

RADON IN HOMES

**Strengthening State Policy to
Reduce Risk and Save Lives**



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Radon in Homes: Strengthening State Policy to Reduce Risk and Save Lives

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CHAPTER ONE

Introduction

Lung cancer is a devastating disease. Over half of all people with lung cancer die within one year of being diagnosed, and the five-year survival rate is lower than that of any other type of cancer.¹ Indoor exposure to radon gas results in an estimated 21,000 lung cancer deaths in the United States every year. This makes radon the second leading cause of lung cancer and the seventh leading cause of cancer mortality overall.²

The effects of exposure to indoor radon became widely recognized in the late 1980s. In the 25 years since, notable actions have been taken – from the establishment of technical standards and guidance to the implementation of substantial federal and state education, outreach, and technical assistance programs. As a result of these efforts, more people now know what radon is and have taken steps to address radon in their homes. Yet two decades later, efforts to reduce radon risk in the U.S. are still losing ground, as the number of new homes built with elevated radon levels outpaces the installation of radon control systems in new and existing homes.³

State policy can and should play a critical role in reversing this trend. Most existing state

radon laws support a general strategy of voluntary radon testing and mitigation. Over the past several years, however, more states have begun to enact laws and regulations that establish radon-related requirements. Given the number of deaths attributable to radon exposure, every state in the U.S. can benefit from reviewing existing radon policies and considering new measures to achieve greater radon risk reduction in homes. This report discusses options for establishing stronger radon policies.

THE NATURE OF THE RADON PROBLEM

Radon is a colorless, odorless gas that is produced from the decay of radium released from uranium ore that is present in most rock and soils. When radon enters buildings through cracks or other openings in the foundation or slab, it becomes concentrated indoors. Inhaling radon over a period of years increases cancer risk; the higher the radon levels, the greater the risk.⁴

Radon's impact on human health has been the subject of considerable study, and there is wide agreement among public health officials and scientists about the dangers of radon exposure to smokers and non-smokers alike.

The U.S. Surgeon General's 2005 National Health Advisory on Radon:

Indoor radon gas is the second-leading cause of lung cancer in the United States and breathing it over prolonged periods can present a significant health risk to families all over the country. It's important to know that this threat is completely preventable. Radon can be detected with a simple test and fixed through well-established venting techniques.

Source: <http://www.surgeongeneral.gov/news/2005/01/sg01132005.html>

Radon is the leading cause of lung cancer among non-smokers; of the estimated 21,000 radon-related lung cancer deaths each year, 2,900 occur among people who have never smoked. Moreover, radon exposure significantly exacerbates the lung cancer risk among smokers; people who smoke and also are exposed to radon have a higher risk of lung cancer than from either exposure alone.⁵

IDENTIFYING AND FIXING RADON PROBLEMS

A key principle – and an important challenge – in addressing radon is that you must *test* the air in a home in order to know whether it has elevated radon levels that require mitigation. Knowing the radon level next door or elsewhere in your neighborhood will not indicate the level in your own home. Fortunately, radon testing is easy, unobtrusive, and relatively inexpensive. Individuals can purchase a radon test kit themselves or hire a radon professional to test the air in their home.⁶ EPA provides considerable information on radon testing for both homeowners and professionals, though the agency does not oversee the accuracy or reliability of radon test devices or laboratories.⁷

Where elevated radon levels are discovered, well-established techniques for installing radon control systems can lower radon levels effectively in most cases. Similarly, radon control techniques carried out as part of new home construction offer a way to prevent radon from accumulating at elevated levels.⁸

Technical knowledge provides an important part of the solution for reducing radon levels in homes, but individual action is needed to put this technical knowledge to use. Because radon is a naturally-occurring, odorless, invisible gas whose health effects are not immediate, public policy has a critical role to play in increasing action to identify and fix radon problems.

THE FEDERAL RADON PROGRAM: CONTEXT FOR STATE POLICY

The Indoor Radon Abatement Act (IRAA) was enacted in 1988 as part of the federal Toxic Substances Control Act.⁹ The IRAA authorizes EPA to conduct studies and demonstration projects, develop guidance and model standards, establish proficiency programs for radon professionals, and provide technical and financial assistance to states.

EPA's radon program has carried out a wide array of activities to implement the federal law. Important components of this program have been the issuance of technical guidance documents and the implementation of an extensive and ongoing public education and outreach campaign to raise awareness and promote radon testing. EPA also has administered the State Indoor Radon Grants (SIRG) program, and SIRG grants have provided crucial support for radon programs throughout the country.

Two other significant EPA actions under the IRAA establish important background for state radon policy development.

EPA Action Level. Following enactment of the IRAA, EPA set an indoor radon “action level” of 4.0 picocuries per liter of air (pCi/L). This action level, which has become an important reference point for federal and state radon policy, was based both on risk considerations and on the technical feasibility of radon mitigation techniques to lower radon levels indoors. However, EPA emphasizes that this action level does *not* mean that radon levels below 4.0 pCi/L are safe. There is no “safe” level of radon exposure, and radon-induced lung cancer occurs as a result of exposures above and below the action level.¹⁰

In a 2009 review of the major health effects of radon, the World Health Organization (WHO) lowered its recommended reference level for radon to approximately 2.7 pCi/L.¹¹

Established techniques can reduce radon levels in most homes to 2.0 pCi/L or lower.¹²

EPA Radon Map. The IRAA directed EPA to list and identify areas of the U.S. with the potential for elevated indoor radon levels. EPA developed a Map of Radon Zones using five factors to determine radon potential: indoor radon measurements, geology, aerial radioactivity, soil permeability, and foundation type.¹³ The Radon Map assigns one of three zones to each county in the United States.

- Zone 1 – highest predicted average radon screening levels (greater than 4.0 pCi/L)
- Zone 2 – moderate predicted average radon screening levels (2.0-4.0 pCi/L)
- Zone 3 – lowest predicted average radon screening levels (less than 2.0 pCi/L)

In using the Radon Map to develop and implement radon policies and programs, it is critical to keep in mind that elevated radon levels have been found in all three radon zones and that EPA recommends testing for radon in *all homes*, regardless of geographic location or radon zone designation. As noted earlier, it is also important to remember that there is no safe level of radon exposure, and that radon mitigation can reduce levels to 2.0 pCi/L or lower.

The Radon Map has not been updated since it was created in 1993, and EPA recommends that the map be supplemented with any available local data in order to better predict the radon potential of a specific area. Some states have created their own radon maps using state-collected radon data.

REPORT PURPOSE AND ORGANIZATION

The purpose of this report is to provide information to assist state policymakers and others in establishing laws, regulations, and policies that will result in greater reduction of indoor radon levels than is currently being achieved. Though exposure to elevated radon

levels occurs in schools and other types of buildings, this report focuses on radon in *residential* buildings.

The following chapters each discuss one of five key radon policy strategies:

- Regulation of Radon Professionals – About a dozen states currently certify or license professionals who provide radon services in their states.
- The Real Estate Transaction – The most common type of state radon policy establishes radon disclosure requirements in the sale of a home.
- Rental Dwellings – Only a few states have enacted laws or regulations that address explicitly the obligations of landlords with respect to radon.
- New Home Construction – A small but growing number of states have included radon control requirements in their state-wide building codes.
- State Housing Finance Programs – Many states have taken steps to ensure that state-funded affordable housing is developed with radon measures in place.

Each chapter provides a review of existing state radon policies and offers recommended elements to consider when establishing new or revising current radon laws and regulations.

The strategies discussed in this report are not the only possible radon policy approaches. Yet they represent the overwhelming majority of existing state radon laws and regulations, and further development of these approaches can help achieve greater radon risk reduction. Not all of these strategies will be applicable for all states. Given the significant differences among states in climate and geography, as well as in political, social, economic, and legal frameworks, there is no one-size-fits-all law or regulation. Despite these differences, however, public policy is a tool that every state can marshal to accelerate progress in reducing radon levels and saving lives.

Chapter Two

Certification of Radon Professionals

Radon policies aim to reduce indoor exposures by increasing radon testing and mitigation. Thus, an important foundational element of a radon strategy is establishing the integrity and reliability of radon testing and mitigation services. One way to do this is to set minimum standards for the radon profession, in order to give the public greater confidence in taking action and to help ensure that radon work is carried out according to accepted industry practices. This is important whether a public policy promotes voluntary testing or whether it requires testing or mitigation in certain circumstances.

Toward this end, EPA developed and implemented a National Radon Proficiency Program (RPP) for several years until the program was discontinued in 1998. According to the agency, EPA “continues to encourage States, industry and consumers to work together to identify those elements that would improve non-Federal radon proficiency programs and go beyond EPA’s former voluntary RPP. These improved elements should then be adopted as standards of practice.”¹⁴ Two non-governmental organizations operate nation-wide voluntary certification programs for radon service providers – the American Association of Radon Scientists and Technologists (AARST), which operates the National Radon Proficiency Program, and the National Radon Safety Board (NRSB).

States require licensing or certification for a wide range of professions, and many states have established such programs specifically for radon professionals. This section reviews existing radon licensing and certification policies and describes key considerations for an effective policy.

SUMMARY OF CURRENT STATE POLICY

Most state laws that regulate the radon profession require professionals to obtain some type of state-issued approval that is specific to the provision of radon services. For purposes of this chapter, these are collectively referred to as radon “certification” policies and programs, though several states use the term “licensing,” and at least one requires “registration.” This section provides an overview of 13 laws that establish a state radon certification program, including minimum qualifications and standards of practice: Florida, Illinois, Indiana, Iowa, Kansas, Kentucky, Maine, Nebraska, New Jersey, Ohio, Pennsylvania, Rhode Island, and West Virginia.

Some state laws that address qualifications for radon service providers in a more limited way are *not* covered in this chapter. For example, the discussion does not include states such as California, Connecticut, and Virginia, which require radon testers, mitigators, and/or laboratories to obtain third-party certification in order to practice, but do not issue their own state certification or carry out a certification oversight program. Nor does this chapter discuss requirements for obtaining a general state contractor’s license.

In addition to the discussion below, tables at the end of the chapter present citations to and key characteristics of the 13 laws covered in the chapter.

Activities Covered. The 13 state policies reviewed here require certification for those performing radon measurement and mitigation. Most states also provide for certification of laboratories performing analysis of

radon measurements. The laws often establish a number of certification categories – testing or mitigation “specialists,” “businesses,” etc.

Activities Exempted. Most state laws exempt from certification those who perform radon testing and mitigation on their own homes. Some exempt state agency employees and those who are doing testing and mitigation for research purposes. Another notable exemption is provided in most state laws for those who use radon control techniques during construction of a new home. States that exempt builders using radon-resistant techniques in new construction may, however, require certification for those who activate a passive system after construction.

