four major goals. These were:

1. To determine what areas of the State, if any, are susceptible to potential indoor radon problems.
2. To determine the magnitude of exposures in any problem area that may exist.
3. To determine what effect housing construction styles have on potential radon problems.
4. To determine what effect, if any, weatherization has on indoor radon levels.

The survey results showed the distribution of potential radon problems in Alabama. Madison County had the greatest problem while areas south of Montgomery had a smaller potential. The highest valid measurement recorded in Alabama was 180 pCi/l in Calhoun County. Levels of radon found in Alabama were not, and are not, in general, as high as those found in other states such as Pennsylvania, New Jersey, or Iowa.

As a general rule, houses in the same area with basements have greater potential problems than slab on grade houses. Similarly, slab on grade houses have a greater potential problem than houses with crawl spaces. There are exceptions to this and it should be considered as a generalization only. It is absolutely necessary to test one's residence to adequately determine the level of radon.

The results obtained from the original tests did not provide the data needed to achieve Goal #4.

Based on the results of the volunteer and random tests, survey results, completed tests, and geological factors underlying the various parts of the State, nineteen counties were designated as locations having the greatest potential for high indoor radon concentrations.

Since the original tests in 1986-87, the State Department of Public Health has encouraged all Alabama residents to have their homes tested for radon. As a result, many additional tests have been completed.

Of the total number of these tests (over 16,000 as of October 1, 1997), almost 2500 have been 4.0 pCi/l or higher. Of these, 245 have been between 20 and 100 pCi/l, and 9 have exceeded 100 pCi/l. Only 16 counties have not had at least one test result equal to or greater than 4.0 pCi/l. On the original survey, 32 counties had not had a test result above the action level of 4.0 pCi/l. As more tests are done, it becomes evident that radon can be a significant problem anywhere in Alabama.

The health and well being of your family is important to you and to the State Department of Public Health. We urge you to have your home or residence tested for the presence of radon. If you have any questions about the information in this booklet, or about radon in general, we have a 24 hour radon information line so you can contact us. During non-business hours, you can leave a recorded message. Our toll free telephone number is:

1-800-582-1866 (Within Alabama Only)

The EPA, in compliance with the 1988 Indoor Radon Abatement Act (IRAA), has been working to identify high radon potential areas in the United States. They have worked with, and obtained data from many sources, including the following: U. S. Geological Survey, EPA/State radon surveys, independent surveys, National Uranium Source Evaluation data, The University of Pittsburgh Radon Project, and the Alabama Department of Public Health. From this accumulation of data, the EPA produced an Alabama Map of Radon Zones.

The Alabama Department of Public Health has reviewed this map and the results of tests performed within Alabama. With this additional data, two additional counties were added to the group designated as Zone 1 counties and one was added to the group designated as Zone 2 counties. The current Alabama Map of Radon Zones is shown in Figure 1. Zone 1 includes those counties that have the greatest potential for high radon concentrations and greater risk to the health of Alabama citizens. Zone 2 includes those counties with a moderate potential and risk. Zone 3 includes all other counties of Alabama. These counties also have a potential for high radon concentrations and health risk, but less than in Zones 1 or 2.



Figure 1

It is vital to remember that high radon concentrations can occur in any zone on the map. The only way to be sure of the radon concentration in a specific structure is to perform a radon test using test kits or equipment that meet EPA requirements. Contact the Alabama Radon Information Line at 1-800-582-1866 for additional information.

How does radon cause lung cancer? Radon naturally breaks down, undergoing radioactive decay, into other radioactive elements. These elements are solids, not gases, and are chemically reactive and electrostatically charged. Therefore, they attach to dust, water particles, and other aerosol particles floating in the air in your home. As you breathe, these particles become trapped in your

lungs. There, these radioactive particles break down further, releasing small bursts of energy which can damage sensitive lung tissue. This damage can eventually lead to lung cancer.

How does radon get into a home? Radon is a gas which can move through small spaces in soils and rocks. Tightly packed and wet soils, such as clay, prevent the free movement of radon. Loose soils, such as sand or loam, and gravelly or highly fissured rock allow radon to move freely through the ground. Then radon can seep into homes, schools, and other buildings. This takes place through dirt floors, cracks in concrete floors and walls, sumps, joints, and foundation openings for pipes, sewers, and other utility connections.

