

U.S. STATE RADON PROGRAMS
DATA COLLECTION & PROGRAM ACTIVITIES

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Abstract

The U.S. radon program has had some strong successes when compared to other national programs. The U.S. radon program is based upon federal as well as state efforts and there are a number of strengths and limitations in the state programs. In order to move forward, a public health assessment that summarizes and analyzes both activities and limits of state indoor radon programs would be invaluable. However, to date, no such appraisal has been published. This study reports the results of a cross-sectional survey delivered to state radon program representatives that assesses residential radon data collection, management, and dissemination efforts. Recommendations for future direction of state radon programs are discussed.

Keywords: state radon programs, residential radon testing, radon mitigation, data collection, data management, risk communication and radon policy

Introduction

The U.S. Environmental Protection Agency (EPA) and the U.S. Surgeon General acknowledge radon as the second leading cause of lung cancer overall and the number one cause of lung cancer among non-smokers. Residential radon is attributed to 21,000 (13.4%) annual lung cancer deaths in the United States, 2,900 of which are among non-smokers (ACS, 2009; EPA, 2003, 2012; Tracy, 2006).

In 1988, Congress passed the Indoor Radon Abatement Act (IRAA; PL 100-551) under Title III of the Toxic Substances Control Act (TSCA), which sets a national goal for, “indoor air to be as free from radon as the ambient air outside buildings (EPA, 2007).” To accomplish this goal, Congress directed the U.S. Environmental Protection Agency (EPA) to set up several baseline services including: (1) establishment of state radon programs; (2) technical assistance to individual states for developing radon surveys, training seminars, mitigation projects and public education materials including distribution of the *Citizen’s Guide to Radon*; (3) administration of a national radon study for public schools with mitigation if necessary; (4) creation of a proficiency program for radon testing and mitigation service providers; and (5) establishment of at least three radon centers at universities.

Despite progress over the past 24 years, there are more U.S. housing units with elevated radon than any time in history (Angell, 2008). Respondents to the National Association of Home Builders Research Foundation’s 2010 annual survey suggests 17% of all new single-family detached homes and 15% of multifamily living units and townhouses (excluding piers) included a radon-control system. The majority of both single-family detached homes (Zone 1= 40%, Zone 2= 17% and Zone 3= 2%) and multifamily dwellings (Zone 1= 19%, Zone 2= 16% and Zone 3= 2%) were located in high radon potential areas (NAHB, 2011). However, there is no independent verification of the efficacy of these systems.

Several studies on indoor radon data collection methodologies and study design, as well as government evaluations on EPA’s progress towards meeting the goals set forth by IRAA, have criticized the agency stating that they have failed to realize their full regulatory potential. Some of the major critiques include lack of quality control (accuracy and reliability) and oversight for radon measurement devices; limited participation in private national radon proficiency programs; ineffective public risk communication; and until recently, uncoordinated federal, regional, and state/tribal agencies and lack of standardized methods for collecting, managing, and reporting residential radon data (Beusse, 2009; Bishop, 2008; Chen and Moir, 2011; Groves-Kirkby, 2006; Miles, 2001; Steck, 1998, 1990, 1992, 2005; Steck, 1996; Steck, 2004; Vaupotic and Kobal, 2002; White, 1994).

These issues appears to stem from the decision to make the U.S. Radon Program voluntary in nature as a non-regulatory program impacts public and stakeholder perception of the health risks from radon (severity and urgency to address the issue), testing and mitigation behaviors, practices and policies, as well as sets a premise for state and local laws and funding for program activities including data collection and monitoring (Bishop, 2008).

In order to move forward a public health assessment that summarizes and analyzes both activities and limits of state indoor radon programs would be invaluable. However, to date no such appraisal has been published.

The main purpose of this study is to gain a better understanding of current levels of residential radon data collection, management, and reporting/dissemination among state radon programs in the United States. Recommendations for future direction of state radon programs are discussed.

Background

The robustness and sustainability of a national public health tracking or surveillance program can be seen in key program elements including the quality and quantity of research, laws, and funding.