Training and Examination. Most certification laws require that radon professionals undergo training on best practices for testing and mitigation. All states require that individuals complete a state-approved training course and pass a state-approved examination in order to be certified. Some states include detailed criteria for state approval of courses and/or trainers, while some specify that the courses must be comparable to those provided by the National Radon Proficiency Program or the National Radon Safety Board. Most states also establish some minimum educational or work experience requirements for one or more categories of certification, and several require continuing education in order to be recertified.

Testing and Mitigation Protocols. A common component of state certification laws are mandatory minimum standards/protocols for carrying out radon testing and/or mitigation. All but one of the states discussed here have laws or regulations that require certified radon testers to comply with federal and/or state *testing* protocols. Most of these states reference EPA guidance documents, while states such as Illinois and Ohio have established their own detailed testing protocols. About half of the states discussed in this chapter explicitly require the use of measurement devices that have been approved by EPA or

the state. Additionally, nine states require certified mitigation professionals to use federal and/or state *mitigation* protocols; most of these states specifically require pre and post-mitigation testing, and some prohibit the same person from doing both testing and mitigation on a project. Illinois and Nebraska have adopted regulations that set forth detailed mitigation protocols.

Other Work Practices – Quality Assurance, Worker Health and Safety, Financial Responsibility, Insurance. Nearly all of the states explicitly require certified professionals to establish quality assurance/quality control plans, and some states establish detailed plan requirements. In some cases, testing and mitigation protocols are incorporated into QA/QC plan requirements. A majority of states also require adoption of health and safety plans to protect those performing the radon work. At least two states (Illinois, Kentucky) require professionals to carry insurance, while Kentucky also requires proof of financial responsibility.

Reporting Requirements. Twelve of the 13 states require that certified professionals report to the state on a regular basis information about their testing and mitigation activities. Reporting is required on a monthly basis (five states), every 45 days (one state), quarterly (four states), or annually (two states). State regulations typically specify the information that must be reported, and most states establish reporting forms that must be used by certified professionals.

Most states require reporting of the address of radon testing and mitigation, the results of testing, and the type of mitigation system. Several states require more specific information about testing (e.g., type and location of the device). A few states ask for additional details. For example, Illinois asks about the purpose of the radon test, whether the test was considered valid, and whether house vents were open or closed. Nebraska asks for floor plans when reporting on installation of mitigation systems. Notably, only the state of New Jersey’s regulations require reporting on

whether the radon test was conducted during a real estate transaction.

Enforcement. All of the state certification laws and regulations include a range of enforcement authorities for addressing violations: (1) inspection of records, businesses, and/or work of certified professionals; (2) suspension or revocation of certification under specified circumstances; and (3) administrative, civil and/or criminal penalties, with the majority of states including the option of criminal as well as non-criminal penalties for violations.

Fees. All of the laws require payment of fees for certification and re-certification. Most specify that the fees (and in some cases, the penalties) collected under the program are to be deposited in a designated account or fund to support program activities.

CONSIDERATIONS FOR FUTURE POLICY DEVELOPMENT

Current state radon certification laws are similar in terms of their central requirements and provide an important legal framework for protecting consumers, reducing radon risk, and improving the states' understanding of radon testing and mitigation activities. Fees for radon certification, often deposited in a dedicated account, defray the administrative costs of running the program. Following are key issues that states should consider in developing radon certification policies.

State Certification: *Require State Certification of Radon Professionals and Laboratories.* Because there is no federal certification program, state radon certification laws should cover all areas of practice – testing, mitigation, and laboratory analysis. Many states with certification laws exempt those who install radon control systems in new construction. In some states, a general contractor's license may be required for this work. Yet the fundamental reason for requiring certification holds true for the new construction arena as well – ensuring that radon work is done by trained professionals in accordance with best

practices. This is particularly important in jurisdictions where the state or local building code does not establish a radon control standard that is overseen by building code officials. New Jersey and Maine are examples of states whose certification policies exempt those who install systems according to the radon control standard included in the state building code.

Training and Examination: *Require Completion of a State-Approved Training Course and Examination.* Training and examination are important elements of a certification policy. Through the process of approving training courses and establishing an examination, states can ensure that radon professionals obtain a minimum level of knowledge about providing radon services, including information about state-specific requirements or protocols.

Work Practices: *Require Compliance with Testing and Mitigation Protocols, as well as Quality Assurance and Worker Health/Safety Plans.* Mandatory testing and mitigation protocols serve a vital purpose – helping to ensure that radon services are provided across the state in a manner consistent with current best practices. Development of *state-specific protocols* has the advantage of ensuring that mandatory protocols are communicated clearly and incorporate state-specific requirements that may not be included in federal or third-party standards.

Referencing and incorporating *federal protocols* into state certification program requirements has the advantage of promoting uniformity among states and reducing the resource burden on state programs. EPA's radon testing protocols, "Protocols for Radon and Radon Decay Product Measurements in Homes," were last updated in 1993; the agency's radon mitigation protocols, last revised in 1994, are no longer published or recommended by the agency. Instead, EPA recommends ASTM E2121-09, "Standard Practice for Radon Mitigation Systems in Existing Low-Rise Residential Buildings."

For measuring radon levels in multifamily housing, EPA's web site references the ANSI/AARST Standard, "Protocol for Conducting Radon and Radon Decay Product Measurements in Multifamily Buildings (MAMF-2010)."¹⁵

Quality assurance plans are important for ensuring that certified professionals and laboratories operate in a way that will produce accurate, effective, and reliable services. Instrument calibration, recordkeeping, and other key aspects of operations can be specified as required elements of a QA/QC plan. Similarly, certification should be contingent on development of and compliance with a health and safety plan that provides for protection of those carrying out the radon services.

Reporting Requirements: *Require Reporting of Testing and Mitigation Activities and Facilitate Data Analysis.* Data on radon testing and mitigation are currently very limited. The reporting of radon testing and mitigation services gives states a potentially powerful tool for understanding both the magnitude of the radon problem and the progress that has been made in reducing elevated radon levels. State agencies should be provided with sufficient resources to analyze the reported information and to use the data to refine radon risk maps, target outreach, and revise program priorities. Confidentiality provisions can be tailored to protect the identity of individual citizens while allowing the state and the public to benefit from a better understanding of radon risks made possible through analysis of the data.

Developing clear and user-friendly reporting forms can help ensure consistent and thorough reporting and facilitate data analysis. Basic reporting requirements may include information about the service provider, address of the property and type of building, type of radon test performed and the results, and type of mitigation system installed (includ-

ing RRNC), along with pre- and post-test results. Information about the circumstances of testing and mitigation activity – e.g., whether the services took place during the real estate transaction – can help illuminate current practices and target risk reduction efforts.

Enforcement: *Establish Clear and Comprehensive Enforcement Provisions.* Strong enforcement authorities are essential to the integrity of radon certification programs. Most current state policies address key enforcement elements – inspection/auditing authority, administrative, civil and/or criminal penalties, and license revocation. Effective implementation of these provisions depends in part on the strength of the enforcement provisions themselves in supporting enforcement action. For example, potentially powerful tools such as license revocation should be carefully delineated in order to provide a solid foundation for the state to take action against significant violations. Specified penalty amounts should be high enough to provide an effective deterrent. State agencies can also supplement certification laws and regulations with written guidance for taking enforcement action – e.g., explanation of the circumstances under which multi-day penalty authority will be utilized.

In addition to enforcement authorities, agencies must have adequate *resources* to conduct oversight activities in order to identify and address sub-standard practices. Program resources for conducting regular audits or inspections – e.g., for ensuring adherence to QA/QC plans, testing and mitigation protocols, and worker health and safety plans – are particularly important if a certification program is to serve its central purpose of ensuring reliable and effective testing and mitigation services. Similarly, program resources are important for providing compliance assistance to certified professionals and businesses.

SELECTED STATE RADON CERTIFICATION LAWS: Citations

	Statute	Regulation
FL	FL Stat. 404.056	FL. Adm. Code 64e-5.1201
IL	420 IL Comp. Stat. 44/1	32 IL Adm. Code 422.10
IN	IN Code 16-41-38-1	410 IN Adm. Code 5.1-1
IA	IA Code 136B.1	641 IA Adm. Code chap. 43, 44
KS	KS Stat. 48-16a01	
KY	KY Stat. 211.9107	
ME	22 ME Stat. 771	ME Adm. Code 10-144, chap. 224
NE	NE Stat. 71-3501	180 NE Adm. Code chap. 11
NJ	NJ Stat 26:2D-70	NJ Adm. Code 7:28-27.1, 7:18-1.1
OH	OH Stat. 3723.01	OH Adm. Code 3701-69-01
PA	63 PA Stat. 2001	25 PA Adm. Code 240.101
RI	RI Gen. Laws 23-61-1	RI Adm. Code 31-1-25:B.1
WV	WV Code 16-34-1	WV Adm. Code 64-78-1

SELECTED STATE RADON CERTIFICATION LAWS: Key Features

	Minimum Qualifications	State-approved Protocols for Practice Required	Additional Requirements for Practice	Reporting to State Required	Enforcement Authorities	Fees
	Course/Exam Educ/Work Experience Financial Responsibility Insurance	Testing, Mitigation, Devices	QA/QC Plan Health & Safety (H&S) Plan	Testing, Mitigation Frequency of Reporting	Inspections Penalties (Admin, Civil &/or Crim.) Lic. Revoc'n	Cert. Fees Required Program Fund Designated
FL	Course/Exam Educ/Work	Testing Mitigation	QA/QC H&S	Testing Mitigation Monthly	All	Fees Fund
IL	Course/Exam Educ/Work Insurance	Testing, Mitigation Devices	QA/QC H&S	Testing Mitigation Annual	All	Fees Fund
IN	Course/Exam Educ/Work	Testing Mitigation		Testing Mitigation Annual	All	Fees Fund
IA	Course/Exam Educ/Work	Testing Mitigation Devices	QA/QC H&S Plan	Testing Monthly	All	Fees
KS	Course/Exam Educ/Work	Testing Mitigation Devices	QA/QC	Testing Mitigation Quarterly	All	Fees Fund
KY	Course/Exam Fin. Resp. Insurance	Testing Mitigation Devices (pending regulations)	QA/QC		All	Fees Fund

Note: All laws included here require certification of radon measurement and mitigation professionals, as well as re-certification after a state period of time. States generally also require certification of radon measurement or mitigation businesses, as well as radon laboratories. Provisions indicated in chart apply to at least one certification category covered by the state law, but may not apply to all categories.