Radon can also enter homes through water supplies obtained from wells or from small water systems. Usually, it is not a problem with large community water supplies. It is also possible to get radon from materials used in the construction of homes. However, building materials are not a major source of indoor radon.

How do I know if there is radon in my home? Since you can't see or smell radon, special equipment is needed to detect its presence. Some of the test equipment is commercially available, relatively inexpensive, and easy to use. These can be purchased and used by the homeowner without outside assistance. Other types of test equipment are more technical and expensive and must be used only by specially trained people.

Radon tests fall into two categories: short-term (screening) tests and long-term tests. Short-term or screening tests are those that are for a period less than three months. Long-term tests are those covering periods longer than three months.

The two most popular, commercially available radon detectors are the charcoal type and the alpha track detector. The charcoal type is always a short-term test but alpha track detectors may be either short- or long-term. Both kinds are designed to be exposed to the air inside your home for a specific period of time. They are then sent to a laboratory for analysis.

Your State Department of Public Health can provide you with a list of companies that sell these kits. Anytime a kit is purchased, the consumer is advised to insure that the kit meets EPA requirements. If ordering by telephone or by mail, specify that you want only kits that meet these requirements. For kits that you purchase locally, make sure that the container is clearly marked "Meets EPA Requirements" or something similar.



Charcoal Canisters



Alpha Track Detectors

Charcoal kits are generally the least expensive. The cost of the kit should be between \$10 and \$45 depending on the type and brand.

There are other types of test equipment that require specially trained operators. These will usually be more expensive than either the charcoal kit or the alpha track detector. The consumer should check to insure that the persons who operate the special equipment have also met EPA requirements. This can be verified by a photo identification card issued by the EPA to individuals who take special training and pass a test.

If you have any questions about test kits, contractors, or procedures used to perform radon tests, contact your State Department of Public Health Radon Information Line at **1-800-582-1866** (toll free within Alabama) or at 205-613-5391.

How is radon measured? The level of radiation of a substance is measured in a term called a curie. A curie is equal to 37 billion radioactive disintegrations per second. A picocurie is one one trillionth of a curie and it is equal to 2.22 radioactive disintegrations per minute. Radon is measured in the number of picocuries per liter of air. This measure is abbreviated pCi/l. The EPA has established the action level for radon at 4.0 pCi/l. The EPA and your Health Department recommend that you take action to reduce the levels of radon in your home if the concentration is equal to or greater than 4.0 pCi/l on a long-term or follow-up test.

How should radon detectors be used? Radon detectors are an easy and economical way to determine the level of radon in your home. The accuracy and usefulness of the test results depend on following the manufacturer's instructions carefully and completely. There are special considerations if you are testing for radon in conjunction with a home sale or purchase. The EPA has published special guidance for these situations. Contact the Alabama Radon Information Line at 1-800-582-1866 for information on this subject.

A radon detector measures the amount of radon present in the specific location where it is placed for the period of time it was open. It provides an average level. Obviously, the longer the kit is exposed to the air, the better average one will get. Charcoal type radon test kits are short term test kits that are normally exposed from 2-7 days. Short-term alpha track detectors are placed for periods between one and three months; long-term alpha track detectors for periods greater than 3 months. Charcoal kits allow one to get results faster and are usually the least expensive type.

Obtaining a useful estimate of the radon level in your home may require that several detectors be used in different areas. In addition to the manufacturer's instructions, the following information may be useful in making your radon test.

Step One: The screening measurement. A screening, or short term measurement, is designed to give you an idea of what level of radon you are exposed to in your home. This is a quick and inexpensive test that should tell you whether you have a radon problem or not.

The screening test should be made in the lowest lived-in part of your home. This means the lowest level in which you presently live or which you frequently use (for example, the basement if you use it regularly, otherwise the first floor) It is preferable to test the area in which you spend the greatest amount of time.

Your home should be kept closed for at least 12 hours before you start the screening test, and kept closed as much as possible during the test. A closed house means doors and windows closed, except for normal entry and departure, and normal operation of the heating and air conditioning system. Because of this need for closed house conditions, it will be more convenient to perform the screening test during the cooler months of the year (the heating season). This does not mean that tests can't be performed at other times if you maintain closed house conditions.