Research

Angell (2008) noted that levels of peer-reviewed radon research presented at the U.S radon symposia declined significantly from 1991 to 1998 and has since been consistently low. There has been no published national or statewide residential radon concentration survey since the EPA's National and State Residential Radon Surveys of the late 1980s to early 1990s. Since 2000, a few studies published in the archival literature report recent residential radon data collection and management at the state and/or local level (Distenfeld, 2001; Farah, 2012; Joshi, 2002; Kitto, 2003; Kumar, 2003; Steck, 2005, 2006, 2008, 2009; Wilcox, 2008). Seven of the nine studies are in the context of epidemiologic, radon measurement, or spatial studies and not direct reporting of radon testing and mitigations done by state radon programs or health departments.

Radon Laws

According to the Environmental Law Institute and National Conference of State Legislatures at least three-quarters of states have adopted some type of radon law. However, passage of new radon legislation has waned since the early 1990s (ELI, 2012; NCSL, 1993). A few research and academic organizations including the Environmental Law Institute (ELI), the University of Kentucky and the National Conference of State Legislatures have created summary reports on state radon laws and regulations (ALA, 2009; ELI, 2012; Farquhar, 2008). The most recent is the 2012 ELI Database of State Indoor Air Quality Laws: Radon Laws Excerpt (see table 1).

The non-partisan research and education center found 30 states to have some form of radon disclosure law that pertain to real estate transactions of properties with 4 or less units. At least two of these states, Illinois and Iowa, have laws or administratively mandated strong radon notification requirements. Twenty states require some type of standards for radon service providers such as accreditation programs, National Environmental Health Association (NEHA)/National Radon Safety Board (NRSB) certification, and/or state certification. ELI reports only eight states require licensure of radon device and service providers: Illinois, Nebraska, New Jersey, Ohio, Rhode Island, Utah, Virginia and West Virginia. However, a number of the ELI reported certification states have administrative rules that require licensure of

certified individuals, such as: Florida, Iowa, Indiana, Kansas, Maine, Pennsylvania, and New Jersey.

Table 1. Summary of select ELI reported state radon laws

Type of Radon Law	Count	States
Real Estate Disclosure	30	AK, CA, CO, CT, DE, DC, IL, IN, IA, KY, ME, MD, MI, MS, MT, NE, NJ, NY, NC, OH, OK, OR, PA, RI, SC, SD, TN, TX, WA, WI
Radon Service Provider Standard (e.g. NEHA/NRSB proficiency exam, state health department certification)	20	CA, CT, DC, FL, IL, IN, IA, KS, KY, ME, MD, MT, NE, NJ, NY, OH, PA, RI, VA, WV
Mandatory Licensure of Radon Devices and/or Radon Service Providers	8	IL, NE, NJ, OH, RI, UT, VA, WV
Mandatory testing of K-12 schools (private and/or public)	9	CO, CT, FL, IL, NH, NY, RI, VA, WV
Mandatory testing of licensed daycare providers, group daycare homes, and 24-hour care facilities	8	CT, FL, ID, IA, MD, MI, NJ, RI
Mandatory testing of public buildings and ‘high-priority buildings’ (e.g. located in Zone 1, government buildings, licensed rental properties)	3	ME, NH, RI
Mandatory radon service provider reporting of test and mitigation results to the state radon program	7	FL, IL, IA, KS, NJ, NY, PA
Confidentiality of testing and mitigation data enforced by state law	3	IA, NJ, PA
Consumer education requirements	12	CA, IL, ME, MA, MT, NH, NJ, OH, OR, RI, WV, WI
*Radon resistant technology/RRNC requirement	24	Statewide: MD, MI, MN, NJ, OR, WA Local Jurisdictions: AL, CO, ID, IL, IA, KS, MT, NE, NM, NY, OH, OK, PA, SC, TN, WV, WI, WY
Sources: Environmental Law Institute, 2011; *EPA, 2011		

In terms of testing requirements, ELI found nine states that require private and/or public K-12 schools to test for radon (Colorado, Connecticut, Florida, Illinois, New Hampshire, New York, Rhode Island, Virginia and West Virginia) and eight states that require licensed daycare and/or group home providers to test (Connecticut, Florida, Idaho, Iowa, Maryland, Michigan, New Jersey and Rhode Island). Several of the states that require testing of schools and daycares have additional requirements to publically disclose test results and mitigate if levels are at or above the EPA action limit of 4.0 pCi/L. Two states (New Hampshire and Rhode Island) require radon testing in ‘high-priority’ public buildings and the state of Maine requires landlords to test and mitigate in accordance with the EPA action limit.