SELECTED STATE RADON CERTIFICATION LAWS: Key Features

	Minimum Qualifications	State-approved Protocols for Practice Required	Additional Requirements for Practice	Reporting to State Required	Enforcement Provisions	Fees
	Course/Exam Educ/Work Experience Financial Responsibility Insurance	Testing, Mitigation, Devices	QA/QC Plan Health & Safety (H&S) Plan	Testing, Mitigation Frequency of Reporting	Inspections Penalties (Admin, Civil &/or Crim.) Lic. Revoc'n	Cert. Fees Program Fund Designated
ME	Course/Exam	Testing Mitigation Devices	QA/QC	Testing Mitigation Monthly	All	Fees Fund
NE	Course/Exam Educ/Work	Testing Mitigation Devices	QA/QC H&S Plan	Testing Mitigation Monthly	All	Fees Fund
NJ	Course/Exam Educ/Work	Testing Mitigation	QA/QC H&S Plan	Testing Mitigation Monthly	All	Fees
OH	Course/Exam	Testing Mitigation Devices	QA/QC H&S Plan	Testing Mitigation Quarterly	All	Fees Fund
PA	Course/Exam Educ/Work	Testing Mitigation Devices	QA/QC H&S Plan	Testing, Mitigation Every 45 days	All	Fee Fund
RI	Course/Exam	Testing	QA/QC H&S Plan	Testing, Mitigation Quarterly	All	Fees
WV	Course/Exam		QA/QC H&S Plan	Testing, Mitigation Quarterly	All	Fees Fund

Chapter Three

Radon in the Real Estate Transaction

For the past two decades, the real estate transaction has been a central focus of efforts to increase testing for and mitigation of elevated radon levels in existing homes. The purchase and sale of a home is a key opportunity for testing and mitigation, as the parties are already negotiating various aspects of the transaction that involve repairs and improvements to the property.

Governmental and non-governmental organizations have undertaken considerable education and outreach activities to make buyers, sellers, and real estate professionals aware of the importance of radon testing.¹⁶ Since EPA first published its “Home Buyer’s and Seller’s Guide to Radon,” many state agencies have followed suit with guidance and other materials on how to incorporate radon testing into the real estate transaction. It is generally believed that a substantial percentage of the residential radon testing that occurs in the U.S. takes place when a home is sold. Yet most homes in the U.S. still have not been tested for radon.¹⁷ State policies can be developed to take fuller advantage of the real estate transaction as an opportunity to increase the number of homes tested and reduce risk in the existing housing stock.

While federal policy does not play a role in this arena, state law does address various aspects of the real estate transaction. States should review their existing laws, regulations, and policies and consider adopting new measures to promote greater action to reduce radon levels.

SUMMARY OF CURRENT STATE POLICY

Over 30 states have laws that address radon in the private, residential real estate transaction.¹⁸ None of the laws requires radon testing on

the part of the buyer or seller. Most include radon in a comprehensive list of real estate disclosures that sellers must provide to buyers about property conditions that are within the seller’s knowledge. A small number of states have statutory and regulatory provisions that require sellers to provide buyers with general information about radon.

Following is an overview of 32 state laws, referred to as “disclosure” laws for the purpose of this discussion. In some cases, the laws themselves specify the required radon disclosure, while in other cases the required radon disclosure is included in a property disclosure form that is developed by a state agency to implement the law. The disclosure form may be promulgated as part of a regulation or otherwise established by the state agency. The discussion below is based on the state laws, as well as the regulations and disclosure forms adopted pursuant to the laws. Information about the laws, including citations, is summarized in a table at the end of the chapter.

Transactions Covered. Disclosure laws cover the transfer of residential real property and often restrict coverage to properties containing between one and four dwelling units. The laws typically include a number of exemptions, such as transfers pursuant to court order, by executor/fiduciaries and government agencies, and between co-owners. Notably, several states also exempt sales of newly-constructed homes.

Information to be Disclosed. The laws typically require disclosure of conditions of which the seller is “aware” or has “knowledge.” The laws do not require the seller to undertake special investigation of the property to determine whether a condition exists. It is not

possible to know the radon level of a specific property without conducting a radon test. Thus, disclosure laws will only yield specific radon information about a property if the seller has tested for radon or has knowledge of a radon test conducted on the property.

In addition to, or in lieu of, asking about a seller's knowledge of radon, about half of the state laws reviewed here explicitly require disclosure of the results (or copies) of any radon tests performed on the property. A few states also require disclosure of information about any radon control systems on the property.

Provision of General Radon Information. At least eight states have laws that require sellers to provide buyers with general information about radon. (Six of these eight states also require disclosure of known, property-specific radon information, as described above.) The type of general radon information provided to buyers varies. Florida, New Hampshire, Rhode Island, Kansas, Montana, and Illinois each require provision of a short warning statement about radon at the time of or prior to executing the contract for sale.

Kansas' required disclosure contains several key elements of a general radon warning:

“Every buyer of residential real property is notified that the property may present exposure to dangerous concentrations of indoor radon gas that may place occupants at risk of developing radon-induced lung cancer. Radon, a class-A human carcinogen, is the leading cause of lung cancer in non-smokers and the second leading cause overall. Kansas law requires sellers to disclose any information known to the seller that shows elevated concentrations of radon gas in residential real property. The Kansas department of health and environment recommends all home-buyers have an indoor radon test performed prior to purchasing or taking occupancy of residential real property. All testing for radon should be conducted by a radon measurement technician. Elevated radon concentrations can be easily reduced by a radon mitigation technician. For additional information go to www.kansasradonprogram.org.”

Illinois, Iowa, and Delaware laws require that buyers be provided with a state-created radon fact sheet and that buyers sign a form acknowledging receipt of the information.

**Federal Lead Disclosure under Title X:
The Residential Lead Based Paint Hazard Act of 1992**

While there is no federal law addressing radon disclosure, federal law does establish requirements for disclosure of lead-based paint and lead-based paint (LBP) hazards in residential real estate transactions. This law, known as Title X, includes many of the elements to consider in adopting a state radon disclosure law. Title X requires sellers to:

- Disclose the presence of known LBP and/or LBP hazards
- Provide any available records or reports pertaining to LBP and/or LBP hazards
- Provide an approved lead hazard information pamphlet
- Allow 10 days for purchasers to conduct a risk assessment/inspection
- The Sales Contract or Offer to Purchase must include an attachment with the following:
 - “Lead Warning Statement”
 - Statement disclosing the presence of known LBP and/or LBP hazards
 - List of records or reports that have been provided to purchaser
 - Statement by purchaser affirming receipt of seller's disclosures and opportunity to conduct risk assessment or inspection
 - Signatures of seller and purchaser certifying the accuracy of their statements

See 42 USC 4852d et seq; 40 CFR Part 745.100 et seq.

CONSIDERATIONS FOR FUTURE POLICY DEVELOPMENT

Two important aspects of an effective radon disclosure requirement are content and format. The more specific the content (e.g., test results for the property), the more likely it will prompt action. Moreover, the way in which the information is conveyed can help make it more likely that the parties will pay attention to radon even as they grappling with many other issues and documents. Following are elements to consider in developing a robust radon disclosure policy.

Transactions Covered: *Require Disclosure in Existing and New Home Transactions.* In addition to establishing disclosure requirements for existing homes, states should require disclosure in the sale of newly constructed homes. In new homes that do not have radon control systems in place, information about whether a radon test has been performed (along with general information about radon testing) may help promote testing. If the builder has installed radon control features, mandatory disclosure will ensure that the purchaser receives information about the radon system and any tests conducted following system installation. Because installation of a “passive” radon mitigation system will not reduce radon below the EPA action level in all cases (see Chapter 4), disclosure can promote testing and assist purchasers in deciding appropriate next steps.

Nature of Disclosure: *Require Disclosure of Known Property-Specific Radon Information.* Disclosure laws often add radon to a list of known environmental “hazards” to be disclosed. It is important that the disclosure requirement be framed clearly. Requirements to disclose “hazardous conditions....such as radon,” or “unsafe concentrations....of radon” are unnecessarily vague. Since there is no “safe” radon level, and the only way to know a specific radon level is to test for it, a better approach is to require that the seller disclose known radon levels and knowledge of

any radon testing of the property, along with results and copies of tests. State laws should also require disclosure of the existence and type of any radon control system.

Radon Warning: *Require Provision of General Radon Information.* Including radon as one of numerous conditions to be disclosed may not help promote radon testing where the seller has not tested the home and is not aware of any prior testing. Buyers may not pay attention to an issue that is marked “no” or “not applicable” as part of a lengthy checklist. Even those buyers who review the disclosure form carefully may not consider addressing radon if they do not understand the health effects of exposure and the fact that a test is required in order to know the levels in a particular home. Thus, with respect to radon, state laws should go beyond the standard property disclosure to require provision of general information about radon that will help the buyer make an informed decision about the property. In developing this supplemental information, the state should consider including:

- the health impacts of radon exposure and other basic facts about radon,
- a recommendation to test for radon,
- facts about radon testing and mitigation,
- considerations for hiring a radon professional,
- state-specific information (e.g., requirements for radon certification), and
- sources of additional information.

To help ensure that buyers review this radon information, the material should be provided on a stand-alone form and presented in a format that is easy to read and hard to ignore.

Acknowledgement: *Require Seller and Buyer Signatures to Affirm Distribution and Receipt of Required Radon Disclosures.* Prospective purchasers receive a great deal of paperwork associated with the real estate transaction. Even if buyers are provided with general information about radon to supplement a dis-

closure form, the information may get lost in the process of reviewing numerous technical documents. State laws could require that, as part of the purchase agreement, buyers complete a signed acknowledgement that they received the required radon information. This acknowledgement could be included on the fact sheet or other radon statement prescribed by the state. Requiring a signature can promote compliance and help ensure that purchasers read the information.

Required Testing: *Require Sellers to Test for Radon and Disclose the Test Results.* Given the number of people at risk of dying each year from radon-related lung cancer, state policy makers should consider requiring sellers to have their homes tested for radon at the time of sale. Such a requirement, combined with a requirement for providing radon information

to buyers, would be a significantly stronger step toward addressing the problem of exposure to elevated residential radon levels. The policy could allow sellers to satisfy the requirement by providing copies of radon tests undertaken within a certain number of years prior to the transaction.¹⁹ Policy makers could also consider limiting the requirement to homes in high or moderate average radon potential zones.

Although no states currently require radon testing as part of the real estate transaction, some states do require other types of testing to address environmental health issues. For example, New Jersey law requires testing of private drinking water wells prior to sale of a home. Massachusetts and Iowa require testing of private septic systems prior to transfer of the property (see box.).

State Laws Requiring Environmental Testing in the Real Estate Transaction

Although no states currently required radon testing in the real estate transaction, following are examples of state laws that require other types of environmental health-related testing and inspection when a home is sold.

