Indoor Radon: Regulating a Blameless Cause

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I. Introduction

December, 1994 earmarked the ten-year anniversary of the recognition of indoor radon as a substantial human health threat. In fact, radon has been deemed the most serious environmental carcinogen threatening the American public today. Despite this fact, attempts to regulate indoor radon pollution by the Federal government over the past decade were haphazard, and primarily

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1 In December of 1984, an employee of a nuclear power plant, Stanley Watras, set off a radiation detecting device when he reported to work. The source of the contamination was traced to Watras's house, in which extremely high levels of radon gas were found. See Robert D. King, The Legal Implications of Residential Radon Contamination: The First Decade, 18 WM. & MARY J. OF ENVTL. L. 107 [hereinafter King]. Stanley Watras is now a Pennsylvania-certified radon tester. RADON NEWS DIG. Vol. 6 No. 3 Fall, 1992, at 17.

2 Radon exposure from both uranium and phosphate mining was recognized as a human health risk as early as the 1950's, when it was noticed that these miners had higher incidence of lung cancer. Anne Rickard Jackowitz, Radon's Radioactive Ramifications: How Federal and State Governments Should Address the Problem, 16 B.C. ENVTL. AFF. L. REV. 329, 329 (1989) [hereinafter Jackowitz]. However, the scope of this comment is limited to indoor radon exposure.

3 For a discussion of the health effects of radon exposure to humans see infra notes 46-75 and accompanying text.

4 Although the focus of this comment is the indoor radon problem of the United States, Ireland, the United Kingdom, Norway, Sweden, Finland and Japan have recognized the problem of indoor radon exposure, and have surveyed, or are in the process of surveying their housing stock. See PHILLIP K. HOPKE, RADON AND ITS DECAY PRODUCTS (1987).


7 "The legislative and regulatory framework for radon has been characterized by ambiguity and controversy about whether particular agencies have the responsibility and authority to address the problem." SHELDON
limited to funding for research and surveys to ascertain the depth and severity of the radon problem in the United States. Some commentators have suggested that the Federal government is not regulating radon as stringently as other pollutants. It has also been suggested that the Federal government may not have the authority to regulate radon. The United States Environmental Protection Agency (hereinafter EPA or Agency) has stated that radon is a naturally occurring substance, and by its very nature, it presents regulatory difficulty.


8 For a discussion of the extent of the severity of radon in U.S. homes, see generally Anthony V. Nero et al., Distribution of Airborne Radon-222 Concentrations in U.S. Houses. 234 SCIENCE 992 (1986); Cohen, A National Survey of 222 Rn in U.S. Homes and Correlating Factories 51 HEALTH PHYSICS 175 (1986); Marcinowski et al., National and Regional Distributions of Airborne Radon Concentrations in U.S. Homes 66 HEALTH PHYSICS 699 (1994).

The average radiation exposure from radon is estimated to be greater than the exposure from medical treatments such as x-rays, and much greater than the dose from industrial activities such as nuclear power plants. See generally DAVID BRODANSKY, INDOOR RADON AND ITS HAZARDS (1987) [hereinafter BRODANSKY].

9 See Janet I. Moore, The Radon Review: The Federal and State Government's Response to Indoor Radon Contamination, 7 TEMPLE ENVTL. L. & TECHNOLOGY J. 41 (1988) [hereinafter Moore]. This comment argues that the nature of indoor radon makes it difficult to regulate, and also questions whether the government has the authority to do so.

10 Id. at 41. This commentator argues that the government may not have the right to require radon mitigation as it impacts on an individual's economic and social preferences. This theory would be consistent with the thought of free market advocates who would believe that homeowners have the right to decide whether or not to improve the quality of their own indoor air. See Laurence Kirsch, Behind Closed Doors: Indoor Air Pollution and Government Policy, 6 HARV. ENVTL. L. REV. 339, 383-386 (1982) for a discussion of the free market position on regulation of indoor air pollution.

11 Radon's natural occurrence can be contrasted with manufactured industrial pollutants which are regulated.

12 See Moore, supra note 9, at 42. Radon is not a homogenous problem. The degree of radon contamination is highly site specific. The presence of radon gas in
Due to the severity of the potential health risks\textsuperscript{13} associated with prolonged radon exposure, government intervention\textsuperscript{14} is needed to both educate and protect the public from this "colorless, odorless silent killer."\textsuperscript{15} This comment calls for further government regulation at both the federal and state levels to combat the indoor radon problem.

Section one of this Comment will define radon, discuss its sources of emission, the health ramifications associated with exposure to it, demographics of the radon problem, and current means of radon mitigation. Section two will review federal legislation addressing the indoor radon problem. Section three will recommend ways in which the federal government can protect the public from potential radon exposure utilizing existing regulatory framework. Finally, Section four will propose new legislative initiatives to abate indoor radon pollution.

\begin{quote}
a building depends upon various factors including the structure of the dwelling unit, the geographical location of the building, and the rock formation that the home is built upon. See infra notes 17, 29-45 for a discussion of how radon is emitted into the atmosphere.

\textit{See also} Paul A. Locke, \textit{Promoting Radon Testing, Disclosure, and Remediation: Protecting Public Health Through the Home Mortgage Market}, ENVTLL. L. REP. 10475, 10479 (November, 1990) (stating "because almost all radon occurs naturally, it presents a special environmental challenge. The usual rules of thumb, like 'polluter pays' do not fit well").

\textsuperscript{13} Radon has been identified as second only to cigarette smoking as a cause of lung cancer. Jonathan Samet, \textit{Radon and Lung Cancer}, 81 J. NATL. CANCER INST. (1989).

\textsuperscript{14} But see King, supra note 1, at 159 (discussing the violation of the Constitutional right to privacy with regard to radon testing and abatement). However, the government has intervened into the right to privacy to protect public health and welfare by promulgating seatbelt laws and smoking restrictions.

\textsuperscript{15} A major problem with radon gas is detection. It may go unnoticed for years due to the fact that it can not be seen or smelled. For this reason Time magazine called radon a "colorless, odorless silent killer." \textit{The Colorless, Odorless Killer}, TIME, July 22, 1985 at 72.
\end{quote}
II. Characteristics of Radon

A. What is Radon?

Radon-222\(^{16}\) is a naturally occurring radioactive gas, which results from the breakdown of underground uranium deposits,\(^{17}\) including granite, shale and limestone. These deposits may be found in soil, rock and water.\(^{18}\) As Uranium decays,\(^{19}\) it releases a by-product known as radium, which eventually releases radon gas.\(^{20}\) The gas then undergoes further decay, releasing dangerous radioactive alpha elements,\(^{21}\) such as Polonium-218\(^{22}\) and Polonium-

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\(^{16}\) Radon is an inert gas which does not react chemically with other elements. During its radioactive decay, however, it produces a chemically active progeny referred to as radon daughters or radon progeny. It is this decay product which actually causes negative health ramifications in humans. Locke, \textit{supra} note 10, at 10,475 n.2. For simplicity, radon progeny will be referred to as radon.

\(^{17}\) As Uranium is found in virtually all soils, radon gas is a commonly occurring natural phenomenon. \textsc{Office of Air and Radiation}, \textsc{U.S. Environmental Protection Agency and Centers for Disease Control}, \textsc{Report No. DPA-86-004, A Citizen's Guide to Radon—What It Is and What to Do About It}, at 4 (1986) [hereinafter \textsc{Citizen's Guide}].


\(^{19}\) Like any radioactive element, Radium's atomic structure is unstable, and undergoes radioactive decay in an attempt to reach a more stable structure by emitting subatomic particles, which is a gaseous element known as radon. \textsc{Konrad B. Krauskopf & Arthur Beiser}, \textit{The Physical Universe} 272-77 (1973).

\(^{20}\) \textit{Id.}

\(^{21}\) Alpha elements or particles have been found to be highly effective in damaging lung tissue. \textsc{Office of Air and Radiation, United States Environmental Protection Agency}, \textsc{Pub. 402-K-93-008, Radon: The Health Threat With a Simple Solution: A Physician's Guide}, Sept. 1993 [hereinafter \textsc{Physician's Guide}].

\(^{22}\) Polonium-218 and Polonium-214 have been implicated in a causal relationship with lung cancer in humans. \textit{Id.} at 3.
The gas poses little threat outdoors as it dissipates into the atmosphere, where it is virtually harmless.

B. Sources of Emission

Indoors, radon can reach unsafe concentration levels as it becomes trapped in enclosed areas of a building. The magnitude of indoor radon concentration depends primarily upon both a building's construction and the characteristics of the underlying soil. The gas seeps into the building due largely to the differential between the relatively low air pressure in the structure and the higher air pressure in the soil. Effectively, the building acts as a vacuum, drawing radon into the structure.

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23 Id.
24 Radon is diluted to low concentrations outdoors, and thus causes significantly less health risk than it does when trapped indoors. A Physician's Guide, supra note 21, at 3. The average outdoor radon level is estimated to be approximately 0.4 pCi/L. Id. at 7.
25 Shuko, supra note 18, at 362-63.
28 Radon concentration rates are inversely proportional to the ventilation rate of a building. Cross, supra note 26, at 269.
29 Id.
30 Air pressure in a building is usually lower than pressure in the soil around the foundation of a building. OFFICE OF AIR AND RADIATION, U.S. ENVIRONMENTAL PROTECTION AGENCY, PUB. NO. 402-K92-003, CONSUMER'S GUIDE TO RADON REDUCTION (1992).
31 PHYSICIAN'S GUIDE, supra note 21, at 11.
32 Id.
Sources of radon emission include the permeation of the gas into a building through soil containing uranium through cracks in the structures foundation or walls. Exposed earth, such as floorless basements or cold rooms are also a major point of entry for radon. The gas may also enter a structure through drainage areas or sump-pumps. Natural gas and water sources, including both private

33 Radon may also be found in soils which have been contaminated with industrial wastes. A CITIZEN'S GUIDE, supra note 17.

34 It should be noted that even homes with no visible cracks in the structure can be subject to radon gas seepage. See FRANK B. CROSS, LEGAL RESPONSES TO INDOOR AIR POLLUTION 7 (1990).