Seven states have laws requiring all certified service providers to report radon testing and mitigations to the state radon programs (Florida, Illinois, Iowa, Kansas, New Jersey, New York

and Pennsylvania). Confidentiality of data is enforced by law in Iowa, New Jersey, and Pennsylvania.

According to the most recent EPA data report (2011) on radon-resistant new construction (RRNC), the majority of states do not have statewide or local jurisdictions with radon control codes for new residential construction (twenty-five states and three districts/territories) (EPA, 2011). Six states have statewide or EPA Zone 1 RRNC codes that apply to designated jurisdictions and eighteen states have RRNC codes in local jurisdictions only (EPA, 2011) (see table 1).

Budget

Table 2. Annual funding for State Indoor Radon Grants (SIRG)

Fiscal Year	EPA Funding for SIRG
2000	\$8.2
2001	\$8.2
2002	\$8.2
2003	\$8.1
2004	\$8.2
2005	\$7.0
2006	\$7.4
2007	\$7.4
2008	\$7.9
2009	\$8.1
2010	\$8.1
2011	\$8.1
2012	\$8.1 (FY 2012 Enacted: \$4.1 M)
Source: Bishop, 2008	

The 1988 Indoor Radon Abatement Act allotted \$10M towards the development of state radon programs. Since 2000, the level of funding for state radon programs have been fairly consistent at \$8M with the exception of this year’s slash to \$4.1M (see table 2). According to the President’s proposed FY2013 Budget, the national radon program budget will be cut again in half (\$2.2M), and SIRG eliminated altogether (Whitehouse, 2012). Given widespread governmental budget cuts, the EPA has suggested removing SIRG stating, “[radon] exposure pathways and effects are understood and local and state capacity has been developed to implement

protections (EPA, 2012).” The agency will instead focus its limited resources towards implementation of the Federal Radon Action Plan, a multi-agency approach to leverage resources in order to meet the Healthy People 2020 goals (EPA, 2011).

Methodology

In March 2012, a 12-question survey was emailed with a request for information to all state radon programs using the contact information on the U.S. EPA radon website and/or state radon program websites. Follow-up with non-respondents occurred in July 2012. The questionnaire consisted of nine multiple-choice and fill-in questions and three open-response questions (see Appendix), which quantitatively assessed: (1) the number of radon programs collecting residential radon testing and mitigation data, (2) the source(s) of the data, (3) the type of data collected (e.g. testing and mitigation rates, radon concentration, other), and (4) any use of GIS mapping. The questionnaire also asked respondents about funding sources, staff, and state/local mandates and laws to provide a relative picture on current state radon program capacity to collect, analyze, and report data in addition to other program activities. Lastly, open-response

questions asked state radon program representatives from their perspectives what changes in data collection or program activities they would like see changed. Results were entered into MS Excel 2007 with double-entry validation and analyzed using the program.

Results

Four of the fifty states including Hawaii, Louisiana, Maryland, and New Hampshire, do not currently have a state radon program according to the EPA website or email contact. Of the 46 states and District of Columbia with known radon programs, 13 were unreachable or refused to take part in the survey. Therefore, information reported here is based on 33 state radon programs, yielding a response rate of 70%.

Residential radon testing

Table 3. Summary of state radon program residential testing data collection efforts

	Frequency (N= 33)	%
Residential radon levels collected	32	97
Source of testing data		
Analytical laboratory	30	94
Private contractor	12	38
Survey	2	6
Other	1	3
Testing device used		
All radon measurement devices	10	31
Alpha-track and charcoal devices	12	38
Charcoal device only	7	22
Alpha-track device only	3	9
Spatial level of testing data		
Full home address	20	63
County and Postal code	7	22
Postal code only	4	13
County only	1	3
None	0	0
Note: Variables in bold that do not add to 100% are multiple-choice responses.		