Testing of Private Drinking Water Wells

New Jersey's Private Well Testing Act (2002) was enacted to help ensure that purchasers and lessees of properties with private potable wells are aware of the quality of the drinking water source prior to sale or lease. The law requires sellers or buyers to have wells tested prior to sale for a variety of listed drinking water parameters. Laboratories must report results to both buyer and seller, who must acknowledge their receipt prior to closing of title. Results are also provided to the state, which may not disclose the information in a way that identifies the specific property location of a well. N.J. Stat. 58:12A-26, et seq.; N.J. Adm. Code 7:9E, et seq. The cost of the required testing is estimated at \$450-\$650, considerably higher than the estimated average cost of radon testing. NJ DEP, *The New Jersey Private Well Testing Act: An Overview* at 5 (2009).

Oregon law requires testing of private wells that supply ground water for domestic purposes. The seller must, upon accepting a purchase offer, have the well tested for parameters specified in the law and regulations. The seller must use an accredited laboratory and submit the results, on a state-created form, to the state and to the buyer. Or. Rev. Stat. §448.271; Or. Adm. Code § 333-061-0325.

Numerous local jurisdictions in the U.S. also require private well testing prior to the sale of a home.

Testing of Private Septic Systems

Massachusetts regulations require, with certain exceptions, that private septic systems be inspected at or within two years prior to transfer of the facility. Inspections must be conducted by a state approved System Inspector according to criteria listed in the regulations. A copy of the inspection report must be provided to the buyer and the results submitted to the state or local approving agency. If the results show that the system is failing to protect public health as provided in the regulations, the system must be upgraded pursuant to standards set forth in the regulations. 310 Code Mass. Regs 15.300.

Iowa law requires inspection of private sewage systems prior to property transfer. Results must be submitted to state and local agencies. Ia Code 455B.172; Ia. Adm. Code 567-69.2 (455B). The state's property disclosure regulation requires disclosure of known problems with septic tanks or sewer systems. IAC 193E-14.1 (543b).

SELECTED STATE RADON/REAL ESTATE DISCLOSURE LAWS:
Citations and Key Provisions

	Citation	Required Specific Disclosure	Required General Radon Information	Exemptions
	Statute	Awareness of Radon	Fact Sheet/Pamphlet	Exemption for New Construction?
	Regulations	Results of Radon Test/ Copy Radon Control System	General Radon Warning Statement Signed Buyer Receipt	Other
AK	AK Stat. 34.70.010	“Aware of any substances... that may be an environmental hazard such as...radon gas.”		Yes
CA	CA Civil Code 1102.1	Aware of “substances...which may be an environmental hazard such as...radon gas.... If the answer ...is yes . . . explain.”		
CO	CO Rev. Stat. 12-61-804	“Do any of the following conditions now exist or have they ever existed hazardous materials... such as radon.”		
CT	CT Gen. Stat. 20-327b CT Adm. Code 20-327b-1	Test, copy Radon control system		Yes
DE	6 DE Code 2572A 24 DE Adm. Code 2900-9.0	“Are you aware of the presence of radon in the property?” Test, copy	Fact Sheet Buyer Receipt	
FL	FL Stat. 404.056		Warning Statement	
IL	765 IL Comp. Stat. 77/1	“Aware of unsafe concentrations of radon on the premises....If ...yes, please explain.”		Yes
	420 IL Comp. Stat. 46/1	“Elevated radon concentrations ...are known to be present” Test, copy	Fact Sheet Warning Statement Buyer Receipt	
IN	IN St. 32-21-5 876 IN Adm. Code 1-4-2	“Have there been...hazardous conditions...such as ...radon gas?... Explain.”		Yes

SELECTED STATE RADON/REAL ESTATE DISCLOSURE LAWS:
Citations and Key Provisions

	Citation	Required Specific Disclosure	Required General Radon Information	Exemptions
	Statute Regulations	Awareness of Radon Radon Test Results/ Copy Radon Control System	Fact Sheet/Pamphlet General Radon Warning Statement Signed Buyer Receipt	Exemption for New Construction? Other
IA	IA Code 558A IA Adm. Code 193E-14.1 (543B)	Test	Fact Sheet Buyer Receipt	
KS	KS Stat. 58-3078a	“Aware of any of the following substances ... which may be an environmental hazard radon gas.”	Warning Statement	
KY	KY Stat. 324.360 201 KY Adm. Code 11:350	“Aware of any testing for radon gas?...Results, if tested.” Test results		Yes
ME	33 ME Stat. 171	“The presence or prior removal of hazardous materials ... including...radon”		
MD	MD Real Prop. Code 10-702	“Are there any hazardous or regulated materials ... including ...radon ... on the property? If yes, specify....”		Yes
	MD Real Prop. Code 10-603	Describe “any hazardous or regulated materials... including... radon... present on the site of the new home.”		Builder participating in new home warranty security plan
MI	MI Stat. 565.951	“Are you aware of any substances ... that may be an environmental hazard such as ... radon gas?... If yes, explain.”		Yes
MS	MS Stat. 89-1-501	“Are you aware of any problems which may exist with the property ... such as ... radon gas?... If Yes, please explain.”		
MT	MT Stat. 75-3-606	Test results/copy Radon control system	Warning Statement Buyer Receipt	

SELECTED STATE RADON/REAL ESTATE DISCLOSURE LAWS:
Citations and Key Provisions

	Citation	Required Specific Disclosure	Required General Radon Information	Exemptions
	Statute	Awareness of Radon	Fact Sheet/Pamphlet	Exemption for New Construction?
	Regulations	Radon Test Results/ Copy Radon Control System	General Radon Warning Statement Signed Buyer Receipt	Other
NE	NE Stat. 76-2, 120 302 NE Adm. Code chap. 1, sec. 001	Have any of the following substances... been on the property . . . radon gas? If tests have been conducted . . . provide a copy of all test results, if available.” Test results/ copy		Yes
NH	NH Rev. Stat. 477:4-a		Warning Statement Buyer Receipt	
NJ	NJ Stat. 26:2D-73	Test results/copy Radon control system		
NY	NY Real Prop Law 462, 463	Test results/copy		Yes
NC	NC Gen. Stat. Chap. 47E-1 21 NC Adm. Code 58A.0114	“Do you have any ... environmental hazards ... including ... radon gas? If... yes... please explain.”		Yes
OH	OH Rev. Code 5302.30 OH Adm. Code 1301:5-6-10 (App.)	“Do you know of the ... presence of ...radon gas? If ‘Yes,’ indicate level of gas if known ... describe and indicate any ... mitigation.” Test Radon Control System		Yes
OK	OK Stat. 60-831 605 OK Adm. Code ch. 10, subch. 17, App A	“Are you aware of the presence of radon gas? Have you tested for radon gas? If ‘Yes’ ... explain.”		Yes Seller/builder who provides disclaimer
OR	OR Rev. Stat. 105.462	“Has any portion of the property been tested or treated for ... radon gas? If yes ... attach a copy or explain.” Test results/copy		Yes

SELECTED STATE RADON/REAL ESTATE DISCLOSURE LAWS:
Citations and Key Provisions

	Citation	Required Specific Disclosure	Required General Radon Information	Exemptions
	Statute	Awareness of Radon	Fact Sheet/Pamphlet	Exemption for New Construction?
	Regulations	Radon Test Results/ Copy Radon Control System	General Radon Warning Statement Signed Buyer Receipt	Other
PA	68 PA Stat. 7301 49 PA Adm. Code 35.335a	“Are you aware of any ... (hazardous substances ... including) ... radon?... has the property been tested for any hazardous substances? Explain...”		Yes
RI	RI Gen. Laws 5-20.8-1	Test	Warning Statement	Yes
SC	SC Code of Laws 27-50-10	“Do you have knowledge of any ... environmental hazards ... including ... radon? If you check "Yes" ... you must explain the problem or attach a descriptive report from an ... expert.”		Yes
SD	SD Codified Laws 43-4-37	“Aware of any existing hazardous conditions ... and of any tests... [for] radon gas?... If the answer is yes, please explain....” Test		Yes
TN	TN Code 66-5-201	“Are you aware of ... substances ... which may be an environ-mental hazard such as... radon?”		Yes
TX	TX Prop. Code 5.008	“Are you... aware of ... radon gas? If... yes, explain.”		Yes
WA	WA Rev. Code 64.06.005	“Are there any substances ... that may be environmental concerns, such as ... radon gas?” “If you answer ‘yes’... please explain your answer and attach documents....”		
WI	WI Stat. 709.01	“Aware of a defect caused by unsafe concentrations of, or unsafe conditions relating to, radon...” If yes, “provide ... an explanation....”		

Chapter Four

Radon in Rental Dwellings

More than one-third of the nation's housing units are occupied by renters. Many states have laws and regulations establishing minimum conditions in rental housing, including requirements for addressing indoor air quality conditions such as lead-based paint and carbon monoxide. Few of these state policies explicitly address radon.

Two principal types of state laws establish minimum conditions for rental dwellings. Housing codes (alternatively known as sanitary codes or property maintenance codes) set minimum conditions and maintenance requirements for rental properties and are typically enforced by local housing or health agencies. Though usually adopted by local governments, some states have established housing codes that set statewide requirements. Another type of state law sets forth the rights and responsibilities of landlords and tenants and may include responsibilities for maintaining the premises. Unlike housing codes, these landlord-tenant laws are enforced mainly through private legal action between landlords and tenants. They provide landlords and tenants with legal recourse for addressing statutory violations, including the failure to remedy substandard housing conditions as outlined in the law.²⁰

With one notable exception, states have not incorporated minimum radon standards into these areas of law. Thus tenants who live in dwellings with elevated radon levels face considerable obstacles in using the laws to address the problem and protect their families. State or local building codes generally have not been applied to compel mitigation absent an explicit radon provision in the code. The private (lawsuit) remedies provided in

landlord-tenant laws are difficult to pursue, especially when the law does not specifically mention radon as a substandard condition. Even where tenants can establish a legal claim absent a specific radon requirement, the expense and practical difficulties of bringing a case in court are often prohibitive.²¹

State law can play an important role in addressing the limitations of current law and promoting reduction of elevated radon levels in rental housing.

SUMMARY OF CURRENT POLICY

To date, only a few states have adopted laws or regulations explicitly addressing radon in rental dwellings. They have done this in two ways: by requiring landlords to disclose radon information to tenants, and by requiring landlords to test for and mitigate elevated radon levels. The main characteristics of these policies are described below. The table at the end of the chapter also summarizes and provides citations for these laws.

Disclosure. At least two states have enacted laws that require landlords to disclose radon information to tenants. **Florida's** disclosure requirement, which also applies to sellers in a purchase/sale transaction, requires lessors to provide tenants with a one-paragraph general radon warning statement at or prior to execution of the rental agreement.