35 "Radon can seep into a home through dirt floors, cracks in concrete walls and floors, floor drains, sumps, joints and tiny cracks or pores in hollow block walls." OFFICE OF AIR & RADIATION, U.S. ENVIRONMENTAL PROTECTION AGENCY & CENTERS FOR DISEASE CONTROL, U.S. DEP'T OF HEALTH & HUMAN SERVICES, REPORT No. DPA-86-004, A CITIZEN'S GUIDE TO RADON-WHAT IT IS AND WHAT TO DO ABOUT IT (1986) [hereinafter EPA CITIZEN'S GUIDE 1986].


37 Id.

38 Natural gas also contains high levels of radon at the well head, although much of the radon decays during gas storage or transport. DOUGLAS G. BROOKINS, THE INDOOR RADON PROBLEM (1990).

39 "The potential concern with radon in water is the airborne radon released when the water is used." HOMEOWNER'S GUIDE, supra note 36, at 3. The EPA estimates that between 100-1,800 lung cancer deaths per year in the U.S. result from radon-contaminated water. See id. See also Cross et al., Health Effects and Risks From 22 Rn in Drinking Water, 48 HEALTH PHYSICS 149 (1985) (stating that water contributes significantly to indoor radon contamination). But see Anthony V. Nero, Airborne Radionuclides and Radiation in Buildings: A Review, 45 HEALTH PHYSICS 303, 304 (1983) (stating that "water and natural gas are not the largest sources of indoor radon, and contribute perhaps no more than 3% of the average concentration found throughout the country").
wells 40 and water pipes 41 also contribute to the indoor radon problem. Furthermore, building materials 42 containing uranium 43 also release radon gas. 44 There is a general consensus, however, that the largest source of indoor radon contamination are ground emissions. 45

C. Health Ramifications

Occupational exposure 46 to radon 47 in underground miners 48

40 Water from private wells or small community water systems can contribute significantly to elevated radon level within a house especially in the northeast and west. HOMEOWNER'S GUIDE, supra note 36, at 3.

41 Large community water supplies generally don't pose the problem that private wells do, as radon gas typically is released into the atmosphere before the public water reaches the home. U.S. ENVIRONMENTAL PROTECTION AGENCY PUB. NO. OPA-87-001, REMOVAL OF RADON FROM HOUSEHOLD WATER (1987).


43 Many building materials such as brick, granite, limestone, concrete and drywall may also contain radon-releasing material. See Ingersoll, supra note 42, at 367-68.

44 Experts now believe, however, that concrete could account for only up to ten percent of indoor radon concentrations, and is not thought to be a primary source, unless tailings from uranium or phosphate mining operations have been used in construction. See, e.g., Ingersoll, supra note 42.

45 ISAAC TURIEL, INDOOR AIR QUALITY AND HUMAN HEALTH (1985). See also Ingersoll, supra note 42.

46 A substantial portion of the knowledge of the health ramifications of radon exposure has been extrapolated from studies of underground miners. Critics have argued that this may be an inappropriate basis for estimating indoor radon risk. See, e.g., Leonard A. Cole, Radon Scare—Where's the Proof?, N.Y. TIMES, Oct. 6, 1988, at A31; U.S. OVERESTIMATES PERIL OF RADON IN HOMES, NEW STUDY SAYS, N.Y. TIMES, Mar. 29, 1991, at B6; Eric Morgenthaler, For a Healthy Glow, Some Folks Try A Dose of Radon, WALL ST. J., Oct. 12, 1990, at A1. However, the National Academy of Sciences concluded that although it is reasonable to extrapolate data from the mining studies into the indoor realm, "the effective dose per unit of exposure for people in their homes is approximately 30 percent less than for miners." HOMEOWNER'S GUIDE, supra note 36, at 7; See also NAT'L ACADEMY OF
was recognized as a health threat as early as the 1950s. However, it was not until 1984, and the *Watras* case that indoor radon was recognized as a serious health risk. Exposure to radon and its progeny is known to increase an individual's likelihood of 

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**SCIENCE, COMPARATIVE DOSIMETRY OF RADON IN MINES AND HOMES (1991).**

Health concerns have been associated with uranium and radium mining since the 1500's. The premature deaths of such miners due to respiratory illness were linked to malignant lung tumors almost three hundred years later. King, *supra* note 1, at 115; see also Shuko, *supra* note 18, at 364.

Extensive epidemiological studies of underground metal, fluorspar, shale and uranium miners have been conducted in the U.S., Canada, Australia, China and Europe, which have all "consistently shown an increase in lung cancer occurrence with exposure to radon decay products, despite differences in study populations and methodologies." *Physician's Guide*, *supra* note 21, at 4.


See King, *supra* note 1, and accompanying text for a discussion of the Watras case and the discovery of indoor radon.


"Trapped inside the lung in close proximity to sterile lung tissue, radon progeny continue to decay, giving off radiation that can weaken, chemically alter, or damage the lung." Locke, *supra* note 10, at 10475.

An individual's health risk from radon exposure may depend upon a variety of factors, including the amount of time he or she is exposed to the gas. Studies conducted in the U.S. and Europe indicate that people residing in industrialized nations spend 93% of their time indoors. See *OFFICE OF AIR AND RADIATION, U.S. EPA REPORT TO CONGRESS ON INDOOR AIR QUALITY: VOLUME II: ASSESSMENT AND CONTROL OF INDOOR AIR POLLUTION*, i (1989). "Moreover lifestyles are said to impact the risk-smokers and children are believed to be more susceptible, and those who sleep or spend considerable time in lower portions of the house, such as basements." *Citizen's Guide*, *supra* note 17, at 12.

Factors such as age and duration of exposure, as well as the usage of tobacco have been found to influence the individual's chance of developing radon-induced cancer. "The use of tobacco multiplies the risk of radon-induced lung cancer enormously." *Physician's Guide*, *supra* note 21, at 4. See also *Citizen's*
developing cancer.\textsuperscript{54} There is also increasing evidence that exposure\textsuperscript{55} to radon causes genetic damage.\textsuperscript{56}

Radon is the second\textsuperscript{57} leading cause of lung cancer\textsuperscript{58} in the United States,\textsuperscript{59} and may be linked to other respiratory cancers\textsuperscript{60} as


\textsuperscript{55} During exposure to radon, the radiation given off through the decay process may effect DNA molecules by reorganizing it's molecular structure and changing the genetic coding. The cell may then become abnormal or cancerous if it is still capable of reproducing. Shuko, \textit{supra} note 18, at 363.

\textsuperscript{56} See, \textit{e.g.}, Vahakangas, et al., \textit{Mutations of p53 and Ras Genes in Radon-associated Lung Cancer From Uranium Miners}, 339 \textit{THE LANCET} 576 (1992). Mutations were found in genes by direct DNA sequencing which "may reflect the genotoxic effects of radon." \textit{Id.}

\textsuperscript{57} Radon is second only to cigarette smoking as a cause of lung cancer. Brodansky, \textit{supra} note 8, at 5; see \textit{also} Samet, \textit{supra} note 13 .

\textsuperscript{58} "Once inside the lung, radon continues to decompose, releasing fragments of radiation into the lung cavity. Radiation exposure imparts considerable damage to delicate lung tissue, and prolonged exposure can lead to lung cancer and death." \textit{Joint Hearings}, \textit{supra} note 54, at 85 (prepared statement of Alfred Munzer, President of the American Lung Association).

\textsuperscript{59} \textit{PHYSICIANS'S GUIDE}, \textit{supra} note 21, at 2.

\textsuperscript{60} \textit{See generally Joint Hearings}, \textit{supra} note 54, at 50 (National Academy of Science report). The incidence of respiratory tract tumors increased in animals as they were cumulatively exposed to radon. \textit{Id.}
well. Exposure to the gas has also been linked to leukemia and cancers of the stomach, brain, spine, bone, skin, and kidneys. The EPA estimates that between thirteen to fifty of every thousand people exposed to unsafe levels of radon could develop cancer. The Agency also estimates that exposure to radon gas causes 14,000 deaths per year, but cautions that this number could actually range from 7,000 to 30,000 deaths per year.

Radon has been classified as a group "A" carcinogen by both the EPA and the World Health Organization. A substance receives this classification only when there exists known, reliable, solid human data which directly links the element to human fatalities or carcinomas. It has been argued that radon exposure studies are the most complete studies that the scientific evidence indicates.

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61 Brodansky, supra note 8, at 5.
62 Although lung cancer is the most prevalent type of cancer induced by radon, due perhaps to the fact that the lungs get "the highest dose within the human organism...all the other organs and tissues of the body...are exposed to a radiation burden due to the inhalation of radon and radon daughters from the lungs into the bloodstream." Pohl-Ruling, Effects on Peripheral Blood Chromosomes, RADON AND ITS DECAY PRODUCTS 487 (1987).
64 Brodansky, supra note 8, at 5.
65 CITIZEN'S GUIDE, supra note 17, at 2.
66 The World Health Organization and the EPA have classified carcinogens in categories based on the elements' causal relationship with cancer. The grouping is ranked A through C, with group A carcinogens being the most likely to cause cancer. Subcommittee on Transportation, supra note 51, at 39.
67 Id. at 39.
68 Human data is contrasted with animal data procured from experimentation on laboratory animals and extrapolated to the human population.
69 It is estimated that three of every one-hundred individuals exposed to radon at a dose of 4pCi/L will die of lung cancer. Subcommittee on Transportation, supra note 51, at 44.
70 Id. at 42.
71 The EPA states in its CITIZEN'S GUIDE TO RADON, supra note 17 that "we know more about radon risks than risks from most other cancer-causing
community\textsuperscript{72} has ever compiled.\textsuperscript{73} It is a well-known and accepted scientific fact\textsuperscript{74} that radon is among the most powerful carcinogenic agents to which the general public is exposed.\textsuperscript{75}

D. Demographics

Indoor radon concentrations are not evenly distributed among buildings across the country, but rather vary widely based on a number of factors.\textsuperscript{76} The average indoor radon level for single-family homes is approximately 1.5 pCi/L.\textsuperscript{77} This number is equal to a whole-body radiation dose of approximately 300 millirem (mrem) per year\textsuperscript{78}...because estimates of radon risks are based on studies of cancer in humans (underground miners).”\textsuperscript{72} \textit{Citizen’s Guide, supra} note 17 at 11. See also \textit{A Physicians Guide, supra} note 21, at 4. "More is known about health risks of radon than about most other human carcinogens."