Virtually all of the responding states (94%) collected data from analytical laboratories and 38 percent also collected data from certified or licensed radon measurement providers. These data are reported to the states as a summary hardcopy report or electronic form through a partnership agreement with the state radon program or to meet requirements set forth by state statute (e.g. mandate for licensure, mandated for listing on the states' radon web page).

Over a-third of reporting state radon programs' residential radon concentration data was collected by both alpha track and charcoal devices (38%). And 31% of radon programs' concentration data is collected via multiple measurement devices (e.g. alpha track and charcoal devices, continuous radon monitors [CRM] and other professional devices). Thirteen-percent of all responding state radon programs collect

both number of residential radon tests conducted and concentration measured on an annual, semiannual or quarterly basis. The majority (87%) additionally collect information on the testing and analysis date, floor tested (e.g. basement, first floor, second floor), and other housing and/or resident demographics.

Sixty-three percent of state radon programs reported that residential radon data is collected with a full home address (first address, second address, city, state, postal code). Nearly one-quarter (22%) of state radon programs have radon testing data by county and postal code. And thirteen-percent have testing data by postal code and three-percent by county only.

Residential radon mitigations

Table 4. Summary of state radon program residential mitigation collection efforts

	Frequency (N= 33)	%
Residential mitigations	24	72
Source of mitigation data		
Private contractor reports	20	88
Phone Inquiry	4	17
Other	3	13
Mitigation information		
Number of mitigations installed, concentration of tests (pre/post levels), type of mitigation installed, installation and test dates and contractor information.	10	42
Number of mitigations only	12	50
Number of mitigations installed and concentration of tests (pre/post levels)	2	8
Spatial level of mitigation		
Full home address	9	38
County and Postal code	2	8
Postal code only	3	13
County only	0	0
None	10	42
Note: Variables in bold that do not add to 100% are multiple-choice responses.		

Seventy-two percent of radon programs collect at least some information on residential radon mitigation. Of the twenty-four states that collect radon mitigation data, the majority (88%) collect data as a summary hardcopy report or electronic form filled out by private radon mitigation companies through a partnership agreement or to meet requirements set forth by state statute or rule (i.e. mandate for certification, licensure or state listing). Seventeen-percent collect radon mitigation data over the phone by directly contacting private radon mitigation companies or contacting homeowners who have recently conducted a radon test and had levels at or above the 4.0 pCi/L EPA action limit.

Forty-two percent of all reporting state radon programs that gather mitigation data, collect the number of mitigation systems installed, pre/post mitigation levels, contractor information and dates of collection and analysis. Half of these programs collect only the number of mitigation systems installed and eight-percent collect both number of mitigation systems installed and pre/post concentration

levels. Four out of ten state radon programs do not collect spatial data on residential mitigations. Over a third collect full address (first address, second address, city, state and postal code) (38%) and 8% collect mitigation data by county and postal code only.

Mapping Residential Radon Data

Almost half of the reporting state radon programs utilize Geographic Information Systems (GIS) software technology in some fashion (49%). Maps are generally created by radon program, state health department, or partnering university staff. Of the sixteen state radon programs that use GIS, 88% map residential radon concentration data and 75% map the number of residential radon tests conducted annually or other selected time period while 13% map the number of mitigations installed. Regardless of the spatial level of information collected, these features are typically mapped by county and/or zip code only to maintain homeowner privacy.

Data Use, Sharing/Dissemination and Public Outreach

Table 5. Summary of state radon program data sharing

Data sharing	Frequency (N= 33)	%
State Indoor Radon Grant (SIRG) requirement	31	93
State internal evaluation	33	100
County and local public health	16	49
Contractors and partners	15	46
Community educators	14	42
Public	14	42
Modes of public data sharing		
Phone/Email Inquiries	26	87
Fairs/Booths	20	67
Pamphlets and Handouts	18	64
Website	19	63
Note: Variables in bold that do not add to 100% are multiple-choice responses.		