An **Illinois** law requiring radon disclosure in the real estate transaction was amended in 2011 to add a requirement for disclosure to tenants who have written lease agreements. The law requires landlords to make certain

disclosures to current and/or future tenants of units below the third story of a building. If the landlord conducts a test that reveals a “radon hazard” in a unit, he or she must notify current and prospective tenants of the unit of the existence of a radon hazard. If a current tenant conducts a test that reveals a radon hazard, the landlord must disclose to prospective tenants of that unit that “a radon hazard may exist.” These disclosures are not required if the landlord undertakes radon mitigation and subsequent testing shows that the hazard no longer exists.

Testing and Mitigation. **Maine** is the only state that has enacted legislation or regulations requiring testing and/or mitigation in rental dwellings. These requirements were established in 2009 as part of Maine’s landlord-tenant law, and the state is developing implementing regulations. The law applies state-wide (Maine is comprised mostly of high radon potential areas, along with a number of moderate areas), covers most residential lease agreements, and includes the following elements.

Testing. By March 2014, landlords must have their residential buildings tested for radon. Following the initial test, the building must be re-tested at least every ten years. The testing must be carried out by a professional who is registered with the state pursuant to the state’s radon certification law (see Chapter Two).

Mitigation. If radon testing reveals radon levels at or above 4.0 pCi/L, the landlord must have the building mitigated until the radon is below 4.0 pCi/L. The mitigation must take place within six months of the testing, with additional time allowed if a local permit is required for the work. The mitigation must be conducted by a professional who is registered with the state pursuant to the state’s radon certification law.

Notification/disclosure. The law requires landlords to provide current and prospective tenants with written information about radon,

including the risks from radon and the results of any radon testing performed pursuant to the law. The state health department is directed to develop and publish a form for this purpose, which includes the tenant’s acknowledgement of receipt of the radon disclosure. Following mitigation, the landlord must provide the tenant with written notice that radon levels have been mitigated.

Enforcement. The law provides for a \$250 civil fine for violations.

CONSIDERATIONS FOR FUTURE POLICY DEVELOPMENT

Tenants face significant constraints in addressing radon problems, given their lack of authority to undertake building repairs and the challenges they face in pursuing the legal remedies that may be available to them. Following are important considerations for ensuring safe and healthy rental housing through a policy of radon testing, mitigation, and disclosure.

Testing and Mitigation: *Require Landlords to Test for and Mitigate Elevated Radon Levels.* An affirmative requirement that landlords test (and periodically retest)²² their properties and mitigate elevated radon levels can be established by enacting a new law or amending an existing law. If included as part of the state’s landlord-tenant statute, enforcement is typically through private action by landlords and tenants, as provided in the statute.

An alternate approach is to require that landlords maintain their property free of radon above a specified level. Where such a requirement is established as part of the state housing code, local officials would be responsible for enforcing the requirement – e.g., by reviewing radon testing and mitigation reports to determine whether a violation exists. However, absent an explicit requirement for landlords to test for radon, this type of requirement might not be triggered unless or until a party chose to test.

Some states have programs that provide home repair financing to eligible homeowners.²³ State policymakers can review their existing state housing finance programs to identify or expand such opportunities for landlords of affordable housing properties who seek financial assistance in order to comply with radon testing and mitigation requirements.

Professional Services: *Require that Testing and Mitigation of Rental Property be Carried out by Certified Professionals.* In states that require certification of radon professionals, a policy addressing rental housing should affirm the requirement that testing and mitigation be performed by certified professionals to help ensure that the work is done in accordance with state and industry standards (see Chapter Two).²⁴ In states that lack a certification program, the policy could include a requirement that testing and mitigation be carried out by a professional who has received independent, third-party certification. If the radon requirement is part of a building code, local enforcement will be facilitated by a requirement for professional testing and mitigation and for written documentation of those services.

Reporting: *Require Reporting of Testing and Mitigation Activities to Tenants and to the State.* A requirement that landlords disclose information about radon risks and radon tests can be a useful element of a state policy. Such disclosure gives tenants important information

about their home (or potential home) environment and may promote mitigation by landlords who seek to retain and attract tenants to the property.

However, a requirement to provide current and prospective tenants with information about radon risks and about known radon levels in the building can be more effective if combined with a requirement that landlords ensure tenants are not exposed to high radon levels. Disclosure alone may not be effective if tenants lack the ability to negotiate for and choose among a variety of housing options. For existing tenants, this may not be possible within the current landlord-tenant relationship and terms of the lease. Moreover, a policy that relies solely on disclosure may be one that benefits mainly those existing and prospective tenants who can afford to either pursue mitigation by the landlord or find other housing.

Radon certification laws typically require reporting of test results and mitigation activity to the state (see Chapter Two). Absent such a law, a rental housing policy should require such reporting by landlords. This will assist the state in tracking compliance with the law and in understanding radon levels and radon mitigation activities across the state. Disclosure of testing and mitigation to tenants can also assist the state in overseeing compliance with the law.

SELECTED STATE RADON/RENTAL HOUSING LAWS

	Statute Regulation	Testing and Mitigation Required	Disclosure Required
Maine	14 ME Rev. Stat. 6030-D	Testing every 10 years Mitigation of elevated levels	General Radon Info. Results of required testing, mitig.
Florida	FL Stat. 404.056	None	Radon warning statement prior to execution of lease
Illinois	420 IL Comp. Stat. 46/25	None	Radon hazard as indicated by any landlord or tenant testing of unit

Chapter Five

Radon in New Home Construction

A vital component of a state radon risk-reduction strategy is ensuring that new homes are built to minimize radon entry. New home construction techniques for controlling radon are well established, and it is widely believed that the cost involved is considerably lower than the cost to install a radon control system in an existing home.²⁵ Nonetheless, of more than 1.5 million single-family homes built in Zone 1 high radon potential areas from 2001 to 2005, only about 18 percent were built with radon-resistant new construction (RRNC) features.²⁶ Stronger RRNC action is needed to keep pace with new construction and *reduce* the number of homes in the U.S. with elevated radon levels.

In contrast to the existing home context, many states and localities already regulate health and safety aspects of new home construction. Yet, this opportunity to reduce radon exposures is not yet fully realized. Most states that have both statewide building codes and significant areas of high and moderate radon potential still do *not* address radon control in their building codes.

This chapter discusses state building code requirements for controlling radon in new home construction. The final chapter of the report discusses another related policy strategy – incorporating RRNC requirements into state housing finance programs.

SUMMARY OF CURRENT POLICY

Seven states in the U.S. – Illinois, Maryland, Michigan, Minnesota, New Jersey, Oregon, and Washington – have adopted mandatory RRNC measures as part of their state-wide, residential building codes. Three of these state

policies were adopted in the last three years (Illinois, Maryland, and Oregon). In all seven states, the RRNC requirements are not dependent on local building code adoption.²⁷ The key characteristics of the policies are described below and set forth in the table at the end of the chapter.

An eighth state – Maine – takes a somewhat different approach. In 2008, Maine legislation established a state-wide uniform building code and required the code to incorporate a radon standard. The state's new building code references an RRNC standard; however, according to the state building codes agency, the standard must be met only if a homeowner or builder chooses to incorporate RRNC techniques at all.²⁸ Thus, Maine's RRNC standard as currently applied is not mandatory for new residential construction.

Radon Control Standard. Five of the seven states with mandatory RRNC standards have adopted (and/or amended) the radon control standard of the International Residential Code (IRC), Appendix F. Illinois' 2012 law requires RRNC, though regulations have yet to be promulgated to delineate the RRNC standard. The state of New Jersey has developed its own radon standard, which includes elements similar to the IRC Appendix F standard.

The IRC is published by the International Code Council, which develops and updates on a three-year cycle a series of model building codes that are widely adopted by states and localities throughout the United States. The IRC applies to detached one- and two-family dwellings and townhouses that are not more than three stories in height. In addition to the main body of the code, the IRC has several

optional appendices, including Appendix F (“Radon Control Methods”). Appendix F incorporates a “passive” sub-slab or sub-membrane depressurization system designed to resist radon entry and to facilitate future “active” radon mitigation through installation and use of a fan (see box). Jurisdictions that adopt the IRC as part of their building code must explicitly adopt Appendix F in order to establish the IRC’s radon control standard.²⁹

The IRC Appendix F standard does not require radon testing following construction or provision of test kits to the owner, and none of the seven states requiring passive RRNC systems has adopted such a requirement.

Maine’s building code references ASTM E-1465 (Standard Practice for Radon Control Options for the Design and Construction of New Low-Rise Residential Buildings), which incorporates a requirement for testing of passive RRNC systems and activation of the systems if needed. As noted above, however, the standard is not currently mandatory for new residential construction.

Type of Residential Construction Covered. Three states – Michigan, Minnesota, and Maryland – apply their RRNC requirements to dwellings covered by the IRC. The remaining states apply the requirements more broadly. New Jersey’s radon control requirements apply to all occupancies within the “Residential Group R” designation in the state building code, including apartment buildings, hotels, motels, dormitories, etc. Oregon’s RRNC requirements apply to R-2 and R-3 designations, which include buildings that contain one- and two-family dwellings, townhouses, and apartment buildings. Washington requires RRNC techniques in all Group R occupancies, which include apartment buildings as well as one- and two-family homes. Illinois’ 2012 law requires RRNC for all new residential construction.

Geographic Scope of the Requirement. Minnesota’s code requires homes throughout the state to

Passive and Active RRNC Systems

A **Passive** Sub-slab Depressurization System reduces radon levels using natural pressure differentials between the air in an installed pipe, and the rest of the home and the outside air. It consists of several key features:

- *Gravel* layer below the “slab
- *Plastic Sheeting or Vapor Retarder* on top of the gas permeable layer
- *Vent Pipe* from the gravel layer through the house to vent outside above the house
- *Sealing and Caulking* of floor-wall joint and other openings in the slab
- *Junction Box* for a radon fan for possible future activation of the system

An **Active** Sub-slab Depressurization System uses a fan to actively draw radon from the soil into the stack. It consists of the features of a passive system, plus:

- *Installation and Operation of a Radon Vent Fan*

Source: EPA, Building Radon Out (2001), at: <http://www.epa.gov/radon/pdfs/buildradonout.pdf>.

use radon-resistant construction techniques. (According to EPA’s Map of Radon Zones, all counties in Minnesota are classified as either Zone 1 or Zone 2.) Similarly, Illinois’ new law requires RRNC for all new construction in the state. The other five state policies apply to specified localities based on average radon potential. The radon requirements in Michigan and Maryland are applicable to construction in counties designated as Zone 1 areas on EPA’s Map. The state of Washington applies IRC Appendix F to EPA Zone 1 counties, as well as to any home built without a ventilated crawl space. In New Jersey, the RRNC requirement applies to municipalities that have been designated by

the state as “Tier 1” (high radon potential) areas. Similarly, in Oregon, which has no Zone 1 counties according to the EPA Map, the building code is applicable to several counties specified in the state law (as well as any county for which the building codes agency, in consultation with the state health agency, considers the standards “appropriate due to local radon levels”).