\textsuperscript{73} \textit{Subcommittee on Transportation, supra} note 51, at 42.

\textsuperscript{74} All major health organizations, including the AMA, the American Lung Association, and Centers For Disease Control agree that radon causes thousands of lung cancer deaths annually. It should be noted, however, that some scientists dispute the precise number of deaths due to radon. \textit{A Citizen’s Guide, supra} note 17, at 13.

\textsuperscript{75} \textit{Biophysical Effects of Radon Exposure on Human Lung Cells (Phillip K. Hopke ed., 1987), Radon and Its Decay Products, 487.}

\textsuperscript{76} \textit{Brodansky, supra} note 8, at 51. Influencing factors vary greatly based predominantly upon the site of the building as well as the structures construction.

\textsuperscript{77} \textit{Id.} The Curie is the commonly used measurement for radioactivity. This level is too large to use for radiation levels discussed in radon cases. Thus, the usual unit used is the pico Curie, equal to one-millionth (0.000001) of a Curie. To measure radon concentrations in water and air, the unit is pico Curies per liter (pCi/L). E. Greenfield, \textit{House Dangerous: Indoor Pollution in Your Home and What You Can Do About It!} 171-73 (1987).

\textsuperscript{78} \textit{Id.} For purposes of comparison, it should be noted that the average human exposure dosage from naturally occurring sources, such as cosmic rays, radionuclides in the ground, and radionuclides in the body is approximately 100 mrem. \textit{Id.} The maximum allowable exposure from nuclear reactors or potential
Elevated indoor radon concentrations have been found in every state of the Union, as well as in several Indian Nations. Higher levels of the gas are generally found in geographical areas containing more dense concentrations of uranium. As uranium is one of the most widely spread of all elements, virtually every geographic area in the world contains some amount of it. The average uranium soil content in the United States is one-part uranium per one-millionth parts ground soil. However, certain areas of the country, such as the Reading Prong, have significantly higher nuclear waste disposal sites is limited to 25 mrem per year for members of the general public. Interestingly, "even the accident at Three Mile Island did not lead to any off-site exposures as high as 100 mrem." Id.

But see ANTHONY NERO & WILLIAM W. NAZAROFF, RADON AND IT'S DECAY IN INDOOR AIR 11 (1988) (claiming "Despite a broad range of U.S. efforts to characterize indoor radon, there has been no direct broad-scale determination of concentrations to which the population is exposed.")

PHYSICIAN'S GUIDE, supra note 21, at 9.

The EPA has conducted radon screening in 42 States and seven Indian nations, and six additional states have conducted their own radon testing, with elevated levels having been in every state. TESTIMONY OF ROBERT SUSSMAN, Joint Hearing, supra note 54, at 52.

"The highest levels of radon concentrations are found in Pennsylvania, New York, New Jersey, parts of New England, along the Appalachia region, Florida, scattered areas in Wisconsin and Minnesota, and other areas west of the Rocky Mountains." CROSS, supra note 34, at 6.

See supra notes 17-23 and accompanying text for a discussion of radon resulting from the natural decay process of uranium.

Uranium can be found in approximately 150 Minerals. MICHAEL LAFAVORE, RADON THE INVISIBLE THREAT 24 (1987).

Moore, supra note 9, at 42.

King, supra note 1, at 36. See also Cole, supra note 46, at 8 "Although uranium is particularly abundant in granite, shale, and phosphate-bearing formations, small amounts are dispersed throughout the earth's crust. Radon, therefore, may be found everywhere."


The Reading Prong is a large deposit of low grade uranium extending throughout the States of Pennsylvania, New York and New Jersey. King, supra
concentrations\textsuperscript{88} of uranium.\textsuperscript{89} Large deposits of the uranium also exist west of the Rocky Mountains,\textsuperscript{90} as well as in reclaimed phosphate mining land\textsuperscript{91} in the State of Florida.\textsuperscript{92}

Soil content\textsuperscript{93} is not the only factor to be considered when attempting to predict areas which may be at risk for high indoor radon readings.\textsuperscript{94} A building's susceptibility to radon contamination is significantly effected\textsuperscript{95} by its structure\textsuperscript{96} and the surrounding soil's permeability.\textsuperscript{97} Although geographical patterns of high radon

\begin{footnotesize}
\begin{enumerate}
  \item \textsuperscript{88} "Hot spots" of radon concentration have been found in Arizona, Arkansas, California, Colorado, Idaho, Illinois, Maine, Maryland, Massachusetts, Montana, New Hampshire, New Jersey, New Mexico, New York, North Dakota, Ohio, Pennsylvania, Rhode Island, Vermont, Virginia, Wyoming, and the Pacific northwest. LAFAVORE, \textit{supra} note 83, at 33.
  \item \textsuperscript{89} \textit{Id.}
  \item \textsuperscript{90} Cross, \textit{supra} note 34, at 6
  \item \textsuperscript{91} There exists 25,000 acres of reclaimed phosphate mining land within the State of Florida. "Phosphate rock can contain between 50 and 125 parts of uranium per million parts of soil." King, \textit{supra} note 1, at 136 n.5.
  \item \textsuperscript{92} \textit{Id.}
  \item \textsuperscript{93} Hopke, \textit{supra} note 4, at 2. "Initial efforts at predicting areas where houses may be at higher risk have focused on searching for areas with above average levels of soil radium." SEXTRO, \textbf{INVESTIGATIONS OF SOIL AS A SOURCE OF INDOOR RADON AND ITS DECAY PRODUCTS} 10 (1986).
  \item \textsuperscript{94} HOPKE, \textit{supra} note 4, at 2.
  \item \textsuperscript{95} "One of the most important physical characteristics of soil pertinent to indoor radon is it's permeability i.e. how readily a fluid-in this case air-may flow through it." Nero 61. "Houses on soils with below average radium concentrations can have high indoor radon if the soil is highly permeable and the house extracts a large fraction of it's makeup air from the soil." HOPKE, \textit{supra} note 4, at 2. \textit{See also} SEXTRO, \textit{supra} note 93, at 10; LAFAVORE, \textit{supra} note 83, at 33.
  \item \textsuperscript{96} It has been determined that the structural characteristics of a home effect the rate that radon infiltrates the building. \textit{See} Cross & Murray, \textit{supra} note 26, at 693. "The actual pathway by which radon enters a building from the soil appears to vary substantially with building design and construction practice." \textit{Id.}
  \item \textsuperscript{97} HOPKE, \textit{supra} note 4, at 2. In most cases, the radon infiltrates from the soil into the building under the influence of a pressure differential caused by the structure itself.
\end{enumerate}
\end{footnotesize}
concentration have emerged,\textsuperscript{98} it is not uncommon for one house to have injurious levels, and an adjacent property to have a negligible level.\textsuperscript{99}

Given the difficulty in accurately assessing the risk of a potential radon problem,\textsuperscript{100} both the EPA and the surgeon general recommend that every home below the third floor be tested for the presence of the gas.\textsuperscript{101} The Agency has set an action level of 4pCi/L\textsuperscript{102} and recommends that remedial measures be taken to lower radon

\begin{footnotesize}
\textsuperscript{98} Although high radon concentration areas have emerged geographically, contaminated homes in low potential areas have been found as well. \emph{Joint Hearing}, \textit{supra} note 54, at 51.

\textsuperscript{99} \emph{Id.} at 51-52. "Even if one house tests low, the neighboring home could have elevated levels." \emph{Id.} See also King, \textit{supra} note 1, at 117.

\textsuperscript{100} "Presently there is no reliable method for predicting where elevated levels of radon are present. Geological factors are an indication that a particular area may have radon problems, yet not every home in a certain area is affected to the same degree." \textit{MAINE COMMISSION ON RADON, REPORT TO RESOLVE, TO DIRECT A COMPREHENSIVE EXAMINATION OF THE HEALTH THREAT OF RADON AND ITS DERIVATIVES UPON MAINE.} Section II, Jan.15, 1988.

\textsuperscript{101} \emph{Joint Hearings}, \textit{supra} note 54, at 52; see also \textit{PHYSICIAN'S GUIDE}, \textit{supra} note 21, at 2; \textit{CITIZEN'S GUIDE} \textit{supra} note 17, at 3; \textit{CONSUMER'S GUIDE TO RADON REDUCTION}, \textit{supra} note 30, at Introduction.

\textsuperscript{102} Radon exposure at this level is not completely risk free, but insures a minimal risk of contracting lung cancer. Barnes, Senate Leaders Urge Caution on Setting Health-Based Radon Standard, 18 ENVT. REP (BNA) 1739 Nov. 13, 1987. The EPA \textit{Citizen's Guide} also admonished that the population should "keep in mind that radon levels below 4pCi/L still pose some risk." \textit{CITIZEN'S GUIDE}, \textit{supra} note 17, at 14. See also "The EPA's suggested guideline of 4piC/L is the equivalent to the risk of smoking eight cigarettes per day or having more the 200 x-rays per year." \textit{EPA COMPILING DATA ON EXTENT OF INDOOR RADON HAZARD, C7 EN.}, Aug. 17, (1987) 22.

