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RADON IN GEORGIA

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Career MPH

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RADON IN GEORGIA

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An abstract of
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Abstract

RADON IN GEORGIA

BY

Lauren Moss Owens

Radon is responsible for up to 21,000 deaths each year in the United States with 600 of those in Georgia. Currently, there are no regulations in the state pertaining to testing, education, or building construction. This study assessed the knowledge, attitudes and practices of residents on radon in a high-risk county through the administration of a door-to-door KAP survey. Radon test results obtained through Air Chek, Inc. were used to assess the accuracy of the EPA radon zone map for Georgia. An interview with an educator from the University of Georgia Radon Education Program identified key areas needing focus to further radon action in the state. Funding to the radon education program is lacking and residents across the state are not being adequately reached to promote testing. The EPA map of Georgia needs reconstruction to better link risk to documented test results from each county. Future collaborations with national organizations, additional funding allocated to the radon education program, radon education with established smoking cessation programs, and involvement of the state legislature and health departments are key actions that can be taken to promote action against radon in the future.

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CHAPTER 1

Introduction and Rationale

Radon is a colorless, odorless, tasteless radioactive gas produced through the natural decay of uranium in soil, rock, and water. The gas gets into the air and has the ability to accumulate in homes. Radon is the second leading cause of lung cancer after tobacco and is estimated to cause 20,000 deaths every year in the United States and 600 in Georgia [1].

While many states have laws requiring radon testing before buying and selling homes, Georgia does not. Homeowners are not required to disclose test results to potential buyers, and mortgage companies do not require testing to issue a home loan. The burden falls on the buyer to address this issue. The EPA lists four counties (Cobb, Fulton, DeKalb, and Gwinnett) as being the highest risk in Georgia for radon [2]. The purpose of this project is to address radon knowledge, attitudes, and practices of homeowners that reside these high-risk areas. Health departments receive funds to address issues directly impacting the health of their citizens. One question to address is if these four county health departments have conducted radon surveys and what they are currently doing to address this issue? Are there any programs that aim to educate residents and/or assist in testing or mitigation? The second question is if homeowners residing in one of these counties are aware of the problem and have taken action in their own home? A third question is if testing data agrees with the EPA map that these counties are at highest risk for radon and if the zoning appears accurate? These questions will help to assess if further outreach is needed in these high-risk areas to address this

public health issue. As a result, future programs can have the most impact in educating homeowners against this silent but deadly radioactive gas and potentially prevent a number of future lung cancer cases.

Problem Statement

Radon is imperceptible to the human senses and can get into any type of building where it is able to accumulate without proper ventilation. The EPA estimates that radon causes more deaths per year than drunk driving, falls in the home, drownings, or home fires [1]. Smokers have an even higher risk of developing lung cancer due to radon exposure, and research has shown that households with smokers are significantly less likely to test for radon [3]. Radon testing is inexpensive and mitigation in homes can be conducted for about the same cost as any other common home repair. Actions from health departments and educational programs could provide the knowledge homeowners need to take action in their own homes for the sake of their family's health.

Many states are proactive when it comes to radon in homes. Laws exist in these states where radon is especially a high threat to require testing prior to purchasing or selling homes. As a result residents in these areas are often aware of this public health threat. This study aims to assess the knowledge of homeowners on radon in a community located in a high risk Georgia county to establish if and how future educational programs would be beneficial and if the county health departments or any other entity has been active in dealing with this issue.

Theoretical Framework

The theoretical rationale behind this study is the health belief model, which is the theory that a person's willingness to change their health behavior is based on perceived susceptibility, severity, benefits, and barriers. Radon is a known and documented public health threat that is responsible for up to 600 deaths per year in Georgia due to lung cancer [1]. Since radon is imperceptible to the human senses, educational programs and laws are the only way to make the public aware of the situation. However, Georgia does not have any laws requiring disclosure of radon tests or mandatory testing to buy and sell homes.

Nearly 1 in every 15 homes in the U.S. is estimated to have elevated radon levels [1]. Approximately 15% of tested homes in Georgia are reported to have elevated radon levels. These statistics indicate a high level of susceptibility. Lung cancer resulting from radon exposure is a very serious disease with an average of only 15% survival rate 5 years after diagnosis. Mitigation of radon in homes is an efficient process that reduces levels by up to 99% [1]. Through surveys of residents and the analysis of conducted radon studies, it will be possible to assess the current knowledge, attitudes, and practices in the highest risk Georgia counties and provide the tools necessary for a future high impact educational program. Education showing the susceptibility and severity of this threat along with the minimal barriers and subsequent benefits from taking action will promote homeowners to test and mitigate their homes.