CONSIDERATIONS FOR FUTURE POLICY DEVELOPMENT

A number of states now require radon control features in new homes. Nevertheless, there is considerable unrealized potential in this area of policy. Following are options that policymakers can consider for strengthening existing policies and adopting new RRNC requirements to reduce exposures.

Geographic Scope: *Apply RRNC Requirements to Residential Construction in High and Moderate Radon Potential Areas.* While some states have restricted RRNC requirements to high radon potential areas as designated on the EPA Map of Radon Zones, others have gone further. Because there is no safe level of radon exposure and because RRNC systems can reduce levels to 2.0 pCi/L or lower, state policy-makers should consider applying RRNC requirements throughout the state or to high and moderate radon potential zones. States can augment the EPA Radon Zone maps with state-collected radon testing data or state-generated maps that identify high and moderate radon potential zones within the state.

Radon Control Standard: *As an Alternative to Requiring a Passive RRNC System, Require an Active RRNC System or a Passive System Combined with Testing.* The RRNC policy approach to date has been to require passive RRNC techniques similar to those established in the IRC Appendix F. This is a straightforward approach to incorporating radon control for states that have already adopted the IRC as part of their state building code.

Nevertheless, states should also consider other approaches to establishing an RRNC standard, given the potential limitations of a passive (non fan-powered) system. Although research on the effectiveness of RRNC systems is limited, one recent review of this research concluded that passive RRNC systems can be expected to provide about a 50 percent reduction in radon levels *if* the systems are properly installed. The review affirmed the widely held view that active radon systems produce greater indoor radon reduction than passive systems.³⁰ Similarly, research in Minnesota concluded that passive systems can achieve a 40 percent reduction in radon levels, while active systems can achieve reductions of 80 percent or higher.³¹

Thus, a considerable number of new homes built with passive RRNC systems will still have elevated radon levels that can only be reduced to below EPA’s action level of 4.0 pCi/L with the use (activation) of a fan. Without conducting a radon test, however, builders and homeowners will not know the extent of radon reduction achieved in homes with passive systems. Many will be unaware that elevated radon levels exist. Indeed, many will wrongly believe that installation of the passive system has “solved” any radon problem. An aggressive outreach and education initiative by state agencies could promote radon testing by new homeowners and could track the results and follow-up actions taken by owners, though such an approach requires dedication of sufficient program resources to the task.

Requiring *active* RRNC systems is another policy approach for ensuring adequate reduction of radon levels. This approach would promote greater reduction of radon levels, though it would add financial costs and energy usage connected to installing and running the radon vent fan for all covered homes.³² An alternate approach is to require a passive system but provide for *post-construction testing* of the home – requiring, for example, that the builder either have the home tested or provide the occupant with test devices. This

approach has the advantage of targeting active systems to homes with elevated radon levels. Disadvantages include the financial and process costs to builders who must arrange for radon testing, or the lack of certainty over whether testing will occur if responsibility for testing is placed with the occupant.

Given the high cost to human health from indoor exposure to radon and the fact that there is no safe level of radon exposure, policy makers should consider an approach that offers builders the option of either installing an active system or installing a passive system and activating the system if required pre-occupancy testing reveals elevated levels. States considering an RRNC policy approach that goes beyond installation of a passive system may be able to draw on third-party guidance in developing their regulatory standards.³³

Residential Buildings Covered: *Apply RRNC Requirements to All Types of New Residential Construction.* About half of the state RRNC policies apply to all residential construction, rather than to only one- and two-family homes and townhouses. This approach can help address the problem of high radon levels in low-rise and high-rise multi-family buildings, where tenants often lack the financial ability or the legal authority to fix the problem (see Chapter Four).

Local Implementation: *Incorporate Technical Assistance and Capacity Building for Local Code Officials who Enforce RRNC Requirements.* A key to the effectiveness of any law is its implementation, and this is certainly the case with RRNC requirements. It is vitally important that code officials have the knowledge and resources needed to oversee compliance with RRNC requirements through the building permit and inspection process. Legislation requiring adoption of an RRNC standard could direct the state agency to provide code officials with education and/or technical assistance in administering the new standard. Such a provision, however, is dependent on the availability of resources – e.g., through federal agencies, non-governmental organizations, or state radon and other program offices.

Disclosure: *Require that Builders Provide New Homeowners with Radon Information.* Regardless of the type of RRNC standard adopted, those who purchase a new home should receive information about the radon control system that has been installed, including information about any radon testing that was carried out prior to occupancy. If such disclosure is not required separately under a state's real estate disclosure law (see Chapter Two), the legislation requiring establishment of an RRNC standard could include such a provision.

STATE LAWS AND REGULATIONS REQUIRING RRNC

	Statute Regulation	Geographic Areas Covered	RRNC Standard*	Radon Test Required Pre- Occupancy?	Residential Occupancies Covered**
Illinois	IL Public Act 097-0953 (H.B. 4665)	All	Passive RRNC (regs pending)	No (regs pending)	All residential construction
Maryland	MD Public Safety Code 12-503, 504 MD Adm. Code 05.02.07.04(C)(1)	EPA Zone 1	IRC App. F	No	Dwellings covered by IRC
Michigan	MI Comp. Laws 125.1504 MI Adm. Code 408.30401	EPA Zone 1	IRC App. F	No	Dwellings covered by IRC
Minnesota	MN Stat. 326B.106 (Subd. 6) MN Rules, chap. 1322, 2100--2103 (under revision)	All	IRC App. F	No	Dwellings covered by IRC
New Jersey	NJ Stat. 52:27D-123a NJ Adm. Code 5:23-10; 5:23-3.14(c)(3)	State- Designated “Tier 1” Areas	State-created standard (passive RRNC)	No	New Jersey Residential Group R occupancies
Oregon	OR Sen. Bill 1025 (2010) OR Adm. Code 918- 480-005, 918-460-0015	State- Designated Counties	IRC App. F	No	Oregon Group R-2 & R-3 occupancies
Washington	WA Rev. Code 19.27.031, .074 WA Adm. Code 51-50- 1203	EPA Zone 1	IRC App. F	No	Washington Group R occupancies

NOTE: The RRNC standard referenced in Maine’s building code (ASTM E-1465) is not included in this chart, as it is currently not required for new residential construction.

* References to International Residential Code (IRC) Appendix F include adoption with modifications.

** Dwellings covered by International Residential Code (IRC) – includes 1- and 2-family dwellings and town houses up to three stories in height.

Chapter Six

Radon in State Affordable Housing Finance Programs

State affordable housing programs can play an important role in reducing radon risk as one element of a strategy to promote healthy housing. Most states have programs that help finance affordable housing construction, rehabilitation, or repair. States administer project selection criteria and requirements that must be met by funded projects. Increasingly, these criteria and requirements include elements of “green” or “sustainable” design and construction.

State affordable housing finance programs thus provide an opportunity to reduce radon risk in underserved populations that face the greatest challenges in undertaking radon testing and mitigation. Indeed, a number of states already have established specific radon-related requirements in connection with their affordable housing funding programs.³⁴ This chapter describes examples of state housing guidelines that apply to a range of affordable housing programs, as well as state policies that are targeted to specific federal housing programs administered by the state.

RADON IN AFFORDABLE HOUSING PROJECT GUIDELINES

A number of states have included radon requirements in written project guidelines that apply to a variety of affordable housing programs administered by the state. These programs typically cover both new construction *and* rehabilitation activities and thus may require radon-resistant new construction techniques and/or radon testing and mitigation. In some cases, the program guidelines include mandatory green building criteria – e.g., adapting a third-party standard such as the Enterprise Green Communities Criteria for affordable housing developments – which incorporate mandatory radon elements.

Following are several – though not the only – examples of state affordable housing guidelines that include radon requirements.

Connecticut. The Connecticut Housing Finance Authority has developed Standards of Design and Construction that establish requirements for multi-family housing financed through the agency. The Standards require installation of a passive radon control system unless pre-construction testing is feasible and shows radon levels below 4.0 pCi/L. The Standard further requires post-construction radon testing and activation of the radon control system if radon levels remain elevated.³⁵

Minnesota. The Minnesota Housing Finance Agency has adopted and modified a third-party green building standard, Enterprise Green Communities Criteria.³⁶ Single-family and multi-family new construction and substantial rehabilitation projects requesting funding from the agency must comply with the Criteria, which include radon as a mandatory element. New construction and substantial rehabilitation of multi-family buildings must install a passive radon control system, test prior to occupancy, and activate the system if testing reveals radon levels of 4.0 pCi/L or higher. New construction of single-family homes must include installation of a passive radon system; an active system is encouraged but not required. For rehabilitation of single-family homes, radon testing is required and a mitigation system must be installed if testing reveals elevated levels. Minnesota Housing worked in partnership with the state Department of Health to establish a demonstration project to provide \$500 to defray the cost of radon mitigation in 20 homes required to mitigate elevated radon levels under this rehabilitation standard.³⁷

New York. New York State Homes and Community Renewal (HCR) encompasses several state housing and community renewal agencies, including the state Housing Finance Agency and the Housing Trust Fund Corporation. These agencies administer various programs for the development of affordable housing. Multiple HCR agency publications include radon requirements for funded projects, and these requirements are framed in similar terms and apply to both new construction and rehabilitation. For example, the HCR Design Handbook requires that new construction projects in EPA Zones 1 and 2 install passive radon-resistant features and requires that the system be activated if tests confirm radon concentrations above the EPA action level. For rehabilitation projects, the Handbook requires installing an active radon-reduction system in Zones 1 and 2 if tests confirm radon concentrations above the EPA action level. The Handbook references the ASTM E1465 and E2121 standards for guidance.³⁸

Pennsylvania. Applicants for financing from the Pennsylvania Housing Finance Agency (PHFA) for new construction, rehabilitation, and preservation projects must include certification by the design architect that the project will conform to Threshold Green Building Criteria. These Criteria are a set of 24 items including the following radon requirement: “Passive radon mitigation systems shall be installed in areas designated as EPA Radon Zone 1 and 2. The lowest level containing dwelling units or community space must be tested for radon in all buildings prior to occupancy. Test results above the action level will require that an active radon mitigation system be installed [to achieve] satisfactory test results.”³⁹

These new construction requirements are also spelled out in the PHFA Submission Guide for Architects, which includes the agency’s design standards. According to the Guide, existing buildings proposed for rehabilitation must be tested for radon as a part of the Phase I Environmental Site Assessment pro-

cess and radon reduction techniques incorporated if tests indicate radon concentrations exceeding the EPA action level. The Guide also requires that there be post-rehabilitation, pre-occupancy testing and activation of the systems if results are above the EPA action level.⁴⁰

Rhode Island. Rhode Island Housing’s Guidelines for Development include Design and Construction Guidelines that must be followed by all development financed by the agency. These Guidelines incorporate a radon requirement: “Existing buildings proposed to be rehabilitated and proposed new construction sites shall be surveyed for the existence of radon levels exceeding the maximum safe limits as established by local, state or federal authorities. For those locations considered at risk due to elevated radiation, appropriate design and construction requirements will be imposed to mitigate the problem. Determination of any radon hazard will be made during the initial (preliminary) loan underwriting period.”⁴¹

Virginia. The Virginia Housing Development Authority (VDHA) Minimum Design and Construction Guidelines include the following requirement for rehabilitation projects: “Identify any hazardous materials including radon or recalled drywall on site and in buildings. Address or abate all hazardous materials per applicable regulations. Submit abatement certification to Virginia Housing Development Authority if requested.”⁴² According to VHDA officials, the Guidelines require projects to test for radon and then to perform radon mitigation if elevated radon levels are identified.