It should also be noted that an individual's being exposed to 4pCi/L of radon is the equivalent of a whole-body radiation dose of roughly 800 mrem per year. For comparison purposes, see BRODANSKY, \textit{supra} notes 8 and 78 and accompanying text.
\end{footnotesize}
concentrations in excess of this safety level.\textsuperscript{103}

\section*{E. Mitigation}

Radon has been labeled "the health threat with a simple solution,"\textsuperscript{105} perhaps due to the fact that "virtually every structure contaminated with indoor radon is deemed to be remediable."\textsuperscript{106} As previously stated, the EPA recommends that all homes be mitigated if the confirmed radon contamination levels in the structure is 4pCi/L or higher.\textsuperscript{107} Numerous methods exist to remediate an indoor radon problem.\textsuperscript{108} However, as radon levels and sources of emission vary tremendously,\textsuperscript{109} each diagnosis must be addressed on a building-by-building basis.\textsuperscript{110}

Radon abatement can be approached from two vantage points,

\begin{itemize}
  \item The EPA estimates that one of every ten households in the country contains radon concentrations in excess of this action level. \textit{Joint Hearings}, \textit{supra} note 54, at 24 (testimony of Hon. Edward Markey before the Joint Committee).
  \item CONSUMER'S GUIDE TO RADON REDUCTION, \textit{supra} note 30, at Introduction; \textit{see also} CITIZEN'S GUIDE, \textit{supra} note 30, at Introduction; \textit{see also} PHYSICIAN'S GUIDE, \textit{supra} note 21, at 2 ("Fix your home if your radon level is 4pCi/L or higher."); PHYSICIAN'S GUIDE, \textit{supra} note 21, at 2 ("It is recommended that a confirmed radon level of 4pCi/L of air be reduced...").
  \item The EPA has named its PHYSICIAN'S GUIDE RADON: THE HEALTH THREAT WITH A SIMPLE SOLUTION, \textit{supra} note 21, perhaps due to the fact that associated health risks from radon exposure are preventible by limiting exposure through mitigation methods.
  \item See \textit{supra} note 1. \textit{See also} HOMEOWNERS GUIDE, \textit{supra} note 36 ("...there are ways to fix a radon problem. Even very high levels can be reduced to acceptable levels"). \textit{See also} D. Waltz, \textit{Ramiifications for Real Estate Transactions} 91 Dickison L. Rev. 1138 "There are several remedial measures which can alleviate or control the problem."
  \item \textit{See supra} note 102 and accompanying text.
  \item \textit{See supra} note 106.
  \item For a discussion of sources of radon emission, \textit{see supra} notes 26-45 and accompanying text.
  \item Moore, \textit{supra} note 9, at 41. \textit{See also} U.S. ENVTL. PROTECTION AGENCY, \textit{A REPORT TO CONGRESS ON INDOOR AIR POLLUTION AND RADON UNDER TITLE IV, SUPERFUND AMENDMENTS AND REAUTHORIZATION ACT OF 1986, 1987}. ("Mitigation schemes are very specific.")
\end{itemize}
the first of which is the prevention of radon entry into the indoor environment.\textsuperscript{111} The second, and perhaps less desirable method of radon mitigation is the removal of the gas once it has permeated the structure.\textsuperscript{112} Costs of radon mitigation range from $500 to $2,500, with the average being $1,200 for abatement performed by a contractor.\textsuperscript{113}

As ground emissions are responsible for the majority of indoor radon concentrations,\textsuperscript{114} sealing cracks\textsuperscript{115} and other openings\textsuperscript{116} in the foundation can be an essential aspect of a building radon mitigation program. However, the EPA does not endorse the usage of sealing alone as the singular\textsuperscript{117} means of radon abatement.\textsuperscript{118} The EPA has concluded that complete sealing of all radon entry routes is impractical,\textsuperscript{119} and may be impossible.\textsuperscript{120} Furthermore, studies have proven that sealing alone does not adequately lower radon levels

\begin{itemize}
\item \textsuperscript{111} PHYSICIAN'S GUIDE, supra note 21, at 11.
\item \textsuperscript{112} Id.; see also, Prussman, supra note 63, at 724 ("The prevailing radon reduction strategy...is to prevent radon's entry into a home, rather than trying to rid the structure of existing gas.")
\item \textsuperscript{113} CITIZEN'S GUIDE, supra note 17, at 9; PHYSICIAN'S GUIDE, supra note 21, at 2.
\item \textsuperscript{114} See supra note 45 and accompanying text.
\item \textsuperscript{115} Cracks to be sealed could include those in the buildings' floors, walls, or any part of the foundation.
\item \textsuperscript{116} Openings in the foundation could refer to earthen floors, untrapped floor drains, sump pumps, wells or french drains. HOMEOWNER'S GUIDE, supra note 36, at 2.
\item \textsuperscript{117} The EPA concludes that "...more than one mitigation method may have to be used to reduce radon to an acceptable level in a given house." Id. at 18. See also Cross & Murray, supra note 26, at 702 No. 105.
\item \textsuperscript{118} See U. S. ENVTL. PROTECTION AGENCY, HOME BUYERS AND SELLERS GUIDE TO RADON, 21. See also supra note 26, at 100 ("Sealing entry points has some significant limitations as a complete solution to the indoor radon problem").
\item \textsuperscript{119} HOMEOWNER'S GUIDE, supra note 36, at 12. (The EPA cites a number of hard to reach areas to seal, such as the tops of block walls and spaces between block walls and the exterior.)
\item \textsuperscript{120} Id. ("Settling foundations, seismic activity and expanding floor cracks continually open new entry routes and reopen old ones.")
\end{itemize}
significantly or consistently.\textsuperscript{121}

Soil gas suction\textsuperscript{122} is the most widely\textsuperscript{123} used preventative mode of radon abatement.\textsuperscript{124} Employment of this system\textsuperscript{125} prevents the gas from seeping into the structure from below the foundation\textsuperscript{126} of the building.\textsuperscript{127} In theory, soil gas suction reduces exterior air pressure to a level lower than that of the interior,\textsuperscript{128} thereby reversing the flow of the gas.\textsuperscript{129} The cost of contractor installation of this system, which is generally recommended,\textsuperscript{130} averages between $800 and $2,000.\textsuperscript{131} Soil gas suction systems can reduce elevated radon

\textsuperscript{121} HOME BUYERS AND SELLERS GUIDE TO RADON, supra note 118 at 21. \textit{See also} Bernard L. Cohen, A National Survey of {Rn} in U.S. Homes and Correlating Factors, 51 HEALTH PHYSICS 175, 179 (1986) ("sealing cracks is not particularly useful").

\textsuperscript{122} Soil gas suction is also referred to as "sub-slab depressurization" or "sub-slab suction." PHYSICIAN'S GUIDE, supra note 21, at 11.

\textsuperscript{123} This technique is the most common and usually the most reliable radon reduction method. CONSUMER'S GUIDE TO RADON REDUCTION, supra note 30, at 9; \textit{see also} L. Cole, ELEMENT OF RISK: THE POLITICS OF RADON 35 (1993).

\textit{But see}, Cole, \textit{id.} at 35-36 ("This technique would be inapplicable or prohibitively expensive in some circumstances - for instance, when cement blocks in a structure are the main cause of elevated radon, or when a home is built on a rock foundation that precludes easy manipulation below its lowest floor").

The long term-relationship of the systems has also been questioned. \textit{id.} at 36.

\textsuperscript{124} HOMEOWNER'S GUIDE, supra note 36, at 6.

\textsuperscript{125} For a complete discussion of this system of radon reductions, \textit{see} HOMEOWNER'S GUIDE, supra note 36, at 6-12.

\textsuperscript{126} These systems of abatement can be used in buildings with either basements or crawl spaces. CITIZEN'S GUIDE, supra note 17, at 9.

\textsuperscript{127} HOME BUYERS AND SELLERS GUIDE, supra note 119, at 21.

\textsuperscript{128} In soil gas suction, pipes are inserted through the floor slab, or below the concrete slab from the exterior of the building. The pipes are connected to a fan, which draw the radon from below thee house, acting as a vacuum cleaner. CONSUMERS' GUIDE TO RADON REDUCTION, supra note 30, at 9-10.

\textsuperscript{129} HOMEOWNER'S GUIDE, supra note 36, at 6.

\textsuperscript{130} The EPA cautions that installation of such a system is not a simple "do-it-yourself job, although homeowners with the necessary skills and equipment may be able to do it successfully..." HOMEOWNER'S GUIDE, supra note 36, at 8.

\textsuperscript{131} \textit{id.}
Indoor radon levels by 80-99%.  

Modes of radon mitigation which remove the gas after it has permeated the structure include Heat Recovery Ventilators (HRV) and Air Cleaners. HRV's replace internal air with fresh outdoor air. The system is designed to ensure a constant degree of ventilation in the building. HRV's are installed directly in the substructure of the building, and can be designed to ventilate the structure in whole or in part. Radon reductions range from 50-75%, depending upon the capacity of the unit. The EPA cautions, however, that if an HRV is the only radon mitigation remedy being used, it should only be deployed in buildings with

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132 Id.
133 HRV's are also referred to as air-to-heat exchangers.
134 As previously noted, the EPA recommends mitigation methods which prevent the entry of radon from permeating the structure, as opposed to those which attempt to remove the gas after it has reached the inside of the building. See supra note 113 and accompanying text.
135 This system is also effective in removing other indoor air pollutants. CONSUMER'S GUIDE TO RADON REDUCTION, supra note 30, at 12.