Purpose Statement

The purpose of this project is to conduct a pilot study to assess the knowledge, attitudes, and practices of homeowners in high-risk areas in Georgia on the public health issue of radon. The role of county health departments and other radon programs in research and outreach on radon will be assessed. Collected radon test data will be assessed to look at the four highest risk counties and overall problem for Georgia.

Research Questions

The primary research questions this research aims to answer are:

1) Are homeowners in high-risk areas of Georgia knowledgeable about radon?
2) Do homeowners in Georgia feel there needs to be more effort to reach the public about this issue?
3) Have health departments in high-risk Georgia counties researched the extent of this issue through home radon surveys?
4) Have health departments in high-risk counties reached out to residents about this issue?
5) Are there any other radon programs reaching out to residents in these counties?
6) Does radon testing data agree with the EPA risk map for Georgia?

Significance Statement

The knowledge obtained from this research will be important to assess the needs of Georgia when it comes to radon. Using available testing data along with feedback from surveys of residents, it will be possible to appropriately focus future educational

campaigns to make the most impact. Spreading the word about radon will help Georgians take action in their own home and inform their family and friends. As knowledge of this public health issue spreads, it will be possible to seek government action on this issue through the development of laws requiring radon testing before a home can be bought or sold. Knowledge is power, and education is key to the reduction of lung cancer from radon exposure in the home.

CHAPTER 2

Introduction and Background

Radon is a colorless, odorless, and tasteless radioactive gas that is formed from the natural breakdown of uranium in soil, rock, and water. The presence of trace amounts of uranium in soil means that all humans are exposed to radon to some degree. Radon is measured in picocuries per liter (pCi/L), which is defined as a unit of radioactivity corresponding to one decay every 27 seconds in a volume of one liter, or 0.037 decays per second in every liter of air. About 0.4pCi/L is normally found in outside air[4]. Once radon gets into the air, it is able to get into homes through cracks or gaps in the foundation. Once inside, without adequate ventilation it is able to accumulate to levels well over the EPA action level of 4pCi/L[4].

Radon decays into solid radioactive elements called radon progeny (such as polonium-218, polonium-214, and lead-214). Radon progeny then attach to other particles such as dust and can be breathed into the lungs. As radon and radon progeny in the air break down, they emit alpha particles, a form of high-energy radiation that can damage the DNA in the body's cells[5]. Lung cancer can result from long-term exposure. The EPA estimates that the lung cancer risk from a lifetime radon exposure of 4pCi/L is 2.3% for the entire population, 4.1% for individuals who have smoked, and 0.73% for individuals who never smoked[6]. The EPA radon "action level" of 4pCi/L is roughly equivalent to smoking 10 cigarettes per day. Studies in the United States[7, 8], Europe[9, 10] and China[11] have reported statistically significant increases (8 to 18%) in lung cancer risk at 2.7pCi/L, a concentration below the recommended EPA action

level. The number of radon related deaths exceeds the number of many other types of cancer including melanoma, myeloma, stomach, kidney, ovarian, or liver[6].

Lung cancer has one of the lowest survival rates for those with cancer. Between 11 and 15 percent of those afflicted will live beyond five years of diagnosis[4]. The World Health Organization says radon causes up to 15% of lung cancers worldwide[4]. The EPA estimates that radon is responsible for 21,000 deaths annually (14% of total lung cancer deaths) in the U.S. with 600 of those in the state of Georgia. About 2,900 of these deaths are in people that have never smoked [4, 6]. The number of lung cancer deaths from radon is second only to those caused by tobacco. Smokers are at especially high risk to develop lung cancer as a result of synergistic effects with inhaling radon gas[3]. Radon is found all over the U.S. and as many as 1 out of every 15 homes is estimated to have elevated levels over 4pCi/L [1]. Radon in the home is the main source of exposure to ionizing radiation accounting for up to 50% of the public's exposure to naturally occurring sources of radiation. Radon reduction systems are highly effective and can reduce levels by up to 99%[1].

Harting and Hesse first described lung cancer from radon in 1879 when they described autopsy findings in metal miners that showed pulmonary malignancies. The presence of high radon levels and high lung cancer rates of miners in the Schneeberg mines in Germany led to the hypothesis that radon causes lung cancer. Many studies have been conducted to assess the risk of lung cancer in uranium miners[12, 13]. Results have shown a positive correlation between radon exposure and the development of lung cancer. Studies have also shown that miners who were smokers were more at risk of developing lung cancer[14].