Washington. Washington law requires the state Department of Commerce to develop a sustainable building program for affordable housing projects that receive funding from the state housing trust fund.⁴³ The Evergreen Sustainable Development Standard created by the Department is based on the Enterprise Green Communities Criteria and includes radon requirements for both new construction and

rehabilitation projects. For new construction, the Standard incorporates and affirms existing state law that requires radon-resistant new construction in EPA Radon Zone 1 for all residential construction (see Chapter Five). For rehabilitation, the Standard requires that Zone 1 projects conduct radon testing using EPA protocols and provide radon mitigation measures when testing indicates that indoor radon levels in the home are 4.0 pCi/L or higher.⁴⁴

RADON IN STATE GUIDELINES FOR SPECIFIC FEDERAL FUNDING PROGRAMS

In addition to establishing broad affordable housing guidelines that incorporate radon requirements, states have addressed radon through their administration of individual federal programs that provide funds for affordable housing development. Within the framework of federal program requirements, states establish project selection criteria that may include design and construction elements such as radon control.

One HUD program that has been an important mechanism for implementing green and healthy housing priorities is the Low Income Housing Tax Credit (LIHTC), which helps finance the development of affordable rental housing by awarding tax credits to developers. Each year the states establish Qualified Allocation Plans (QAPs) that set forth their priorities and selection criteria for

awarding the tax credits. A number of states have included radon requirements in their 2012 QAPs, including these examples:⁴⁵

North Carolina requires passive radon control systems in all new construction projects in Zone 1 and 2 counties.

Alabama requires radon-resistant new construction for projects of 12 or more units that are located in EPA Radon Zone 1.

Colorado incorporates the mandatory elements of the Enterprise Green Development Criteria, which includes passive radon control systems in new construction, as well as testing and mitigation of elevated radon levels in substantial rehabilitation projects, in EPA Radon Zones 1 and 2.

A number of other HUD programs provide *block grants* to states or localities for community development activities that may include affordable housing – e.g., the Community Development Block Grant (CDGB) program, the HOME Investment Partnerships Program (HOME), the Neighborhood Stabilization (NSP) Program, and the new National Housing Trust Fund program. States have an opportunity to incorporate radon control activities into these programs – e.g., through program guidance and the multi-year Consolidated Plans that outline their housing needs and priorities and govern the use of block grant funds.

Opportunities for Addressing Radon through Green Building Tax Credits, Loans, and other Financial Incentives

In addition to incorporating radon into affordable housing finance programs, state programs that target financial incentives to green building construction are potential sources of support for radon control activities.

Over the past several years, many states and localities have enacted laws or developed programs to promote green building in the private sector. At the local level, where planning and permitting decisions are made, green building incentives include expedited permitting, bonus density, reduced permitting fees, and tax credits. Some states also have established tax credits or rebates to spur green building practices. Though not limited to affordable housing development, these financial incentives provide an additional opportunity to integrate radon risk reduction into state programs that fund housing construction and redevelopment.

RRNC can be incorporated into green building incentive programs by referencing third-party green building criteria that include RRNC requirements. For example, *New Mexico's* Sustainable Building Tax Credit program requires qualifying residential projects to meet the criteria of the U.S. Green Building Council's LEED/Homes program or the Build Green New Mexico program, both of which require RRNC in homes located in Zone 1 areas. (<http://www.emnrd.state.nm.us/ecmd/cleanenergytaxincentives/documents/SBTCBrochure.pdf>.) The state of *New York* has established a Green Residential Building Program that provides a cash rebate to projects that meet either the LEED/Homes criteria or the National Green Building Standard, both of which require RRNC in Radon Zone 1 areas. (<http://www.nyserda.ny.gov/Residential/Builder-Contractor/Green-Homes.aspx>.) States could also create a state-specific RRNC requirement to supplement third-party green building criteria that do not otherwise incorporate RRNC a way that addresses state priorities for radon control.

Loan programs for energy efficiency improvement are another possible source of radon funding, if those programs are framed broadly enough to allow loan proceeds to be used for radon testing and mitigation. At the federal level, the FHA PowerSaver Energy Retrofit Loan Pilot Program allows homeowners to use up to 25 percent of PowerSaver loan proceeds to fund non-energy improvements, and radon has been designated as an allowable expense under the program. See <http://portal.hud.gov/hudportal/documents/huddoc?id=radonmitigation.pdf>.

Chapter Seven

Summary: Key Considerations for Future Policy Development

Over the past 25 years, many states have adopted policies to address the problem of indoor exposure to radon. Yet, radon remains a serious public health threat today. In light of the number of people at risk of dying from radon-related lung cancer, states can benefit from enacting stronger radon laws and regulations. This report has reviewed existing state radon policies and highlighted key opportunities for achieving greater radon risk reduction in homes.

Radon Control in New Construction

Building Codes. Seven states in the U.S. require the installation of passive radon control systems as part of their residential building codes. Many more states with state-wide building codes lack such requirements, despite the fact that they have areas of high and moderate average radon potential. Statewide building codes should include minimum radon control measures for all types of residential construction. States can strengthen the current policy approach by requiring builders either to install an active radon control system or to install a passive system and activate the system if pre-occupancy testing reveals elevated levels.

Affordable Housing Project Guidelines. States provide various kinds of financing for the development of multi-family rental properties and other types of affordable housing. Several states have begun to incorporate radon requirements into the guidelines governing their finance programs for new construction and rehabilitation of affordable housing. All states should consider similar steps to ensure that the residential properties they support do not expose occupants to elevated radon levels.

Radon Control in Existing Homes

Real Estate Transactions. The purchase/sale of a home has been an important opportunity for radon testing over the past two decades and should be an even more significant driver of radon testing in the future. States can advance the goal of radon testing in all homes by strengthening their real estate disclosure policies to require the provision of detailed radon information and/or to require radon testing as a condition of sale.

Rental Dwellings. One-third of all housing units in the U.S. are occupied by renters, yet tenants lack effective legal mechanisms to ensure that elevated radon levels in their homes are mitigated. State laws establishing minimum habitability standards for rental housing should address radon exposure directly. States can build on early policy efforts in this area by requiring owners to test for and remediate units with elevated radon levels.

Certification of Radon Professionals

Certification requirements. Thirteen states implement programs to oversee the certification of radon service professionals. Additional state certification policies can help ensure the effectiveness of radon testing and mitigation activities by establishing minimum qualifications and best practices and by including a robust enforcement component.

Reporting and Data Collection. New policies also can help address the limitations in existing radon data by requiring the reporting of testing and mitigation activities and by providing resources for the state to collect and use the reported data.

NOTES

¹ American Lung Assoc., Lung Cancer Fact Sheet, at: www.lung.org/lung-disease/lung-cancer/resources/facts-figures/lung-cancer-fact-sheet.html. It is estimated that approximately \$10.3 billion per year is spent in the U.S. on lung cancer treatment. National Cancer Institute, Cost of Cancer Care, at: http://progressreport.cancer.gov/doc_detail.asp?pid=1&did=2009&chid=95&coid=926&mid=.

² President's Cancer Panel, *Reducing Environmental Health Risks: What We Can Do Now* at 89 (2010), available at: http://deainfo.nci.nih.gov/advisory/pcp/annualReports/pcp08-09rpt/PCP_Report_08-09_508.pdf.

³ See U.S. EPA, U.S. Homes Above EPA's Radon Action Level, at: <http://cfpub.epa.gov/eroe/index.cfm?fuseaction=detail.viewInd&lv=list.listbyalpha&r=224027&subtop=343>; U.S. EPA Office of Inspector General, *More Action Needed to Protect Public from Indoor Radon Risks* at 8-11 (2008), available at: www.epa.gov/oig/reports/2008/20080603-08-P-0174.pdf; W.J. Angell, *The U.S. Radon Problem, Policy, Program and Industry: Achievements, Challenges and Strategies*, *Radiat. Prot. Dosimetry* (2008) 130 (1): 8-13, available at: <http://rpd.oxfordjournals.org/content/130/1/8.full?keytype=ref&ijkey=0UK4il9FRACYAS5>.

⁴ See generally, U.S. EPA, Radon, available at: <http://www.epa.gov/radiation/radionuclides/radon.html>; President's Cancer Panel, *Reducing Environmental Health Risks: What We Can Do Now* at 89 (2010), available at: http://deainfo.nci.nih.gov/advisory/pcp/annualReports/pcp08-09rpt/PCP_Report_08-09_508.pdf; Darby, S., et al., *Radon in Homes and Risk of Lung Cancer: Collaborative Analysis of Individual Data from 13 European Case-control Studies*, *BMJ* at 223-226 (2005), available at: www.ncbi.nlm.nih.gov/pmc/articles/PMC546066/; Krewski, et al., *Residential Radon and Risk of Lung Cancer: A Combined Analysis of 7 North American Case-Control Studies*, *Epidemiology* 16(2) at 127-145 (2005), available at: www.canceriowa.org/Files/Breathing-Easier/EPI-N--American-Pooling.aspx; Committee on Health Risks of Exposure to Radon (BEIR VI), Nat'l Research Council, *Health Effects of Exposure to Radon: BEIR VI* (1999) available at: <http://books.nap.edu/openbook.php?isbn=0309056454>.

⁵ President's Cancer Panel, *Reducing Environmental Health Risks: What We Can Do Now* at 89 (2010), available at: http://deainfo.nci.nih.gov/advisory/pcp/annualReports/pcp08-09rpt/PCP_Report_08-09_508.pdf.