Other indoor air pollutants include Environmental Tobacco Smoke (ETS); Biological Air Pollutants, such as dust mites, molds, and animal dander; Volatile Organic Compounds (VOC)s, which are emitted in gaseous forms from things such as paint, upholstery and copy machines; and Carbon Monoxide. PHYSICIAN'S GUIDE, supra note 21, at 14.
136 Jackowitz, supra note 2, at 336 n.53.
137 HOMEOWNER'S GUIDE, supra note 36, at 19.
138 It should be stressed that there are significant operating costs with the heat recovery system. CONSUMER'S GUIDE, supra note 30, at 12. The average annual operating costs could range from 75-500 dollars for continuous operation. Id. at 18.
139 HOMEOWNER'S GUIDE, supra note 36 at 19; see also CITIZEN'S GUIDE, supra note 17, at 12.
140 But see CONSUMER'S GUIDE, supra note 30, at 16 (where it is predicted that the typical radon reduction for an HRV used for the entire house would be only 25-50%, and 75% if used solely for the basement).
141 HOMEOWNER'S GUIDE, supra note 36, at 19.
142 It should also be noted that an HRV may cause a significant increase in both heating and cooling costs. OFFICE OF AIR AND RADIATION, U.S. ENVTL. PROTECTION AGENCY, supra note 30, at 12.
radon contamination levels no greater than 10 pCi/L.\footnote{HOMEOWNER'S GUIDE, supra note 36, at 19.}

Air cleaners are machines designed to remove particles\footnote{"...radon decay products tend to cling to airborne particles..." Cross and Murray, supra note 26, at 701-02.} from the indoor air.\footnote{HOMEOWNER'S GUIDE, supra note 36, at 21.} Attempts have been made to market these devices as effective means of radon abatement.\footnote{Id.; see also Cross and Murray, supra note 26, at 701-02 (for a discussion of how some air cleaners may remove some radon daughters from the air).} However, the "EPA does not endorse the use of air cleaners as a method of reducing radon decay products in indoor air because this technology has not been demonstrated to be effective in reducing the health risks associated with radon."\footnote{HOMEOWNER'S GUIDE, supra note 36, at 21.} Furthermore, the EPA warns that "while air cleaners can reduce the total concentration of radon decay products, they can actually increase the concentration of unattached decay products, possibly increasing the health risk."\footnote{Id. (emphasis in original text); see also Cross and Murray, supra note 26, at 702 n.103.}

III. Federal Radon Legislation

A. Radon Gas and Indoor Air Quality Research Act

The first significant legislative response to the indoor radon dilemma came in 1986, with the enactment of the Radon Gas and Indoor Air Quality Research Act.\footnote{Radon Gas and Indoor Air Quality Research Act of 1986. Pub. L. No. 99-499, 100 Stat. 1758 (codified as 42 U.S.C. 7401(1988)).} The Research Act was passed as Title IV\footnote{Title IV of SARA was used to implement the radon program since it was determined that Radionuclide, such as radon, fell within the Act's definition of a hazardous substance. See Moore, supra note 9, at 44.} of the Superfund Amendments and Reauthorization Act (SARA).\footnote{Superfund Amendments and Reauthorization Act (SARA) Pub. L. No. 99-499, 100 Stat. 1613. This statute is the Federal Governments authority to}
purpose\textsuperscript{152} of the Act was to authorize further research regarding indoor radon pollution.\textsuperscript{153} The Research Act directed the EPA to coordinate and implement a radon research program, but did not authorize the Agency to promulgate any regulation regarding radon.\textsuperscript{154} In fact, the Act specifically prohibited the EPA from carrying out "any regulatory program or any activity other than research, development, related reporting, information disseminating and coordination activities specified in this title."\textsuperscript{155}

Specifically, the Research Act directed the EPA to conduct research which would both characterize and monitor sources of radon emissions as well as radon levels.\textsuperscript{156} The health ramifications associated with radon exposure were also to be determined.\textsuperscript{157} The EPA was also required to develop mitigation methods, and work with the Secretary of Housing and Urban development (HUD) to address the potential for radon contamination in new construction.\textsuperscript{158} Furthermore, the EPA was instructed to disseminate information on the conclusions of its research to the public.\textsuperscript{159}

Although many Commentators have applauded the Research Act, and it has been referred to as "noteworthy and encouraging,"\textsuperscript{160} the Act has also received some criticism. The Research Act has been

\begin{quote}

clean up hazardous waste sites. See Cross, supra note 34, at 82.

\textsuperscript{152} "Congress wanted to ensure that the EPA would continue to list radon as a high priority and would have clear legislative authority to implement the programs". 131 CONG. REC. S11,682 at S11,684-5 (daily ed. Sept. 18, 1985) (statement of Sen. Mitchell)

\textsuperscript{153} King, supra note 1, at 174.

\textsuperscript{154} Jackowitz, supra note 2, at 337.

\textsuperscript{155} 42 U.S.C. § 7401 (1955); see also Moore, supra note 9, at 44-45; King, supra note 1, at 174.

\textsuperscript{156} 42 U.S.C. § 7403(b) (1955).

\textsuperscript{157} Id.

\textsuperscript{158} The Act directed EPA to work with HUD to develop methods for "assessing the potential for radon contamination in new construction and design measures to avoid indoor air pollution" 42 U.S.C. § 7403(b).

\textsuperscript{159} 42 U.S.C. § 7403(b); see also Moore, supra note 9, at 45.

\textsuperscript{160} Moore, supra note 9, at 46. Moore also described the Act as being "an important step in recognizing the serious threat posed by radon gas..." Id. at 45.
\end{quote}
condemned for doing more to simply recognize the problem of indoor radon than to solve it.\textsuperscript{161} Another commentator took issue with the fact that the EPA was, in essence, given sole responsibility in coordinating United States radon policy.\textsuperscript{162} The commentator criticized the Research Act for its lack of reference to the Department of Energy (DOE), despite the fact that the DOE "had been engaged in radon research for years."\textsuperscript{163}

B. Indoor Radon Abatement Act

The Indoor Radon Abatement Act (IRAA)\textsuperscript{164} was enacted in 1988 as Subchapter III of the Toxic Substance Control Act (TSCA).\textsuperscript{165} The TSCA gives the EPA broad authority to regulate chemical substances\textsuperscript{166} which present an unreasonable risk of injury to human health or the environment.\textsuperscript{167} Recognizing the potential health risks associated with radon exposure,\textsuperscript{168} Congress declared its long-term goal with respect to indoor radon contamination in the IRAA by stating that "the air within buildings in the U.S. should be as free of radon as the ambient air outside of buildings."\textsuperscript{169}

Through the IRAA, Congress directed the Administrator of

\begin{footnotes}
\item[161] See CROSS, supra note 34.
\item[162] COLE, supra note 123, at 14 ("The act in effect designated the EPA administrator chief of radon policy in the United States"). Id.
\item[163] COLE, supra note 123, at 14. For a full discussion of DOE's role in radon research, see id. at 17-19.
\item[166] The TSCA defines a chemical substance as "an organic or inorganic substance of particular molecular identity" 15 U.S.C. § 2602 (2) (a).
\item[167] See generally TSCA, supra note 165.
\item[168] For a discussion of the potential health risks associated with radon exposure, see supra notes 46-75 and accompanying text.
\end{footnotes}
the EPA to update and disseminate to the public its publication known as *A Citizen's Guide To Radon*. The IRAA dictates that the *Guide* should include the EPA action level, associated health risks from radon exposure, and the costs and feasibility of radon mitigation. The EPA was also explicitly mandated to develop and implement public-awareness activities designed to assist State radon programs. The IRAA also provides for State grant assistance in an attempt to aid States in the development and implementation of radon assessment and mitigation programs.

In response to Congress' directive, the EPA promulgated the State Indoor Radon Grants Program (SIRG). The program was created as a three-year Federal matching grant to assist the states with the costs for development of radon assessment. However, the authorization for the IRRA expired in 1991. The 102nd Congress

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170 A copy of *CITIZEN'S GUIDE*, supra note 17, can be obtained through the U.S. Government Printing Office, Superintendent of Documents, Mail Stop: Stop, Washington, D.C. 20402-9328.


172 Congress feared that the public may have misunderstood EPA's action level as being a safe level of radon exposure. *See* King, supra note 1, at 145, n.191; Nicholas, Note, *Construction Contracts Confront the Indoor Radon Hazard: Homeowner's Private Causes of Action and a Federal Response with the Indoor Radon Abatement Bill*. 37 WASH. U.J. URB. & CONTEMP. L. 135, 164 n. 173, n. 178.


174 The Act suggested that, inter alia, the EPA develop seminars, publications and radon measurement scales to assist the states.

175 *Id.*

176 The Act also directed the EPA to study radon levels in both schools and federal buildings. 15 U.S.C. §§ 2667-69.

177 *Id.*


180 *Id.* at 36, 857-58; *see also* Prussman, *supra* note 63, at 740-41 (for a discussion of the SIRG program).

181 *Joint Hearing*, supra note 54, at 44.
attempted to amend and reauthorize the Act, however, the House\textsuperscript{182} and Senate\textsuperscript{183} were unable to reconcile differences in the bills before the end of Congress.\textsuperscript{184} The House once again attempted to reauthorize the IRAA in 1993 through its proposal of H.R. 2448.\textsuperscript{185}

The IRAA received its share of criticism as well. This piece of legislation also ignored the DOE,\textsuperscript{186} "and solidified the role of the EPA as the principal locus of radon policy formulation."\textsuperscript{187} The Act was also criticized for its long-term national goal.\textsuperscript{188} One commentator referred to it as "the Act's most controversial provision,"\textsuperscript{189} and expressed doubts as to whether the goal was attainable with existing radon mitigation technology.\textsuperscript{190} The commentator went on to say that if indeed the goal was technologically possible, it would be astronomically expensive.\textsuperscript{192}

\textsuperscript{182} The House Bill was H.R. 3258. The bill passed the full House by voice vote on September 29, 1992. \textit{Id.} at 45.
\textsuperscript{183} The Senate Bill was S.792. On March 10, 1992, by an 82-6 vote, S. 792 passed the full Senate. \textit{Id.}
\textsuperscript{184} \textit{Id.}
\textsuperscript{186} See supra notes 162-63 and accompanying text.
\textsuperscript{187} COLE, \textit{supra} note 123, at 14.
\textsuperscript{188} \textit{Id.}
\textsuperscript{189} \textit{Id.}
\textsuperscript{190} This commentator may be overlooking the fact that the national long-term goal of Congress was a long-term goal and nowhere in the IRAA does Congress assert that said goal was a present goal, \textit{nor did Congress imply that this goal was technically possible at present. Furthermore, the EPA explicitly states that this long-term goal is not yet technologically achievable in all cases} (emphasis added). \textit{See CITIZEN'S GUIDE, supra note 17, at 7.}
\textsuperscript{191} "Several Scientists doubted that the goal was technically possible to achieve". COLE, \textit{supra} note 124, at 2; see also Phillip H. Abelson, \textit{Uncertainties About Health Effects of Radon}, 250 SCI. 353 (1990). The EPA itself admits that this goal may be presently unachievable, yet stresses that most homes can be mitigated to radon levels of 2pCi/L or lower. \textit{See CITIZEN'S GUIDE, supra note 17, at 7.}
\textsuperscript{192} Philip H. Abelson asserted that to reach the long-term national goal, the cost to homeowners would be an average of $10,000. \textit{See} Abelson, \textit{supra} note 191, at
IV. Protecting the Public from Radon Utilizing Existing Regulatory Framework

A. Clean Air Act

The Clean Air Act (CAA)\(^{193}\) is the statute that is most often considered for combating air pollution,\(^{194}\) and a discussion of regulating indoor radon would not be complete without its inclusion.\(^{195}\) The CAA utilizes a detailed system for regulating air pollution,\(^{196}\) but generally its application has been limited to outdoor air pollution.\(^{197}\) In fact, the EPA has never directly\(^{198}\) attempted to regulate indoor air quality\(^{199}\) under the auspices of the Clean Air Act.\(^{200}\) It has been suggested by some commentators, that absent explicit language to the contrary,\(^{201}\) the Agency may lack authority to utilize this regulatory framework to regulate indoor pollutants such as radon.\(^{202}\)

353. *But see* CITIZEN'S GUIDE, *supra* note 17, at 9 (wherein it is stated that "the average home costs about $1,200 for a contractor to fix").