Step Two: Do I need to make additional tests? Although the screening test provides an average, it is for a short period of time and may not be a reliable measure of the annual average radon level to which you and your family are exposed. Radon levels can vary greatly from season to season as well as from room to room. The weather can also cause the radon levels to vary in your home. The screening test serves to indicate the potential for a radon problem. Depending upon the result of your test, you may need to have additional follow-up measurements made so you can get a better idea of the annual average level of radon in your home.

The following guidelines may be useful to you in deciding whether it is necessary to make follow-up measurements and how urgent it is to do so.

If your screening measurement result is less than about 4.0 pCi/l, follow-up measurements are probably not required. If the measurement was made under closed house conditions prior to and during the testing period, there is only a small chance that the radon concentration in your home will be greater than 4.0 pCi/l on an annual average. However, if you are not sure, if you are uncomfortable with the results, or if the results are very close to 4.0 pCi/l, there is no reason why you cannot perform a follow-up test.

If your screening measurement result is 4.0 pCi/l or higher, perform either a long term test or a second short-term test. The higher your initial short-term result, the more certain you can be that you should take a short-term test rather than a long-term follow-up test. If your first short-term test is several times the action level - for example, about 10 pCi/l or higher - you should take a second short-term test immediately.

If you followed up with a long-term test: Fix your home if your long-term test result is 4 pCi/l or more.

If you followed up with a second short-term test: The higher your short-term results, the more certain you can be that you should fix your home. Consider fixing your home if the average of your first and second short-term tests is 4 pCi/l or higher.

It is important to remember that the higher the screening test radon level is, the more urgent it becomes to perform follow-up tests and take remedial action (mitigate) as recommended by this booklet. The steps presented above are guides to help you make the necessary decisions. Statistically, there may not be much difference between a screening measurement result of 18.0 pCi/l and one of 22.0 pCi/l. Remember, the higher the level, the more urgent it is to take some follow-up action.

You should consider making follow-up tests in at least two lived in areas of your home. If your home has lived in areas on more than one floor, you should make at least one test on each of the floors. One example is to take a measurement in a basement game room, a first floor den, and a second floor bed room.

What do my results mean? The results of your follow-up measurements provide you with an idea of the average radon concentration throughout your home. The longer the period of time the measurement covered, the closer the measurement will be to the true average radon concentration. The actual risk that you face depends on the amount of time you are exposed to this concentration.

The following tables show the radon risk at various levels of radon concentrations for smokers and non-smokers.

It's never too late to reduce your risk of lung cancer. Don't wait to test and fix a radon problem.

If you are a smoker, stop smoking!

RADON RISK IF YOU SMOKE

<i>Radon Level</i>	<i>If 1,000 people who smoked were exposed to this level over a lifetime...</i>	<i>The risk of cancer from radon exposure compares to...</i>	<i>WHAT TO DO: Stop Smoking and...</i>
20 pCi/l	About 135 people could get lung cancer	← 100 times the risk of drowning	Fix your home
10 pCi/l	About 71 people could get lung cancer	← 100 times the risk of dying in a home fire	Fix your home
8 pCi/l	About 57 people could get lung cancer		Fix your home
4 pCi/l	About 29 people could get lung cancer	← 100 times the risk of dying in an airplane crash	Fix your home
2 pCi/l	About 15 people could get lung cancer	← 2 times the risk of dying in a car crash	Consider fixing between 2 and 4 pCi/l
1.3 pCi/l	About 9 people could get lung cancer	(Average indoor radon level)	(Reducing radon levels below 2 pCi/l is difficult)
0.4 pCi/l	About 3 people could get lung cancer	(Average outdoor radon level)	

Note: If you are a former smoker, your risk may be lower.