Testing and Mitigation

Homes that are well insulated, tightly sealed, or built on soil rich in the elements uranium, thorium, and radium can have higher levels of radon. Due to their closeness to the ground, basement and first floor levels typically have the highest levels. The EPA and Surgeon General recommend testing all homes below the third floor[15].

Home testing is a simple process. Low cost kits ranging typically from $15 to $25 are available through the mail, hardware stores, and other retail outlets. It is also possible to hire a qualified tester. There are two general ways of testing, short-term and long-term[1]. Short-term test kits remain in the home from two to seven days. This test uses a container that contains a quantity of granular activated charcoal, which absorbs the radon gas entering the canister from the surrounding air. At the end of the testing period, the canister is sealed and sent to a laboratory for analysis. This option is best when results are needed quickly, but is less likely to give the year round average radon level like long term tests which remain in the home longer than ninety days. Due to simplicity, ease of use, and low cost, it is estimated that 95% of all radon testing is conducted with activated charcoal test kits. Other devices are available but require some formal training to be used properly and are typically used only by professional radon inspectors. Mitigation is recommended when levels are 4pCi/L or higher. Most homes can be reduced to 2pCi/L or below[1]. No level of radon exposure is safe. The risk of lung cancer is reduced by decreasing radon levels. According to the EPA, the average indoor radon concentration is about 1.3pCi/L. However, it is not uncommon for levels to range between 5 to 50 pCi/L, and levels have been found as high as 2,000pCi/L[15].

Typical costs for radon mitigation ranges from $800 to $2500 while the cost of adding radon-resistant features during new home construction ranges from $350 to $500[16]. The EPA reports that the average house costs about $1200 for a contractor to fix. Typically a radon mitigation system involves creating a negative field of pressure below the lowest level of the house (slab or crawl space) to prevent radon from entering the home. Soil testing is not sufficient in determining if a house needs radon-resistant construction as it cannot predict the impact site preparation will have for introducing new radon pathways or the extent of the vacuum produced by the house[15].

Radon in the United States

On October 5, 1988 the President signed the Indoor Radon Abatement Act (IRAA) which established the goal of the United States is to make indoor air as free from radon as the ambient air outside buildings[17]. This act authorized a number of programs to take on the issue. The EPA was given $10 million annually for three years to use towards state grants to establish radon programs, conduct radon surveys, develop public information on radon, and conduct demonstration and mitigation projects[18]. The EPA was also awarded $3 million annually over three years to provide technical assistance to states. These activities included providing assistance with training seminars, radon surveys, public information materials, mitigation projects, and the development of testing and mitigation methods for non-residential child-care facilities[17]. A total of $1 million was allotted for the EPA to study radon in the nation's school and $500,000 for diagnostic and remedial efforts. Another $1.5 million was funded for the EPA to establish proficiency programs for firms offering radon-related services such as testing

and mitigation[19]. The EPA was also given $1 million annually over three years for university grants to establish at least three regional radon training centers. The EPA was also required to develop model construction standards and techniques, update the Citizen's Guide to Radon as found on their website, and require studies of radon contamination in Federally-owned buildings in high risk areas[1, 17]. Since 1988, the EPA has administered a voluntary program to reduce radon levels through promoting awareness, testing, installation of mitigation systems, and the use of radon-resistant new construction[15].

The IRAA required the EPA to identify areas in the U.S. with the potential for high radon levels. Each of the 3,141 counties in the U.S. has been grouped into three zones based on radon potential[15](Figure 1). Zone1 or red zone has the highest potential with a predicted screening level above 4pCi/L. Zone 2 or the orange zone has moderate potential with a predicted screening level between 2 and 4pCi/L. Zone 3 or the yellow zone has low potential with a predicted screening level below 2pCi/L[15]. Regardless of the radon zone, the EPA emphasizes that high radon levels have been found in every zone in the U.S. The map, created in 1993, was intended to be used by state, local agencies, and national organizations to target their resources to higher radon-potential zones and to implement radon-resistant building codes where they may be most needed[15].