⁶ This report does not address testing and mitigation of radon in drinking water wells. However, in addition to testing the air in a home, those with drinking water wells can have their well water tested for radon. The main risk from radon in water is breathing in radon when the water is used – e.g., for showering or washing clothes. See generally Maine Dept. of Health and Human Services, Test Your Home for Radon, available at: www.maine.gov/dhhs/mecdc/environmental-health/rad/radon/documents/2011%20tipsheet%202+list%202011-11-30.pdf.

⁷ See generally, U.S. EPA, Radon Publications and Resources, at: www.epa.gov/radon/pubs/index.html.

⁸ The cost of installing a radon control system varies considerably depending on the components of the system and whether it is installed as part of new construction or in an existing home. Estimates range from several hundred dollars to over \$2,000. EPA does not publish quantitative estimates for these costs.

⁹ 15 U.S.C. 2661-2671.

¹⁰ See US EPA, Radon Health Risks, at <http://www.epa.gov/radon/healthrisks.html>; President's Cancer Panel, *Reducing Environmental Health Risks: What We Can Do Now* at 89 (2010), available at: http://deainfo.nci.nih.gov/advisory/pcp/annualReports/pcp08-09rpt/PCP_Report_08-09_508.pdf.

¹¹ World Health Org., *WHO Handbook on Indoor Radon: A Public Health Perspective* (2009) (proposing a “reference level of 100 Bq/m³ to minimize health hazards due to indoor radon exposure”), available at: http://whqlibdoc.who.int/publications/2009/9789241547673_eng.pdf.

¹² U.S. EPA, *Consumer's Guide to Radon Reduction: How to Fix Your Home* (2010), available at: www.epa.gov/radon/pubs/consguid.html#reductiontech.

¹³ See EPA Map of Radon Zones, at: www.epa.gov/radon/zonemap.html.

¹⁴ See U.S. EPA, Where Can I Get a Radon Test Kit? at: www.epa.gov/radon/radontest.html.

¹⁵ See U.S. EPA, Radon Publications and Resources, at: <http://www.epa.gov/radon/pubs/>. A number of other consensus-based industry standards have been developed or are currently under development by organizations such as ASTM International (see <http://www.astm.org> – search “radon”), AARST (American Association of Radon Scientists and Technologists) and ANSI (American National Standards Institute) (see www.aarst.org/cgi-bin/standards_forum/discus/discus.cgi).

¹⁶ Radon outreach has emphasized the relative ease and affordability of radon testing during the real estate transaction. EPA does not publish information on the cost of professional radon testing, and studies on these costs are limited. Some states offer cost estimates. See, e.g., MI Dep’t of Env. Quality, Frequently Asked Question about Radon (estimating the cost to be \$50-150), at: [www.michigan.gov/deq/0,1607,7-135-3310_4105_4196-10451--00.html#How much does it cost to test](http://www.michigan.gov/deq/0,1607,7-135-3310_4105_4196-10451--00.html#How%20much%20does%20it%20cost%20to%20test).

¹⁷ EPA does not give estimates of the number of homes tested, and state data are limited. Some states (e.g., Colorado, Connecticut, Idaho, Maine, Montana, New Hampshire, and Vermont) have included radon testing questions in their Behavioral Risk Factor Surveillance System (BRFSS) surveys. See CDC, BRFSS State-Added Question Database (query: radon), at: www.ark.org/adh_brfss_questions/results.aspx. Additionally, some states (e.g., New Jersey, Pennsylvania, Iowa) publish information on radon testing activity as reported by certified professionals.

¹⁸In some states, the radon-specific provisions are contained in regulations implementing the laws, rather than in the statutes themselves.

¹⁹ The state of Minnesota, for example, recommends re-testing a home every two-five years, as well as after structural renovations or adding new heating and central air conditioning systems. See MN Dept. of Health, Radon Testing and Results, at: www.health.state.mn.us/divs/eh/indoorair/radon/radontestresults.html.

²⁰ For additional background and analysis of state law governing minimum rental housing conditions and the rights and responsibilities of landlords and tenants, see Env. Law Institute, *Radon in Rental Housing: Legal and Policy Strategies for Reducing Health Risks* (1994), available at: http://www.elistore.org/reports_detail.asp?ID=343.

²¹ Although renters occupy one-third of housing units, there are twice as many renter-occupied households below the poverty line as owner-occupied households. See U.S. Census Bureau, 2010 American Community Survey, Poverty Status in the Past 12 Months of Families by Tenure, available at: http://factfinder2.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=ACS_10_1YR_C17019&prodType=table.

²² As noted earlier, the state of Minnesota recommends re-testing a home every two-five years, as well as after structural renovations or adding new heating and central air conditioning systems. See MN Dept. of Health, Radon Testing and Results, at: www.health.state.mn.us/divs/eh/indoorair/radon/radontestresults.html.

²³ See, e.g., Michigan’s Property Improvement Program, at: www.michigan.gov/mshda/0,4641,7-141-49317---00.html.

²⁴ For radon measurement in multi-family buildings, EPA references the ANSI/AARST Protocol for Conducting Radon and Radon Decay Product Measurements in Multifamily Buildings (MAMF-2010); see www.epa.gov/radon/pubs/index.html. An ANSI/AARST standard for mitigation in multi-family buildings is currently under development; see www.aarst.org/cgi-bin/standards_forum/discus/discus.cgi.

²⁵ Cost estimates for RRNC vary considerably, and EPA does not update cost information. The agency has stated that RRNC “typically costs a builder between \$250 and \$750, depending on the size and location of the house” and can cost less if the builder already uses some of the same techniques for moisture control. U.S. EPA, Builders: The Basics, *at*: http://www.epa.gov/radon/rrnc/builders_basics.html. EPA also notes that, although radon can be measured in soil, soil testing cannot accurately predict what the radon levels will be once the house is built. U.S. EPA, *Building Radon Out* at 20 (2001), *available at*: www.epa.gov/radon/pdfs/buildradonout.pdf.

²⁶ The overall RRNC rate for all new single family homes was about seven percent during this period. U.S. EPA Office of Inspector General, *More Action Needed to Protect Public from Indoor Radon Risks* at 10 (2008), *available at*: www.epa.gov/oig/reports/2008/20080603-08-P-0174.pdf.

²⁷ In some states, including Florida and Virginia, the building code incorporates a *model* RRNC standard that is applicable only if a local jurisdiction chooses to establish radon requirements and formally adopts the standard as part of the local building code. See Fl. Admin. Code r. 9B-52.004; 13 Va. Admin. Code 5-63-210 et seq.

²⁸ See 2008 Maine Public Law 699; 16 Code of Maine Rules 635, ch. 1.

²⁹ The ICC recently published another model code, the International Green Construction Code (IgCC), which applies to large (commercial) buildings, including large residential buildings. The IgCC also addresses radon through an optional appendix (Appendix B).

³⁰ W. Angell, *Radon Control in New Homes: A Meta-Analysis of 25 Years of Research* (2012) (emphasizing the need for further research), *available at*: www.aarst.org/proceedings/2012/02_Radon_Control_In_New_Homes_A_Meta-Analysis_of_25_Years.pdf; see also World Health Org., *WHO Handbook on Indoor Radon: A Public Health Perspective* at 66 (2009), *available at*: http://whqlibdoc.who.int/publications/2009/9789241547673_eng.pdf.

³¹ MN Dept. of Health, *Radon Reduction in New Construction: A Review of Published Studies* (Draft 2012) (on file with ELI).

³² Estimates of these costs vary and are not currently provided by EPA. A study in Minnesota concluded that, depending on the type of fan and other factors, the cost in that state to operate an RRNC fan is just over \$21 per year, while associated increased heating and cooling costs add about \$58 per year. MN Dept. of Health, *RRNC Cost Comparison* (2012) (on file with ELI).

³³ See, e.g., ASTM Standard 1465-E, *Standard Practice for Radon Control Options for the Design and Construction of New Low-Rise Residential Buildings* (requiring either installation of active RRNC system or installation of passive system with verification that pre-occupancy testing shows acceptable radon levels); AARST, ANSI, *RRNC 2.0* (Draft March 2012) (model standard under development, including requirements for installing passive RRNC system, having system tested, and activating system if necessary) *available at*: www.aarst.org/images/RRNC_2_0_Standard_FINAL_A_4th_Public_Review_Draft_March_16_2012.pdf.

³⁴ This chapter does not describe state policies that encourage, but do not require, radon control – e.g., as an optional measure for which funding applicants may earn points in the selection process.

³⁵ CT Housing Finance Authority, *Standards of Design and Construction* at 158-9 (2012), *available at*: www.chfa.org/content/Multifamily%20Document%20Library/2012StandardsFinal_122711.pdf.

³⁶ MN Housing Fin. Agency, *Minnesota Overlay and Guide to the 2011 Enterprise Green Communities Criteria* (2012), *available at*: www.mnhousing.gov/idc/groups/public/documents/webcontent/mhfa_012435.pdf. The Minnesota Criteria include standards for conducting the required radon work.

³⁷ See www.mnhousing.gov/idc/groups/homes/documents/webcontent/mhfa_009281.pdf.

³⁸ HCR/Housing Trust Fund Corporation, *Design Handbook* at 24 (2012), *available at*: www.nyshcr.org/Publications/DesignHandbook/.

³⁹ PA Housing Finance Agency, *2013 Underwriting Application* at 207, *available at*: www.phfa.org/forms/multifamily_application_guidelines/submission/tab_08/dv_tb08_archtcts CRT_thrshd_crtra.pdf.

⁴⁰ PA Housing Finance Agency, *Submission Guides for Architects* at 1.37, *available at*: www.phfa.org/forms/technical_services/current/2013/ts_2013_tab1.pdf.

⁴¹ RI Housing, *Guidelines for Development* at 66-67, *available at*: www.rhodeislandhousing.org/filelibrary/2013%20Section%203_Guidelines_for_Development.pdf.

⁴² VDHA, *2012 Minimum Design and Construction Guidelines* at 6, *available at*: www.vhda.com/BusinessPartners/MFDevelopers/MF-LoanApplication-Guides/MF%20Loan%20Applications%20and%20Guides/2012MinDesignConRequirements.pdf.

⁴³ Rev. Code Wa. 39.35D.080.

⁴⁴ WA Dept. of Commerce, Evergreen Sustainable Development Standard at 75, *available at*: www.commerce.wa.gov/site/1027/default.aspx.

⁴⁵ See Alabama 2012 QAP, *available at*: www.novoco.com/low_income_housing/resource_files/qap/2012/alabama_final_12.pdf; Colorado 2012 QAP, *available at*: www.chfainfo.com/documents/CHFA_LIHFC_Allocation.pdf; North Carolina 2012 QAP App. B, *available at*: www.nchfa.com/Rental/RD2012qap.aspx.

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