\(^{195}\) In his discussion of regulating indoor air pollutants, including radon, one Commentator discussed the CAA in 1982, two years before the Watras incident. See Kirsch, *supra* note 10.


\(^{197}\) Indoor air pollution is now thought to be more serious than outdoor air pollution, according to scientists. Kelly, *supra* note 194, at 311.

\(^{198}\) *See infra* notes 213-18 and accompanying text.

\(^{199}\) *See supra* note 135 for a list of other indoor air pollutants.

\(^{200}\) Moore, *supra* note 9, at 42; Kelly, *supra* note 194, at 311.

\(^{201}\) "The EPA has never attempted to regulate indoor air quality under the auspices of the CAA and no statute currently grants unambiguous authority to do so." Kelly, *supra* note 194, at 311.

\(^{202}\) *See* Kelly, *supra* note 194, at 311 n.126 (quoting Myra Cypser, president-elect of the National Federation of Federal Employees Local 2050, *Union of EPA*
The Act gives the EPA authority to regulate any air pollutant.\textsuperscript{203} The CAA defines air pollutants as "any pollution agent which is emitted into, or otherwise enters the ambient air."\textsuperscript{204} However, the CAA fails to define ambient air.\textsuperscript{205} Furthermore, the judiciary has never addressed the issue, as a challenge has never been presented.\textsuperscript{206}

Under the authority vested in it through the CAA, The EPA has established National Ambient Air Quality Standards (NAAQS).

NAASQS\textsuperscript{207} "specify maximum permissible concentrations in the air for certain 'criteria pollutants'."\textsuperscript{209} The Agency has set NAASQS for sulfur oxide, carbon monoxide, ozone, nitrogen dioxide and lead.\textsuperscript{210} Radon has not been deemed a criteria pollutant,\textsuperscript{211} and thus the EPA lacks the authority to set a NAAQS for it. Furthermore, even if the EPA named radon as a criteria pollutant, regulating radon concentrations accumulated in buildings would be inconsistent with the NAAQS definition of ambient air.\textsuperscript{212}

The EPA has indirectly regulated indoor air pollution under the CAA through section 112.\textsuperscript{213} This section authorizes the Agency to set National Emission Standards for Hazardous Air Pollutants Employees Asks Hill to Improve Timetables for Compliance, GOV'T EMPLOYEE REL. REP. (BNA) July 29, 1991, at 935).\textsuperscript{214}
The Act allows the EPA to promulgate NESHAPS for pollutants which "may reasonably be anticipated to result in an increase in mortality or an increase in serious irreversible, or incapacitating reversible, illness." The EPA banned the spraying of asbestos insulation containing more than one percent asbestos inside buildings under the auspices of "minimizing asbestos emissions into the atmosphere.

The use of the CAA as a framework for radon's regulation is made difficult by the natural occurrence of radon, and its essential harmlessness prior to indoor accumulation. The Act generally regulates pollutants by implementing emission standards, and it would be difficult to enforce an emission standard for radon as "no one is responsible for its release." The general language of the Act has been stretched to develop radon research and technical assistance, but not to directly regulate indoor radon concentrations.

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215 42 U.S.C. § 7412(a) (1).
216 Note that it was the manufacturing industry that was regulated through the CAA.
218 36 Fed. Reg. 23,239 (E.P.A 19*). This argument, however, would be extremely ineffective with regard to regulating radon, as the gas is virtually harmless outdoors, as it dissipates into the atmosphere. See supra note 25 and accompanying text.
219 But see Steven A. Loewy, et. al., Pollution In Commercial Buildings: Legal Requirements and Emerging Trends, 11 TEMPLE J. ENVTL. L. & TECH. 239, 244 (1992) (stating that "the CAA could potentially be used to regulate indoor radon levels").
220 Moore, supra note 9, at 43.
221 It has been suggested by some Commentators that at the inception of the CAA, Congress was unaware of the problem of indoor air pollution, and thus could not purposefully intended to prohibit regulation of indoor air pollution under the auspices of the CAA. See Kelly supra note 193 at 311-12; Moore supra note 9 at 42.
B. Consumer Product Safety Act

Some commentators have suggested that the Consumer Product Safety Act (CPSA)\(^{223}\) could be used to regulate indoor radon pollution.\(^{224}\) The Consumer Product Safety Act was enacted by Congress to regulate consumer products via the Consumer Product Safety Commission (CPSC or Commission).\(^{225}\) A consumer product has been defined by the Act to mean "any article, or component thereof, produced or distributed (i) for sale to a consumer for use in or around a permanent or temporary household or residence, a school, in recreation, or otherwise, or (ii) for the personal use, consumption or enjoyment of a consumer." Arguably, radon-emitting bricks and building materials\(^{226}\) are consumer products.\(^{227}\)

Authority is given the CPSC via the Act to promulgate safety standards for products that may be unsafe, if the standard is "reasonably necessary to prevent an unreasonable risk of injury"\(^{228}\) associated with such product.\(^{229}\) The Commission may also ban a product to protect the public from unreasonable risk of injury if there exists no other "feasible consumer product safety standard (that)ouve.

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\(^{224}\) See Lowey, supra note 219, at 244. _But see_, Moore _supra_ note 9, at 44 ("While this Act may be an answer to controlling other types of indoor pollution, the natural cause of radon once again prevents its regulation").

\(^{225}\) Kelly, _supra_ note 193, at 313; Lowey, _supra_ note 219, at 244.


\(^{227}\) See Kelly, _supra_ note 193, at 313 n.138 ("arguably, building products are all consumer products which could be regulated by the Act").

\(^{228}\) Moore, _supra_ note 9, at 44 (arguing that the CPSA could not be used to regulate indoor radon, as "houses are not 'consumer products' under the Act.")

_See also_ Kelly, _supra_ note 193, at 313-14 (advocating the use of the CPSA to regulate indoor air pollution, but states a drawback of using the Act as the fact that the "Act only covers consumer products"). Kelly further stated that "Houses are not consumer products under the Act." _Id._ at 314.

\(^{229}\) The Act defines risk of injury as "a risk of death, personal injury, or serious or frequent illness." 15 U.S.C. § 2052(a)(3).

would adequately protect the public from unreasonable risk of injury associated with such product.\textsuperscript{231} For example, to protect the public from the health-related dangers associated with asbestos, the CPSA has been used to ban patching compounds, artificial fireplace logs, and garments containing asbestos.\textsuperscript{232}

Radon-emitting products\textsuperscript{233} could be regulated through the CPSA. The Commission could set a mandatory Radon Emission Standard which could regulate how much radon a given product could release.\textsuperscript{234}

Those products dispersing radon in excess of this standard could be banned under section 2057 of the CPSA.\textsuperscript{235} Manufacturers of products known to contain radon-producing elements would thus be required to find safer substitute ingredients to reduce radon by-products.\textsuperscript{236}

As products\textsuperscript{237} releasing radon gas are only a small contributing factor to the indoor radon problem,\textsuperscript{238} the CPSA is not a comprehensive solution.\textsuperscript{239} However, any reduction in indoor radon

\begin{itemize}
    \item \textsuperscript{231} 15 U.S.C. § 2057.
    \item \textsuperscript{232} See Kelly, supra note 194, at 313 n.143.
    \item \textsuperscript{233} Products releasing radon include things such as brick, concrete and alum shale.
    \item \textsuperscript{234} See Kelly, supra note 194, at 313.
    \item \textsuperscript{235} 15 U.S.C. § 2057 (1994). See, e.g., RADON NEWS DIGEST Vol. 6 No. 2, at 5 (1992) ("Orange dye #19 in lipstick was banned because it had a 1 in 19 chance of causing cancer, but 3 in every 100 people exposed to 4 pCi/L of radon gas will die from lung cancer").
    \item \textsuperscript{236} It has been suggested that manufacturers could seal bricks made with radon emitting materials.
    \item \textsuperscript{237} One commentator argued that aside from bricks, "there is no other product worth regulating to reduce the amount of radon in a dwelling." Moore, supra note 9, at 44.
    \item \textsuperscript{238} See supra notes 42-45 for a discussion of building materials as a source of radon emissions.
    \item \textsuperscript{239} "Since the CPSC is inherently limited to consumer products, it can not be used as a comprehensive regulatory approach to indoor air pollution". Kelly, supra
contamination is a step in the right direction, and when used in conjunction with other means of regulation, could be effective in the effort to control the radon problem in the United States.

C. Building Codes

The primary purpose of a building code\textsuperscript{240} is to regulate the design, mode of construction, and choice of building materials\textsuperscript{241} in new construction or renovations of existing construction. Through the exercise of their police power,\textsuperscript{242} local governments\textsuperscript{243} promulgate building codes to protect the health, welfare and safety of its citizens.\textsuperscript{244} Although there are well over five-thousand existing building codes in America,\textsuperscript{245} most of them are based on a national or regional existing model code.\textsuperscript{246}

Building Codes could be utilized as a means of regulating

\textsuperscript{240} Building codes, as used in this article, include any codified body of law used by government to regulate construction and alteration of buildings.