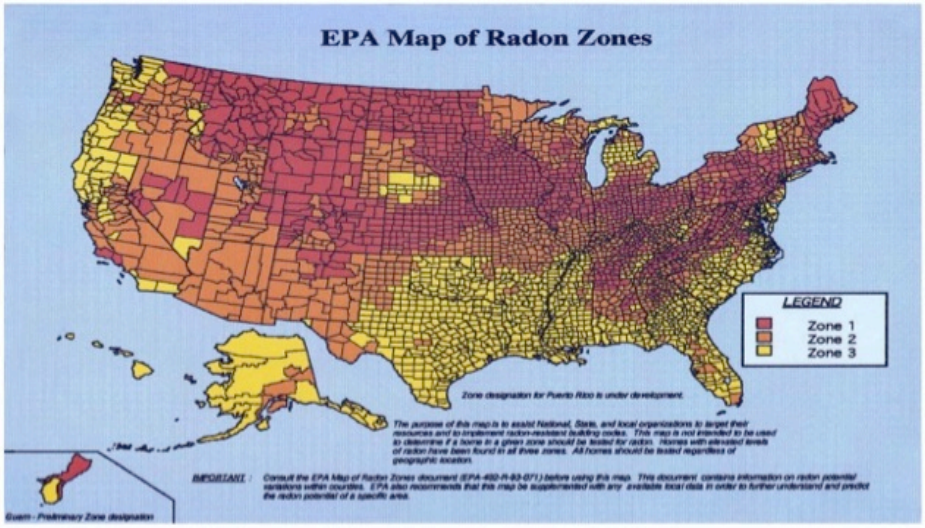

Figure 1: EPA Map of Radon Zones in the United States. Zone 1(Red) has a predicted average indoor radon screening level greater than 4Ci/L. Zone 2 (Orange) has a predicted level between 2 and 4 pCi/L. Zone 3 (Yellow) has a predicted level less than 2pCi/L.

In 2008, the U.S. EPA Office of Inspector General issued a report that was also reviewed by the American Association of Radon Scientists and Technologists (AARST). They both concluded that the EPA had limited progress over 20 years and needed to consider other means to meet the 1988 goal of IRAA. Of the findings in the report included the fact that of 6.7 million new single-family detached homes that were built between 2001 and 2005, only about 469,000 incorporated radon-resistant features. Of 76.1 million existing single-family homes in the U.S. in 2005, only 2.1 million had radon-reducing features[15, 20].

One obstacle to success is the issue that building codes in many areas do not require homes to be built with radon resistant construction. Twenty-five states and three districts/territories do not have statewide or local jurisdictions that have radon-resistant

new construction codes (RRNC). These states are AK, AZ, AR, CA, CT, DE, DC, GA, GU, HI, IN, KY, LA, MA, MS, MO, NV, NH, NC, ND, PR, SD, TX, UT, and VT. Six states including MD, MI, MN, NJ, OR, and WA have statewide RRNC codes that apply to certain designated jurisdictions[21]. Nineteen states including AL, CO, ID, IL, IA, KS, MT, NE, NM, NY, OH, OK, OR, PA, SC, TN, WV, WI, and WY do not have state RRNC codes, but do have local jurisdictions that have RRNC codes. Four states including FL, ME, RI, and VA have statewide RRNC codes, but local jurisdictions must adopt them[21].

Most progress has been made through real estate transactions where a buyer, seller, lender, or real estate agent requests that a home be tested. However, many states and localities do not require testing or the disclosure of test results during real estate transactions[15]. Some states only require that radon be listed along with a list of other potential environmental hazards[15]. The ability for the EPA to achieve results using their voluntary program is limited. The potential loss of a home sale is a disincentive for home sellers and real estate agents to conduct radon tests during real estate transactions. Home inspectors and radon service providers find it difficult to make a profit from these services due to the many hours of work and certification issues and therefore lack incentives to offer these services[15]. The additional expense for radon resistant construction is also a disincentive for builders to add these features to new homes[15].

Radon in Georgia

Radon is responsible for up to 600 deaths per year in the state of Georgia. DeKalb, Cobb, Gwinnett, and Fulton counties have been listed by the EPA as having the

highest potential (Figure 2). Georgia does not require testing or the disclosure of radon test results during real estate transactions. Georgia only requires that radon be listed along with a list of other potential environmental hazards on the seller's disclosure form. There are also no building codes in the state requiring radon-free construction. Currently Georgia has an education program funded by the EPA for a partnership between the University of Georgia Family and Consumer Science (FACS) Extension Office, the Georgia Department of Community Affairs (DCA), and Southface Energy Institute to educate Georgians on the risk of lung cancer caused by radon. This program offers test kits for $10.00 through a mail in form which also includes laboratory analysis[22]. Results from radon testing through 2006 shows high results around the Atlanta area and in counties not designated as high risk by the EPA (Figure 3). The program reaches out to Georgians through press releases, radio ads, newspaper articles, TV appearances, and the website. Regional radon educators are assigned to counties in Georgia where they provide education programs for organizations church groups and schools as well as provide exhibits for health or community fairs (Figure 4). They also target real estate professionals, homebuilders, and medical professionals to encourage radon testing, mitigation, and radon-resistant home construction. In addition to being able to contact regional educators about radon, Southface Energy Institute also has a hotline residents are able to call. This joint education program currently is the only statewide effort in Georgia to take on the issue of radon.