RADON RISK IF YOU'VE NEVER SMOKED

<i>Radon Level</i>	<i>If 1,000 people who smoked were exposed to this level over a lifetime...</i>	<i>The risk of cancer from radon exposure compares to...</i>	<i>WHAT TO DO: Stop Smoking and...</i>
20 pCi/l	About 8 people could get lung cancer	← The risk of being killed in a violent crime	Fix your home
10 pCi/l	About 4 people could get lung cancer		Fix your home
8 pCi/l	About 3 people could get lung cancer	← 10 times the risk of dying in an airplane crash	Fix your home
4 pCi/l	About 2 people could get lung cancer	← The risk of drowning	Fix your home
2 pCi/l	About 1 person could get lung cancer	← The risk of dying in a home fire	Consider fixing between 2 and 4 pCi/l
1.3 pCi/l	Less than 1 person could get lung cancer	(Average indoor radon level)	(Reducing radon levels below 2 pCi/l is difficult)
0.4 pCi/l	Less than 1 person could get lung cancer	(Average outdoor radon level)	

Note: If you are a former smoker, your risk may be higher.

How quickly should I take action? In considering whether and how quickly to take action based on your test results, you may find the following guidelines useful. EPA and the Department of Public Health believe that you should try to permanently reduce your radon levels as much as possible. Based on currently available information, we believe that levels in most homes can be reduced to about 4.0 pCi/l or lower. In fact, the levels in most homes can be reduced to 2.0 pCi/l or lower. Note: Your decision to take corrective action should be based on the results of a long-term, or follow-up tests, and not on a single short-term screening test only.

If you results are about 4.0 pCi/l or lower: Exposures in this range are considered average or slightly above average for residential structures. Although exposures in this range do present some risk to the occupants for lung cancer, reductions of levels this low may be difficult, sometimes impossible, and expensive to achieve.

If your results are 4.0 pCi/l or higher: Exposures in this range are considered above average for residential structures. You should take action to reduce the levels below 4.0 pCi/l. We recommend that you take action within a reasonable time.

Remember: There is an increasing urgency for action at higher concentrations of radon. The higher the radon level in your home, the faster you should take action to reduce your exposure. If you find elevated levels in your home, you should take the relatively easy, short-term actions described below.

Are there other factors I should consider? Most of the risk information given in this booklet, as well as the recommendations for taking corrective action are based on the general case. Your individual living patterns could influence your assessment of your risk and your decisions about the need for further action. Your answers to the following questions may help you evaluate your personal risk.

** Does anyone smoke in your home? Scientific evidence indicates that smoking may increase the risk of exposure to radon. In addition, smoking significantly increases your overall risk of lung cancer.

** Do you have children living at home? Although there are no studies of children exposed to radon to determine whether they are more sensitive than adults, some scientific studies of other types of radiation exposure indicate that children may be more sensitive. Consequently, children might possibly be at more risk than adults from exposure to radon.

** How much time do family members spend at home? The risk estimates given in this booklet assume that 75% of a person's time is spent at home. If you or you family spend more or less time at home, you should take this into consideration.

** Does anyone sleep in the basement? Since radon concentrations tend to be greater on the lower levels of a home, a person who sleeps in the basement is likely to face a greater risk than a person who sleeps in a bedroom on a higher floor of the home.

** How long will you live in your home? The risk estimates in this booklet are based on the assumption that you will be exposed to the radon level found in your home for roughly 70 years. As you evaluate your potential risk, you should consider the total amount of time you expect to live in your home. But remember: other houses you have lived in - or will live in - may have the same or higher radon levels that you should take into consideration.

** Do you plan to sell your home in the near future? Many real estate transactions now require a radon test prior to closing the loan process. A radon test prior to the initiation of the sale can possibly save the owner money. This is because you may be required to fix a potential radon problem in your home based on a short-term test done at the time of the sale. A long-term or follow-up test may show that the levels in your home may in fact be less than 4.0 pCi/l. Performing the test well in advance and saving the records can save money, time, and trouble later.

How can I reduce my risk from radon? Your risk of lung cancer from exposure to radon depends upon the amount of radon entering your home and the length of time it remains in the home. Listed below are some actions you might take immediately to reduce your risk from radon. These actions can be done quickly and with minimum expense in most cases.

** Stop smoking and discourage smoking in your home. By doing so, you should reduce your family's overall chance of developing lung cancer, as well as reducing your family's risk from radon exposure.