All state radon programs reported using radon testing and mitigation data as part of their internal program evaluation. All but two state radon programs also share their data with EPA due to reporting requirements under the state indoor radon grant.

Almost half of state radon programs share, upon inquiry only (46%), summary data with the public, radon testing and reduction service providers, and other entities, while thirty-nine percent of state radon programs actively shares summary data with these entities as well as upon inquiry. Almost half of state radon programs share summary data with county and local public health (49%) and radon testing and mitigation

professionals who provide data to the programs (46%). And forty-two percent of state radon programs provide summary data to community educators and the public.

The majority of state radon programs that participate in active data sharing provide summary radon data and health information via phone and email inquiries (87%). Most also disseminate information to the public through fairs/tables events/conferences (67%), pamphlets and handouts (64%) and their state radon program website (63%).

State Radon Program Capacity

Most testing and mitigations are related to real estate transactions (e.g. initiated by the home buyer). None of the responding programs have compulsory state residential radon testing or mitigation installation. In a few states, testing is only required in public schools, licensed daycares and group homes, and/or 'high-risk' public buildings. Seven of the radon programs reported their state has a law requiring licensed radon professionals including kit manufacturers/testing laboratories and mitigation providers to submit radon test results to the radon program. One program reported state-wide adoption of Section F. of the International Residential Code (radon control for new houses) and two programs reported county/local adoption of Section F.

Most radon programs are administered by environmental health science professionals within state health departments. A few state radon programs partner with local universities and coalitions. Responding state radon programs have on average three employees (range: 1 to 9). Staff typically consists of a variety of part-time and/or full-time employees that work on radon 25 to 50% time in addition to other environmental or healthy housing work duties (e.g. clerical/auxiliary, technical, and supervisory). However, several state radon programs responded that staffing will likely decrease within the next few months due to federal and state budget cuts.

All but two of the thirty-three state radon programs responding to this survey receive SIRG funding (94%) and forty-three percent receive state funding. Only 6% of radon programs report other sources of funding such as fines and fees.

State Radon Program Perceptions about Data Collection & Management

Most state radon program representatives reported at least one or two things they would change about the way radon data is collected and managed at the federal and state levels. The most frequent responses included:

- Development of a centralized online portal or website for collecting radon data;
- Data entry should be done by certified or accredited laboratories and radon professionals (not state radon program staff); and
- More frequent reporting of data from radon service providers, e.g. quarterly.

Other comments on data collection and management were:

- Standardize information reported by radon home-test kit manufacturers and other testing and mitigation service providers (e.g. required report forms with key indicator variables and identification or deletion of quality control measures such as blanks, spikes and duplicates);
- Improved methods for states to collect and evaluate data; and
- Resources for states to post community-level radon concentration data on their websites (e.g. tables, county with postal code maps).

State Radon Program Perceptions about Other Program Activities

State radon programs also reported strong feelings regarding federal and state funding, resources, and policies. Almost half of all radon programs wished there was more federal and state funding for radon program staff and activities. Many were particularly concerned about the proposed 2013 federal budget cuts which would eliminate EPA SIRG funding. Programs felt that SIRG has been consistently underfunded making it impossible to meet the goals of the Indoor Radon Abatement Act. In the opinion of many of the state radon program representatives, termination of this critical funding source will most certainly result in the end of state radon programs. As one state radon program representative poignantly stated:

“SIRG has never been fully funded by Congress and funding has not increased in more than 20 years. While we are doing more with less, inflation and competition has reduced SIRG funding to the breaking point. If SIRG funding is taken away as indicated in EPA’s (President’s Executive Budget) for 2013, many state radon programs will cease to exist and there will no longer be a national program to achieve the goals established by Congress in the Indoor Radon Abatement Act.”

Beyond concerns about SIRG, frequently reported policy changes mentioned by state radon programs include:

- Mandatory radon testing (e.g. in real estate transactions, private and public schools, private and public buildings in high-radon zones, rental properties, and statewide);
- Mandatory installation of a radon mitigation system (when 4.0 pCi/L or higher);
- All states adopting Section F, of the International Residential Building Code for radon-resistant new construction;
- Mandatory state reporting of test results from analytical laboratories, inspectors, and radon service providers;
- Requirement that all radon analytical laboratories and service providers be accredited/certified (e.g. NEHA/NRSB) and licensed by the state; and
- Dedicated funding for states to develop targeted residential radon campaigns.