Figure 2: EPA Map of Radon Zones In Georgia. Zone 1(Red) has a predicted average indoor radon screening level greater than 4Ci/L. Zone 2 (Orange) has a predicted level between 2 and 4 pCi/L. Zone 3 (Yellow) has a predicted level less than 2pCi/L.

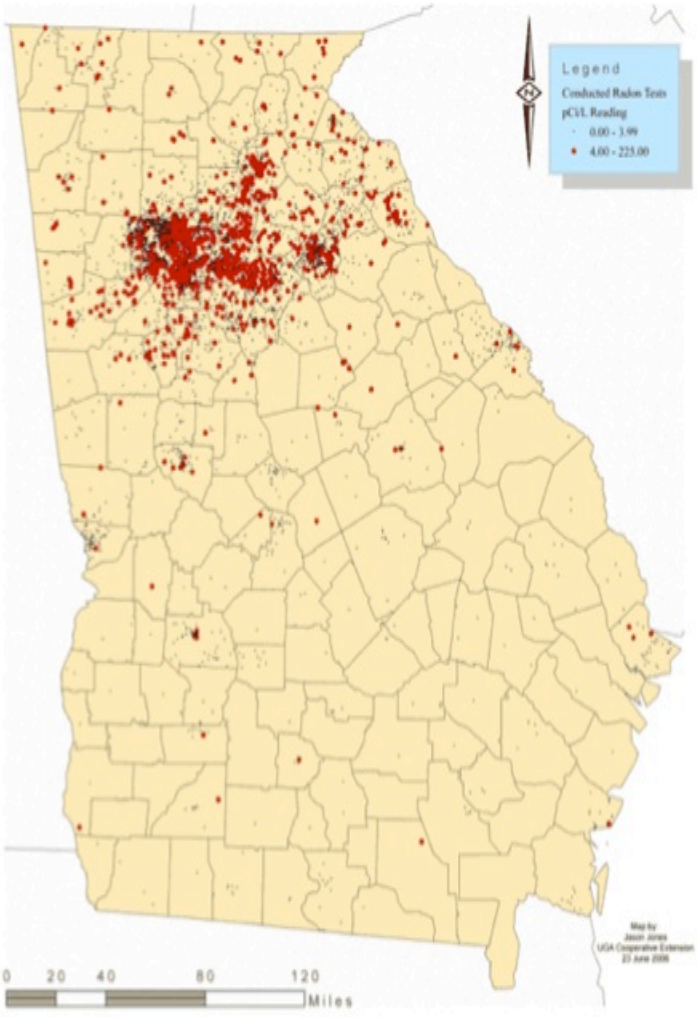

Figure 3: Georgia Radon Test Results from 1986 to February 2006

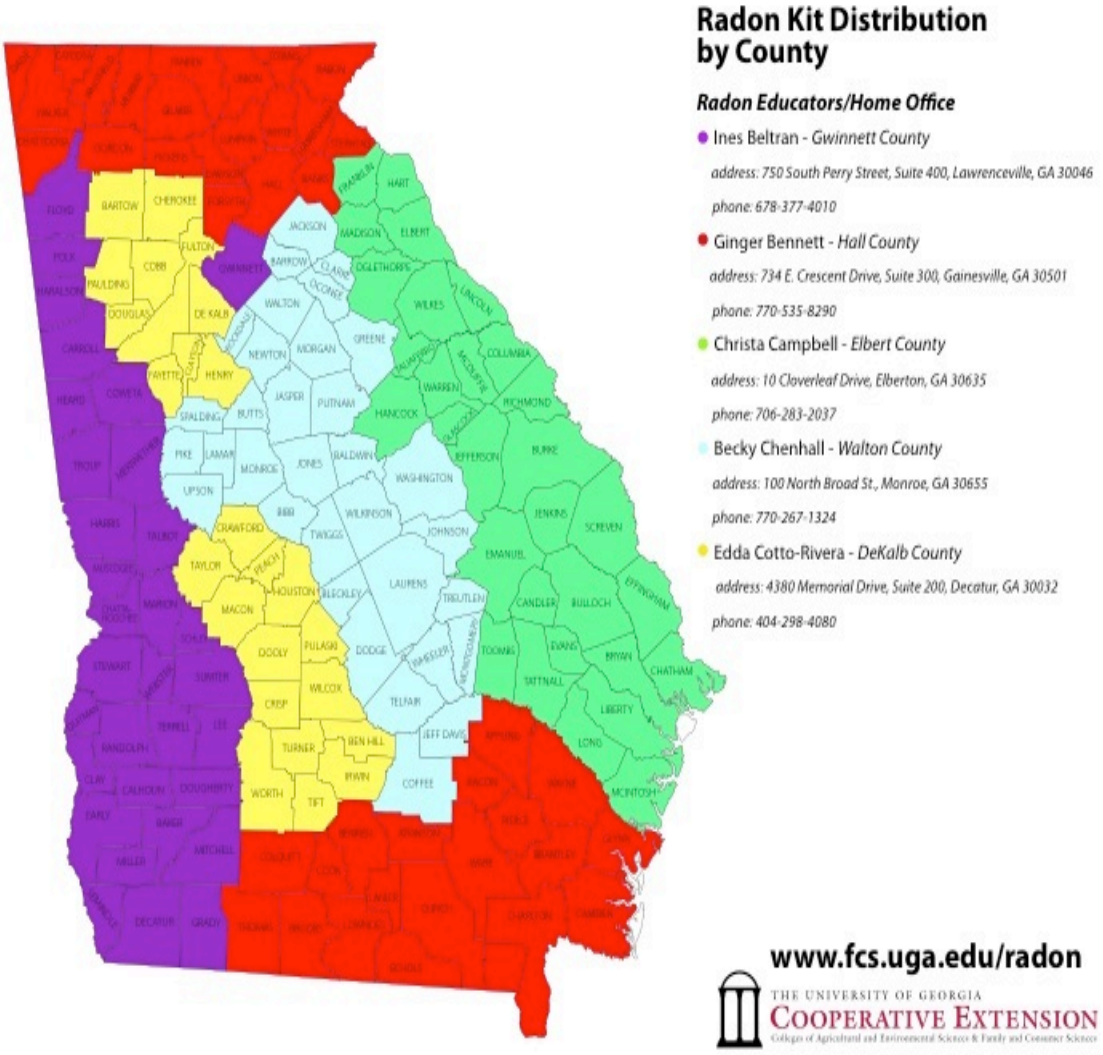

Figure 4: Georgia Radon Program Educator County Assignment

Radon is a public health threat in the state of Georgia with no regulation by state laws. With only one statewide program to attempt educate the public on radon, it is important to reach out to residents to see if the message is reaching the intended audience in the highest risk counties. Local health departments are also important resources for residents seeking public health information and are responsible for using taxpayer dollars to take on public health issues affecting each county. It is also important to look into

their contributions on this issue. Research on collected radon data and surveys of residents can assist future efforts in education and ultimately be used to reach legislators about the need to develop radon laws in Georgia.

CHAPTER 3

Introduction

The EPA has listed DeKalb, Cobb, Fulton, and Gwinnett counties as the highest risk for radon in the state of Georgia. Residents of these counties have a few public health resources available that would be responsible for promoting radon education and testing. County health departments are responsible for assisting residents with public health issues problematic in the area. The University of Georgia (UGA) Radon Education Program is an EPA funded program with the goal of promoting education and testing around the state. This study aims to question residents within one of the high-risk counties about their knowledge, attitudes, and practices when it comes to radon gas in their home. Also testing data will be analyzed to determine if the county risk designations are accurate and if outreach efforts are appropriately targeting the counties of highest concern.

Population and Sample

Residents living in a subdivision in Cobb County were selected to participate in this survey. This subdivision was chosen because it was located within a county designated at high risk for radon by the EPA. Any homeowner over the age of 21 was eligible to participate in the door-to-door survey. Radon testing data was obtained from Air Chek, Inc for all counties in Georgia. An interview was also conducted with one of the five radon educators for the UGA Radon Education Program.

Research Design

An anonymous Knowledge, Attitudes, and Practices (KAP) Survey on radon was conducted in a door-to-door survey of residents living in a subdivision in Cobb County (See Appendix). A total of 18 responses were collected. IRB Approval was received for this project (Emory IRB00055133).

For further information on radon in Georgia, an interview was conducted with one of the five UGA radon educators. Air Chek, Inc. who analyzes the test kits from the UGA radon program was also contacted to obtain testing data for each of the zip codes in the four high-risk counties and for all counties in Georgia.