** Spend less time in areas of your home with higher concentrations of radon, such as the basement.

** Whenever practical, open all windows and turn on fans to increase the air flow into and through the house. This is especially important in the basement.

** If your home has a crawl-space beneath the floor, keep the crawl-space vents on all sides of the house fully open all year.

While the above actions will help reduce your risk from radon, they generally do not offer a long-term solution and should not be used as a long-term solution to a radon problem in your home. You can get more information about permanent, cost-effective solutions to radon problems in your home in the EPA publication, Consumer's Guide to Radon Reduction. A copy of this booklet may be obtained from the State Department of Public Health.

Before undertaking major modifications to your home, we recommend that you consult with the State Department of Public Health to obtain more specific advice or assistance for your particular situation. Call the Radon Information Line at the following toll free number:

1-800-582-1866

Sources of information If you would like further information or explanation on any of the points mentioned in this booklet, you should contact the State Department of Public Health, Radiological Health Branch at the address or phone numbers listed below.

If you have difficulty reaching this office, you may call the National Radon Information Hot Line at 1-800-SOS-RADON or you can contact the Region 4 Office of the EPA at:

EPA Region 4
345 Courtland Street, NE
Atlanta, GA 30365
(404) 347-3907

SOME COMMON MYTHS ABOUT RADON

MYTH: Scientists aren't sure that radon really is a problem.

FACT: Although some scientists dispute the precise number of radon deaths, all major health organizations (like the Centers for Disease Control, the American Lung Association, and the American Medical Association) agree with estimates that radon causes thousands of preventable lung cancer deaths every year. This is especially true among smokers, since the risk to smokers is much greater than to non-smokers.

MYTH: Radon testing is difficult, time-consuming, and expensive.

FACT: Radon testing is inexpensive and easy - it should only take a little of your time.

MYTH: Radon test kits are not reliable and are difficult to find.

FACT: Reliable test kits are available through the mail, in hardware stores and other retail outlets. Call your State Department of Health Radon Information Line (1-800-582-1866) for a list of test kit companies that have met USEPA requirements for reliability.

MYTH: Homes with radon problems can't be fixed.

FACT: There are simple solutions to radon problems in homes. Thousands of homeowners have already fixed radon problems in their homes. Radon levels can be readily lowered for about \$500 to \$2,500. Call the Radon Information Line (1-800-582-1866) for a list of contractors that have met EPA requirements.

MYTH: Radon only affects certain kinds of homes.

FACT: House construction can affect radon levels. However, radon can be a problem in old homes, new homes, insulated homes, drafty homes, homes without basements—homes of all types.

MYTH: Radon is only a problem in certain parts of the country.

FACT: High radon levels have been found in every state. Radon problems do vary from area to area, but the only way to know your radon level is to perform a radon test.

MYTH: A neighbor's test result is a good indication of whether your home has a radon problem.

FACT: It's not! Radon levels vary from home to home. The only way to know if your home has a radon problem is to test it.

MYTH: Everyone should test their water for radon.

FACT: While radon gets into some homes through the water, you should test the air in your home for radon first. If you find high levels and have a well, consider testing water also. Be sure to use a lab certified to measure radiation in water. Contact the Alabama Radon Information Line at 1-800-582-1866 for additional information.

MYTH: It's difficult to sell homes where radon problems have been discovered.

FACT: Where radon problems have been fixed, home sales have not been blocked or frustrated. The added protection can be emphasized as a positive selling point.

MYTH: I've lived in my home so long, it doesn't make sense to take action now.

FACT: You can reduce your risk of lung cancer when you reduce radon levels, even if you've lived with a radon problem for a long time.

MYTH: Short-term tests can't be used for making a decision about whether to fix your home.

FACT: A short-term test followed by a second short-term test may be used to decide whether to fix your home. However, the closer the average of your two short-term tests is to 4 pCi/l, the less certain you can be about whether your year-round average is above or below that level. Keep in mind that radon levels below 4 pCi/l still pose some risk. Radon levels can be reduced in most homes to 2 pCi/l or below.



Division of Radiation Control
Bureau of Health Care Standards
Alabama Department of Public Health
Montgomery, Alabama 36130-3017
(334) 206-5391
1-800-582-1866

ADPH-P-RAD-11/4-96