Other changes to state radon programs reported include:

- Funding, including state/local fees, going directly to state radon program (instead of general fund or to pay administrative fees);
- Elimination of or reduced state-match requirement for SIRG grants;
- Assistance programs for testing and mitigations, especially for low-income and high-risk households (where radon concentration is 4.0 pCi/L or greater);
- Health insurance reimbursement for radon mitigation systems installed;
- Non-legislative incentives for radon testing and mitigation;
- Free radon testing kits for everyone;
- Stronger guidance from EPA for states to administer radon program; and
- Policy-makers to view radon as a public health priority.

Discussion

To the best of the investigators' knowledge, this paper represents the first published appraisal of data collection, management and reporting and program activities of U.S. state radon programs. Several state radon programs in this study collect and manage quantitative and spatial data on residential testing and mitigations. Thirteen state radon programs (39%) collect testing, mitigation, and GIS mapping data, ten state radon programs (30%) collect testing and mitigation data only, and eight state radon programs (24%) collect testing data only. The bulk of data

collection efforts surrounds radon testing, as 87% of radon programs collect full testing data including number of tests, radon concentration, and test and analysis dates while half of programs collect full mitigation data (e.g. number of mitigation systems installed, type of mitigations installed, pre/post concentration levels, test and analysis dates, and contractor information). In addition, several state radon programs collect address location on tests (63%) and mitigations (38%) done in the state. However only half (49%) utilize GIS mapping in their data tracking and evaluation efforts. These findings may be explained by a number of factors including variations in staff and funding, academic and organizational partnerships, state radon service provider certification, licensure, and reporting requirements, the relatively new nature of mitigations included in data collection efforts and SIRG reporting requirements.

Many radon program representatives expressed concern about the quality of data. Measurement error and other systematic biases, selection bias, spatial accuracy, and inconsistent or infrequent reporting were among the top concerns. The majority of state radon programs collect radon concentration data from laboratories analyzing do-it-yourself testing kits and from radon service providers. Studies show measurement variation present in charcoal and alpha track devices (Steck, 1992, 2005, 2009; Steck, 2004). Short-term measurement devices are less representative of annual average indoor radon levels than long-term measurement devices. Secondly, state radon program representatives mentioned that data sets submitted do not always have all the required fields in the form(s) submitted and often contain unlabeled quality control measures (e.g., blanks, spikes, duplicates). Third, not all state radon programs have access to or collect testing and mitigation data by full address. This may be due to state or radon provider confidentiality and privacy laws. Without a full home address, data analysts cannot ascertain individual retesting which can result in selection bias. Moreover, maps generated from this information may be flawed. For example, state and county public health departments find it helpful to look at testing and mitigation rates at the county-level to guide planning and evaluation. Postal codes often cross county lines, therefore if state radon programs only have postal code level information they will be faced with three options: (1) map by postal codes only, (2) delete observations with postal codes that cross county lines, or (3) use an imputation or spatial inference method for deriving a county with postal codes map. Lastly, not all states have laws requiring radon device manufacturers, analytical laboratories, and radon service providers to be licensed and/or accredited. Participation in an EPA co-founded regional radon training center with required passage of the NEHA/NRSB radon proficiency exams may improve the consistency of radon service reporting and delivery.

All state radon programs in this study reported the use of mitigation and/or testing data for program evaluation. States commonly use this information for tracking the level of radon testing and mitigation systems installed within the state in order to identify geographical disparities to guide focused outreach. Besides a need for a more accurate and consistent method for collecting data using current sources, radon program representatives also expressed a desire for obtaining data by other means. A few states have used the CDC's Behavioral Risk Factor Surveillance System (BRFSS) supplemental questionnaire or modules to collect information on radon awareness, testing and mitigation attitudes and behaviors (Kelley, 2011; Laflamme, 2004). Reported studies indicate that using BRFSS may be useful in identifying rough estimates of spatial and socio-demographic disparities to help set priorities in state and local level planning and evaluation efforts, however lack sufficient details required to guide program activities and

outreach. An investigation of current and novel national data collection sources and methodologies is required to improve the tracking of radon testing, installation of mitigation systems, and relevant radon knowledge and behaviors.