Procedures

Homeowners were told what the survey topic was about and given the opportunity to accept or decline to participate. An information sheet explaining the purpose of the study was also given to each participant. Questions were read aloud by the researcher. All answers were also hand recorded by the researcher. Correct answers were explained to each participant at the conclusion of the survey and any questions they had about radon were answered.

An educator in the UGA Radon Education Program was contacted via phone to set up an interview to discuss radon and the role of their program in Georgia. A 45 minute recorded interview was conducted.

To obtain testing results for the state and the four high-risk counties, Air Chek, Inc., the company that reads the test kits for the UGA radon program, was contacted via

phone and email. Test results were obtained for individual zip codes within Cobb, Fulton, DeKalb, and Gwinnett counties. Results from all counties in Georgia were also obtained.

Instruments

One data collection instrument used for this study was a door-to-door KAP survey. Other information was obtained through a face-to-face interview with a radon education specialist from the UGA Radon Education Program. The remaining secondary data was collected and analyzed testing results obtained from Air Chek, Inc.

Plans for Data Analysis

Responses from each of the survey questions were averaged and trends related to knowledge, attitudes, and opinions on radon were determined. Interview information was reviewed for important information regarding the status on outreach to residents in Georgia. Testing information was reviewed to determine if the four high-risk counties are testing highest for radon in the state and if assigned risk zones are accurate.

Limitations and Delimitations

Limitations: The sample population was chosen out of convenience and is not generalizable to the entire county and/or state. A total of 21 homes were approached to participate in the survey and 18 responses were able to be collected as a pilot study without the intent of being able to calculate statistical significance. Test results received

from Air Chek, Inc. only has limited responses from some counties due to low outreach and responses from those areas. Data may not be fully representative of the entire county for those with few tests submitted.

Delimitations: This study only involves survey results from a few households in a subdivision located in Cobb County. This allows the pilot study to focus on a few residents in this designated high-risk county to determine if radon education and outreach is something that needs to be addressed.

CHAPTER 4

Introduction

The EPA has designated DeKalb, Cobb, Fulton, and Gwinnett counties as being the highest risk for radon in Georgia. The UGA Radon Education Program currently conducts all outreach for the state. It's important to understand if residents in the targeted high-risk counties are knowledgeable about radon and are testing their homes. The accuracy of the EPA map for Georgia also needs to be assessed using current testing data to ensure attention is properly focused on counties with the greatest radon issues. Collecting information on current radon outreach will assist on how to make adjustments for the future to conduct a successful radon program.

Findings

Survey:

A door-to-door KAP survey was conducted within a subdivision in Cobb County. This county was chosen because it is one of the four designated as highest risk on the EPA radon map. A total of 18 homeowners participated in the survey.

Most respondents had heard of radon (89%) and thought that it could cause cancer (67%); however, 56% thought or were uncertain if radon could cause asthma. A majority (72%) knew that you could not sense radon in your home; however, when given the choices of 4, 10, 20 or 40pCi/L, 72% of respondents answered incorrectly on the recommended EPA action level. Random guessing would lead to approximately 75% guessing the incorrect action level, which appears to be the case with this question.

Respondents seemed to be aware that there is no real estate law in Georgia requiring radon testing (70%). A total of 67% of respondents felt radon exposure was harmful while 33% felt it was somewhat harmful. No respondents felt that radon was not harmful. A total of 78% of respondents felt that state health departments do too little when it comes to protecting and educating the public on radon. All respondents felt that radon disclosure should be required by law to buy and sell homes, however only 17% had tested their own home. Some respondents had not tested their home because they thought it was only necessary if there is a basement in the home.

Interview:

Phone calls were made to local health departments to determine if any radon testing had been done. None of the counties had an active radon education program or had conducted any surveys of their area. Instead some web pages refer visitors to the UGA Radon Education Program. One of the five radon educators for UGA program was interviewed. The following is a summary of information obtained from the interview.

The UGA Radon Education Program represents the program for the state. They partner with Southface Energy, but the money comes from the EPA. However, the EPA is thinking of cutting the program funding in all states even though the program has been active for the past 10 years (Edda Cotto-Rivera, personal communication, March 2012). Money from the EPA is currently funneled through the Georgia Department of Community Affairs. UGA applied for the grant through UGA Cooperative Extension with Southface and these two entities are the ones doing the radon services in Georgia. Funding may be pulled completely from the program because the EPA wants each state

to come up with its own funds and ways to deal with radon (Edda Cotto-Rivera, personal communication, March 2012).