\textsuperscript{241} "The building code standards for new construction will include structure, material and equipment requirements, everything from the distance between studding to the types of pipe permissible for the transmission of water or sewage". WILLIAM D. VALENTE & DAVID J. MCCARTHY, LOCAL GOVERNMENT LAW 503 (1991).


\textsuperscript{243} Local governments are those entities "subsidiary and largely subordinate to the state" Id. at 1.

\textsuperscript{244} The police power has been designed as "the exercise of governmental power to limit, regulate or prohibit property uses with out government compensation in order to protect the public health, safety, morality and general welfare" McCarthy, supra note 241, at 126.

\textsuperscript{245} Valentine & Mccarthy, supra note 241, at 193.

\textsuperscript{246} These model codes are generally revised annually. Sampson & Charo, supra note 242, at 419.

Examples of these codes include the Basic Building Code, the Uniform Building Code, and the Southern Standard Building Code.
radon emissions in new construction and renovation of existing construction. Congress has created the National Institute of Building Sciences (NIBS),\(^{247}\) which was formed "to make findings and to advise both the public and private sectors of the economy with respect to the uses of building science and technology in achieving nationally accepted standards."\(^{248}\) The EPA could work in conjunction with NIBS to create a Model Building Code which could reduce radon concentrations in buildings.\(^{249}\) The Code could address issues such as ventilation\(^{250}\) and radon-resistant design standards.\(^{251}\)

As building codes address choice of building materials, the Model Code could mandate that radon-emitting construction materials, such as those containing uranium, either be specially treated to prevent the escape of the gas,\(^{252}\) or be altogether banned from usage in new construction.\(^{253}\) The Code could also require that thick plastic barrier sheets be laid upon the bedrock before pouring cement foundation or slab to minimize radon seepage from the ground into the building.\(^{254}\)

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\(^{249}\) "It is generally less expensive to build radon resistant features into new houses than it is to mitigate existing houses." U.S. ENVTL. PROTECTION AGENCY, PUB. NO. 1600/9-90/048, RADON MITIGATION UPDATE, 3 (1990).

\(^{250}\) When the American Society of Heating, Refrigerating and Airconditioning Engineers developed a new ventilation standard based on indoor air quality considerations, it was criticized for requiring "unnecessarily high" ventilation rates. G. THOMPSON, BUILDING TO SAVE ENERGY: LEGAL AND REGULATORY APPROACHES 143-147 (1980).

\(^{251}\) It has been suggested that, assuming 100% implementation of radon-resistant building codes, 30-50 radon lung cancer deaths would be averted during the first year. RADON NEWS DIGEST, Summer 1992, supra note 235, at 17.

\(^{252}\) See supra note 233 and accompanying text.

\(^{253}\) The Swedish government banned a popular building material known as Alum Shale, as it was known to emit radon gas. See Barnaby, Very High Radiation Levels Found in Swedish Homes, 281 NATURE 6 (1979); See also HILDINSON, MEASUREMENT OF RADON DAUGHTERS IN 5600 SWEDISH HOMES (1981).

\(^{254}\) Bricks and concretes could be treated with epoxy resins or other materials to reduce radon from escaping. Kirsch, supra note 10, at 339.
The EPA's requirements regarding action could be codified as a national standard rather than a remediation recommendation, and be incorporated into the code as mandatory.\textsuperscript{255} After completion of construction, the Model Code could require the performance of a radon test to be performed by an EPA or State licensed radon engineer.\textsuperscript{256} Should the test indicate the presence of radon above the national standard, mitigation would be required until the levels fell within an acceptable range.\textsuperscript{257}

Previously, the U.S. Congress has become involved in the Building Code regulatory system. For example, through promulgation of legislation such as its enactment of the Mobile Home Building Code,\textsuperscript{258} which pre-empted existing local codes.\textsuperscript{259} The Federal government has also recommended building standards.\textsuperscript{260} For example, Congress provided financial assistance to states who instituted mandatory thermal efficiency standards and installation requirements.\textsuperscript{261}

Congress could encourage states to adopt the Model Code by offering incentives such as funding for further radon research, or providing education and outreach programs for localities who choose to adopt the model code into their local building codes. They may also have the power to mandate state adaptation of the model code

\textsuperscript{255} It should be noted that the States would not be prohibited from adopting a lower radon standard, as States are not preempted from imposing stricter standard. Comprehensive Environmental Response, Compensation and Liability Act of 1980, 40 U.S.C §9614(a) (1982). \textit{See supra} note 102 for reasons why the States may wish to impose stricter radon action levels.

\textsuperscript{256} The EPA maintains a Radon Measurement Proficiency Program through which it qualifies commercial radon testing firms. \textit{See Proficient Radon Measuring Organizations Have Doubled in Number Since 1986, EPA Says.} 17 ENVTL. REP.. (BNA) 1725 (1987).

\textsuperscript{257} \textit{See supra} notes 105-149 for radon abatement methods.


\textsuperscript{259} Sampson, \textit{supra} note 242 at 12-13.

\textsuperscript{260} \textit{Id.}

\textsuperscript{261} \textit{Id.}
through the Commerce Clause.\textsuperscript{262}

Some commentators have suggested that disadvantages exist in utilizing building codes to regulate radon.\textsuperscript{263} As they generally are not retroactive, building codes generally apply only to new construction.\textsuperscript{264} Furthermore, the housing industry has been criticized as being over-regulated.\textsuperscript{265} However, the development of a model code including radon-reducing technology is critical to protect the public's health and general welfare from the negative health ramifications of radon exposure.

D. Certificate of Radon Compliance

As most radon testing and abatement occurs during real estate transactions,\textsuperscript{266} an attempt to regulate radon through this industry seems logical.\textsuperscript{267} State governments could enact legislation which

\textsuperscript{262} U.S. CONST. art. I, § 8, cl. 3. (empowers Congress to "regulate commerce with foreign nations and among the several states..."). The Supreme Court has allowed Congress to use this clause to regulate any activity that has a "substantial economic effect upon" interstate commerce. Wickard vs. Filburn, 317 U.S. § 111 (1942).

\textsuperscript{263} See Locke, supra note 12, at 10479 ("Radon-resistant construction techniques may prevent radon pollution in new homes, but innovative legal strategies must be designed to address radon in existing homes"). See also Kelly, supra note 194, at 310 ("Building codes apply only to new buildings").

\textsuperscript{264} Building codes may also, however, apply to renovation of existing construction.

\textsuperscript{265} It has been argued that the regulation of construction's negative effect in innovation does not outweigh the benefits of its usefulness of assuring safe and sound construction. OFFICE OF POLICY PLANNING, FEDERAL TRADE COMMISSION, BUILDING REGULATORY PRACTICES AND THE COURTS Sept. 1980 (Prepared for the No. DS 400B). See also id. at 20-23 for a discussion of building regulation's negative effect of innovative construction practices.

Building codes have also been criticized for expanding liability due to the "proliferation of detailed building and housing codes." SWEET, LEGAL ASPECT OF ARCHITECTURE ENGINEERING AND THE CONSTRUCTION PROCESS 327 (1985).

\textsuperscript{266} RADON NEWS DIGEST, supra note 235, at 16.

\textsuperscript{267} One commentator has suggested that radon be regulated through the home mortgage market by requiring that radon information be disseminated to the
would require mandatory radon testing,\textsuperscript{268} and radon abatement\textsuperscript{269} when necessary, with every transfer of residential or commercial real estate.\textsuperscript{270}

This legislation could incorporate the EPA action level\textsuperscript{271} as the level at which mitigation would be necessary. The grantor\textsuperscript{272} could be required to have the building tested for radon by either an EPA or State licensed radon engineer.\textsuperscript{273} The engineer would have the authority to issue a Certificate of Radon Compliance only if the building had indoor radon levels below the statutory mitigation level. It could be required that the Certificate be filed with the Deed of the premises, thus preventing the transfer until the Certificate was obtained.\textsuperscript{274}

The critical issue under this approach would be when the premises had radon levels in excess of the action level. Should this be the case, the parties to the transaction would be required to work

\begin{footnotesize}
\begin{itemize}
\item\textsuperscript{268} It is estimated that 15-20\% of all homes sold are tested for radon. \textit{RADON NEWS DIGEST}, \textit{supra} note 235, at 17.
\item\textsuperscript{269} Of the 15-20 \% tested, 25-30\% of homes with levels in excess of 4piC/L are mitigated. \textit{Id.}
\item\textsuperscript{270} The EPA recommends that if you are selling a home that it is tested before being placed on the market. \textit{HOME BUYERS AND SELLERS GUIDE}, \textit{supra} note 118, at 1. The Agency also recommends that radon levels of a home are obtained before purchasing it. \textit{Id.} at 2.
\item\textsuperscript{271} See \textit{supra} notes 102-104.
\item\textsuperscript{272} The grantee would also have a vested interest in some control over the testing process, as she or he would be detrimentally relying upon the results of the test.
\item\textsuperscript{273} The EPA maintains a Radon Measurement Proficiency Program through which it qualifies commercial radon testing firms. \textit{See Proficient Radon Measuring Organizations Have Doubled in Number Since 1986, EPA says.} 17 ENVTL. REP. (BNA) 1725 (1987).
\item\textsuperscript{274} This regulatory approach is akin to the requirement in some jurisdictions that an operable smoke alarm be installed in the premises with real property transfers. \textit{See, e.g.,} N.Y. EXEC. LAW §378(5) (Consol. Supp. 1994).
\end{itemize}
\end{footnotesize}
together to arrive at a mutually agreeable mitigation plan.\textsuperscript{275} After the structure was remediated, the building would need to be retested, and certified only after the radon levels were below the action level.