This study found that most data sharing is done internally (e.g. EPA/SIRG requirement, state and local evaluations). A little over a third of state radon programs are involved in active data sharing with radon service providers, community educators and the public. Half of state radon programs share information with these entities upon inquiry only, mostly through phone and email correspondences. This is likely due to limited staff and funding, as well as variation in state laws. Several state radon programs mentioned they would like to have more resources for public education and outreach, including planning and implementing a targeted radon campaign, creation of updated radon risk maps and revisions to their website.

Almost all state radon programs in this study currently receive SIRG funding (94%) and half receive state funding. Present levels of funding permit state radon programs on average three staff members that usually have other health promotion obligations such as indoor air quality and healthy housing, and levels of data collection, management, dissemination and public health outreach responsibilities described in this study. State radon programs mentioned the impact that the proposed 2012 EPA budget cut from \$8M to \$4.1M as well as other government and state funding cuts had on their departments, including work time reductions and staff layoffs and subsequent limitations in radon reduction activities. Many felt that elimination of SIRG funding as proposed in the president's 2013 budget will result in many states no longer having a radon program.

The immense problem now facing government agencies is the sustainability of state radon programs and how to continue working on the goals set forth by the Indoor Radon Abatement Act and Healthy People 2020 given the fragile economic climate. As mentioned previously, the root of the problem lies in the nature of voluntary programs which impacts public and stakeholder perception of the health risks from radon (severity and urgency to address the issue), testing and mitigation behaviors, practices and policies, as well as sets a premise for state and local laws and funding for program activities including data collection and monitoring (Bishop, 2008). As this study seems to indicate, variations in state and local resources and laws impacts data quality, collection, and dissemination efforts, and outreach activities.

Unless adjustment to the 2013 budget cuts are made, the plan is to utilize \$2M allotted to the U.S. radon program to implement the 2011 Federal Radon Action Plan. The plan calls for, "the elimination of preventable radon-induced cancer through expanded radon testing of existing homes, mitigation of high radon levels within those homes and radon-resistant new construction." The goal is to have 10 million homes mitigated (equivalent to 6,500 lives saved) by 2015 by: (1) demonstrating the importance, feasibility and value of radon testing and mitigation, (2) providing economic incentives to encourage those who have sufficient resources to test and mitigate and provide direct supports to reduce the risk of those who lack sufficient resources, and (3) building demand for services from the professional, nationwide radon service industry. The federal government plans on accomplishing this by leveraging existing programs that fund housing activities to reduce radon risks such as during home assessments, renovations, retrofits, rehabilitations, repairs and other home-based programs (e.g., low-income HUD).

A collaborative effort is already underway with discussions on how to build and coordinate a national radon database to track key indicator variables at the national and regional level from multiple sources. At the forefront of this effort is the Radon State Data Exchange discussed on radonleaders.org, a partnership between the U.S. EPA, the American Association of Radon Scientists and Technologists (AARST), the Conference of Radiation Control Program Directors (CRCPD), the CDC Environmental Public Health Tracking Network (EPHTN) (ephtracking.cdc.gov), states, tribes and industry. Their goal is to gain a better understanding of the types of data sources available, their strengths and limits, and construct a model for collection, storage and management of radon data. An ideal system would include an electronic easy to use web portal capable of multiple variable query, mapping, and summary data accessible via an excel spreadsheet and portable document format (pdf) similar to the U.S. Census Bureau's FactFinder. The Centers for Disease Control (CDC) is currently funding 23 states and local health departments to develop local tracking capabilities. Data collected can then be uploaded into the national CDC-EPHTN. A few of these states are considering the addition of radon to their list of environmental health tracking topics. Ideally every state radon program should be involved in order to lay the foundation for a national database. However data collection, entry, cleaning and management is extremely time-consuming. Many state radon programs find it difficult to keep up with these tasks under current levels of staff and funding. A few suggested it would be helpful if their state radon program had an electronic database for laboratories and radon service providers to directly import the data.