Two disadvantages may exist with utilization of this regulatory approach. First the public may perceive the statutory action level as safe. However, exposure to radon at any level may not be completely risk free,\textsuperscript{276} but for purposes of regulation, it is necessary to impose a mandatory action level.

The second danger that may exist with the implementation of this approach is the possibility of test tampering.\textsuperscript{277} To be effective, radon tests need to be performed under closed-house conditions.\textsuperscript{278} Otherwise, the grantor may attempt to alter the testing conditions or results. Furthermore, the parties to the transaction may attempt to conspire to obtain the Certificate of Radon Compliance fraudulently, should they not take the radon threat seriously.\textsuperscript{279}

However, attempting to incorporate radon testing and mitigation as an integral part of the real estate transaction could be quite successful.\textsuperscript{280} One commentator has suggested that homebuyers

\textsuperscript{275} See supra notes 105-149 and accompanying text for a discussion of means of radon mitigation.

\textsuperscript{276} A conservative approach to radiation exposure is held by many scientists who believe that "any amount of radiation should be considered harmful." COLE, supra note 123, at 26.

\textsuperscript{277} The EPA also warns that "there is a potential conflict of interest if you use the same company to conduct both the test and the radon reduction of the home" HOME BUYERS AND SELLERS GUIDE, supra note 118, at 24.

\textsuperscript{278} The importance of the testing conditions is stressed by the EPA. It is recommended that during short-term tests, doors and windows are kept closed "at least 12 hours before beginning the test" and as much as possible during the test. CITIZEN'S GUIDE, supra note 17, at 5.

\textsuperscript{279} Despite prompting by the EPA, the majority of Americans have ignored the government's recommendation to test for radon, and remEDIATE their homes when necessary. COLE, supra note 123, at 3. See also Locke, supra note 10, at 10477 ("Several studies of radon risk perception have examined homeowners lack of concern regarding radon").

\textsuperscript{280} "One alternative that leads to more mitigation is the intervention at the time of house sale." Locke, supra note 12, at 10478.
are a subpopulation which recognizes and is influenced by the hazards of radon. This Commentator also calls for other policy alternatives to be developed to encourage homeowners to remedy radon pollution.

Requiring the Certificate of Radon Compliance would serve other socially valuable goals as well. It would not only protect the lives of those individuals involved in the transfer, but it is likely that other members of the real estate community would be prompted to test as well. Furthermore, enactment of the requirement of Certificates of Radon Compliance will also invariably increase public awareness of the indoor radon problem.

E. The Insurance Industry

The Insurance industry could be used to protect the public from indoor radon pollution. The insurance industry in America is a voluntary private market wherein risk classification is an integral part of the system. Risk calculation is used to set policy rates relevant to a potential insured's risk assessment. Certain character traits have traditionally been relied upon by the industry to classify

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281 Locke, supra note 12, at 10479. See also RADON NEWS DIGEST, supra note 235, at 12 ("[i]t's no secret that the radon industry is driven by real estate transaction..."). Id.

282 Locke, supra note 12, at 10477 ("Studies suggest that mass media and information campaigns may not be successful in promoting appropriate self-protective behavior").

283 Other members of the real estate community could include real estate attorneys, their support staffs, mortgage bankers, real estate brokers and lastly, real estate agents.

284 Locke, supra note 12, at 10476. "Clearly more public awareness is needed to disseminate information about radon's health hazards and remediation." Id.


286 Id. Underwriting is used to determine whether or not an applicant will be accepted for coverage, as well as what premium rates will be paid. Id.
common risks. These characteristics include age, gender, health, occupation and hobbies. Other factors such as alcohol and tobacco usage may also be evaluated prior to coverage.

Some commentators have suggested that "the value of any risk classification is increased by its ability to create preventive incentives on the part of the insured." For example, increasing premium rates for smokers may influence an individual to quit smoking. Obviously, the cessation of smoking by an insured lowers the expected loss to the insurance company; however, a larger social goal of protecting public health is also obtained.

Likewise, the insurance industry could be utilized to influence the public to test for, and mitigate indoor radon pollution. It was suggested by one Commentator that life expectancies, and consequently corresponding profits of a life insurance company would increase if the company would provide free radon tests to its insured. Although the tenor of the article was economic gain, the result of this proposal would be increased public awareness of the radon problem, increased testing of homes, and lastly, and most

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288 Advanced age may indicate an increased likelihood of morbidity or mortality. Id. at 716.
289 Studies have indicated that females have longer life-expectancies, and that they may incur substantial medical costs with regard to pregnancy. Id. at 716-717.
290 Id. at 717.
291 Id. at 716 n.47; See also Lee, supra note 285, at 202.
292 Id. at 203; See also Kenneth Abraham, Distributing Risk: Insurance, Theory and Public Policy 71 (1986).
293 Lee, supra note 285, at 203.
294 Id.
295 Bernard L. Cohen, Benefits to a Life Insurance Company From Providing Radon Test For Clients, 65 Health Physics 295 (1993). That author was assuming that about one of 18 homes tested would remediate. Id.
importantly, increased radon mitigation.\textsuperscript{296}

Health insurance companies could also dispense radon tests to applicants, and provide lower premium rates to the insured who have tested their homes, and remediated when necessary.\textsuperscript{297} Insurance companies issuing Homeowners and Renters insurance could also provide lower premium rates for homes that are below a statutory action level,\textsuperscript{298} either initially or after mitigation.\textsuperscript{299}

F. The Federal Tax Code

The Federal Tax code could also be used as a means of encouraging the testing and mitigation of radon. In the past, Congress has used the Federal Tax Code to persuade taxpayers to engage in certain conduct by creating tax incentives.\textsuperscript{300} Tax incentives

\textsuperscript{296} It was also suggested by the commentator that the program could be treated as a survey as well. \textit{Id.} at 297.

\textsuperscript{297} The EPA has estimated that if all homes were tested and mitigated if found to be above the action level, the cost per life saved would be in the area of $700,000. RADON AWARENESS AND DISCLOSURE ACT OF 1994, H.R. REP. NO. 574, 103d Cong., 2d Sess. 15 (1994) (Report together with additional and dissenting views to accompany H.R. 2448.).

\textsuperscript{298} Hoffman, \textit{supra} note 287, at 718. The McCarran-Ferguson Act of 1945, 15 U.S.C. 1011 (1945) provides that regulation of the insurance industry is a states function, except where specifically pre-empted by Federal Law. Perhaps the Federal government could adopt EPA's action level as a national standard, which the States could incorporate into their respective insurance laws.

\textsuperscript{299} These discounted premiums could be similar to those given to homeowners or apartment dwellers for maintaining smoke alarm devices or fire extinguisher on the premises.

For example, the New York Legislature allowed a reduction in the rates of fire insurance premiums where the property was equipped with "smoke detecting alarm devices, approved sprinkler systems or fire extinguisher, should a statistically valid study of insurer experience indicate an actuarially significant decrease in losses in the aforementioned circumstances." N.Y. INS. LAW §2346 (Consol. Supp. 1994).

\textsuperscript{300} The term tax incentive has been defined as meaning any potential government action to stimulate, promote, encourage or accelerate an Action. THE INTERNAL REVENUE ACT AS A VEHICLE TO FOSTER SOLAR COMMERCIALIZATION:
generally include tax deductions, Tax credits, and accelerated depreciation allowances.

For example, Congress passed the Revenue Act of 1962 (Act) in an effort to stimulate the nation's economy by fostering investment in business equipment. The Act created an investment tax credit (ITC) pursuant to section 38 of the Tax Code. Congress also created a tax credit for both homeowners and business owners who installed solar heating and air conditioning systems under The Energy Tax Act of 1978.

To encourage building owners to test their premises for the presence of indoor radon, Congress could create a Radon Tax Act. This Act could allow a tax deduction for any taxpayer who performs a radon test in their home or business. Furthermore, Congress could create a tax credit allowable for any taxpayer who

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302 A tax credit is taken against a taxpayer's liability on a dollar-for-dollar basis, regardless of the taxpayer's marginal tax rate. 9 Stand. Fed. Tax Rep. (CCH) ¶28, 466.025 (1994).

303 Accelerated depreciation allowances are deductions from a homeowner's or a business' taxable income which reduce income tax liability in the current year and over the life of the property. ENERGY TAX ACT, supra note 300, at 18.


305 8 MERTONS, LAW OF FEDERAL INCOME TAXATION §32A.02 (Lisa Fagen et al. eds. 1994).

306 26 U.S.C. §23 (1988 & Supp. 1994) (repealed 1990); "Congress recognized that the high initial cost of solar heating and air conditioning systems was the most serious impediment to their widespread use". ENERGY TAX ACT, supra note 300, at 25.

307 ENERGY TAX ACT, supra note 300, at 18.

308 Hyatt, supra note 301, at 303.
installs an EPA approved mitigation system after the discovery of the presence of radon. This tax credit should be allowed for single or multiple family home owners as well as private or public business owners. These tax incentives would help defray the cost of both radon testing and mitigation. Further, public awareness of the problem of indoor radon pollution would increase through promulgation of a Radon Gas Tax Act.

V. Conclusion

Although the Federal Government has made attempts to protect the public from the serious health threat of radon, it has only begun to chip away at the iceberg. Current governmental regulations rely on voluntary compliance with recommended guidelines. Existing legislation and common law mechanisms are inadequate methods of dealing with the radon problem. It is imperative that Congress promulgate legislation to direct and fund agencies to protect the public from the hazards of radon contamination. More rigorous means of dealing with this serious issue are needed to ensure public health and safety.

Continued radon research and outreach programs under existing legislation is mandatory. However, other means of controlling radon exposure, such as those suggested in this article are needed. Regulating consumer products containing uranium through the CPSA could protect the public from those products emitting radon gas. The EPA could work in conjunction with other agencies to create building codes which would reduce radon concentrations in new construction. Certificates of Radon Compliance could be required in all property transfers. Lastly, the insurance industry as well as the Federal Tax Code could be used both to educate the public, as well as to encourage radon testing and remediation.

309 For a discussion of radon abatement methods, see supra notes 105-149 and accompanying text.
310 Locke, supra note 12, at 10476.