The challenge now lies in creating a standardized system for radon data and key indicator variables to be collected, entered, cleaned, and stored. Working groups planning a national radon database need to consider the feasibility of such efforts; taking into account the variability across states in terms of data sources, source reporting, confidentiality and privacy rules coupled with the inherent issues of measurement error, systematic and selection bias discussed previously, and possible staff reduction due to budget cuts. Working groups should also consider tracking radon using electronic and automated systems as well as creating partnerships with graduate and professional schools and other ways of consolidating and leveraging resources. Ultimately, this endeavor may take a rethinking of our priorities in how we invest our time, money and talent.

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Appendix

State Radon Program Questions

- 1. Do you collect current data on residential radon levels?**
 - a. If yes, how? (e.g. state, county, or local radon surveys; partnership with analytical laboratory; partnership with home builder or real estate association; partnership with private contractors)
 - b. What type of radon testing devices measure the information you collect? (i.e. alpha track, charcoal canister, or both)
 - c. What type of information do you collect on residential testing? (e.g. radon concentration, testing date, analysis date, floor tested, date home was built, other)
 - d. What spatial level information, if any, on residential testing do you collect? (e.g. specific home address, city, county, zipcode, census tract)

- 2. Do you collect current data on residential radon mitigations?**
 - a. If yes, how? (e.g. state, county, or local radon surveys; partnership with home builder or real estate association; partnership with private contractors)
 - b. What type of information do you collect on residential radon mitigations? (e.g. number of mitigation systems installed, types of mitigation systems installed, date of installation, pre and post mitigation radon levels, type of radon measurement device used, radon installation contractor NEHA-NRP or other certification, other)
 - c. What spatial level information, if any, on residential radon mitigations do you collect? (e.g. specific home address, city, county, zipcode, census tract)

- 3. Does your state radon program use Geographic Information Systems (GIS) and if so how?**
 - a. Map current state residential radon testing
 - b. Map current state residential radon mitigations installed
 - c. Map current residential radon concentration
 - d. Other, please list.

- 4. How is state residential testing and mitigation data used?**
 - a. Reported to EPA as SIRG requirement?
 - b. Kept internally at state radon program office for evaluation and/or other purposes?
 - c. Shared with county and local level government for evaluation and/or other purposes?
 - d. Shared with government partners such as home builder and real estate associations or private contractors?
 - e. Shared with community health educators, including clinics and public health professionals?
 - f. Shared with the public?
 - g. All of the above.

5. **If residential radon testing and mitigations are shared with the public, how so?**
 - a. Phone and Email inquiries
 - b. Booths/tables at fairs and other community events
 - c. Educational materials such as pamphlets and handouts
 - d. Website
 - e. All of the above.
6. **In your state, is residential testing voluntary or mandatory? If voluntary, are there some county or local entities that require testing? (e.g. for new builds, real estate transactions, or general requirement)**
7. **In your state, are residential mitigations voluntary or mandatory? If voluntary, are there some county or local entities that require mitigations for those testing at or above the 4.0 pCi/L action limit or other standard? (e.g. for new builds, real estate transactions, or general requirement)**
8. **How many staff members work in your state radon program? (e.g. number FTE, PT)**
9. **What funding sources does your state radon program have? (e.g. SIRG, other federal grant, foundation grant, other private grant)**
10. **What changes, if any, would you like to see in how state residential radon data is collected and reported? (e.g. ways to avoid or determine duplicate reporting, long term radon tests used only, data tables and maps available to public) Feel free to be as specific as you'd like.**
11. **What changes, if any, would you like to see in your state radon program? (e.g. more SIRG funding, more matching funds available, more staff, targeted state residential radon campaign, policies that require radon testing, policies that require radon mitigations, policies that require radon testing contractors and laboratories to be accredited) Feel free to be as specific as you'd like.**
12. **Other comments?**