When asked if there are any other organizations that would be interested in taking on the issue of radon, the educator mentioned a private organization called CANSAR (CANcer Survivors Against Radon). Another mentioned was the American Association of Radon Scientists and Technologists (AARST). Both national organizations are trying to come up with ideas and are working with senators and the government to see if they can keep the radon program. One issue they have is that each state deals with radon very differently and there is no consistency.

According to EPA data, about 21,000 people die due to radon exposure every year. Georgia is first in the Southeast in term of numbers of deaths (Edda Cotto-Rivera, personal communication, March 2012). An epidemiological formula is used to determine the number of deaths actually attributed to radon. There is some research being done to look at markers in the lung (Edda Cotto-Rivera, personal communication, March 2012).

When asked if they had found any problem areas from testing done by UGA, the educator said they were trying to get away from the EPA map because it is very old. The map will give you an idea, but it will also deter people from testing. UGA has found high levels in Cherokee and Douglas counties. The educator emphasized the point that the only way to know if your home has a radon problem is to test. In Georgia there are no laws on radon. You only have to disclose it if you know about it on your contract as a home seller. For radon test kits, the UGA program only keeps information for educational purposes only so they are able to follow up with homeowners about mitigation. With testing companies you can only get information for zip codes and

results are anonymous. There is no way to determine if a homeowner knows about high radon levels and chose not to disclose the information when selling their home (Edda Cotto-Rivera, personal communication, March 2012).

The educator said that if a home tests high for high for radon, for the general public it usually falls under home maintenance and is not usually covered by insurance. There are a few grants available to assist some with mitigation, but it is a very cumbersome process available only for some rural areas and with income guidelines.

Since Georgia is an unregulated state in terms of radon, testing is not required in schools, hospitals, or other public buildings. Because of budget issues, testing and fixing can be costly, so often the decision is made to not even test. The educator emphasized that radon can be in new or old homes, in those with or without basements, and in Florida they found radon on the 17th floor of a building because of building construction.

According the educator, about 15% of those testing their home in Georgia usually have levels over the recommended EPA action level. They have five educators that focus in Georgia and try to concentrate in the metro area. One county of concern is Douglas, but the program doesn't see a lot of people testing but have had many homes test high for radon. The UGA program has tried to reach out to Georgia residents through newspapers and events in radon national action month in January. They have also tried to reach families through kids with poster contests and with county extension messages. They have also tried to contact a few homeowners associations, but not that regularly. Mailing fliers has not been done due to budget issues. The educator said that there will probably be fewer activities instead of more because of funding cuts. The program may continue only to contact people already in their database if they are unable to continue to expand

the program to follow up on mitigation and testing (Edda Cotto-Rivera, personal communication, March 2012).

January is radon action month and the UGA Radon Program offers test kits during this month for free. During this time, they usually see a jump in kit requests. Usually the program in January sees a big jump in kit requests because it's radon action month and they offer test kits for free. The program did big TV report with CBS Atlanta and a program for half an hour on the 11oclock news. They had several phone calls as result of these programs, however the return rate of people requesting test kits was not great. People get something for free and they don't complete the process. They only had about 33% return when kits were free, but when they started charging a small fee they had almost double the return rate at 64% (Edda Cotto-Rivera, personal communication, March 2012).

For mitigation, the UGA program tells people to contact at least two or three mitigators for references. They have seen people charging up to $10,000 for remediation in an affluent area because they could take advantage of these areas. Usually $2500 is the top number for mitigation services they recommend, which is customary. People must be aware because Georgia does not have any radon regulations (Edda Cotto-Rivera, personal communication, March 2012).

There were initial attempts in 2011 to get laws into place in Georgia. The UGA radon program tried getting some things on the code. In Walton County, for example, they have a brochure they have to give to anyone planning on building a new home. It was through the county, but it was accomplished after quite some time pursuing it. It took twenty years to get to where the radon program is today, and the program is

probably going away. There is still a lot to be done, but instead of making progress it appears the program will be cut (Edda Cotto-Rivera, personal communication, March 2012).

The educator said that there was a cancer report from the President in 2011 that included radon and saw it as promising for the program. However, they believe radon will go into Healthy Homes Initiative instead of coming out of the EPA.

Radon Test Data:

Air Chek, Inc is the testing company UGA employs to analyze their radon test kits. This company was contacted for their results for Cobb, Fulton, DeKalb, and Gwinnett counties by individual zip codes and overall results for every county in Georgia (See Appendix B). Testing data goes back to 1986 up to present. Most of the data have been collected since 2003 when the UGA Cooperative Extension Service became involved in radon outreach (Shawn Price, personal communication, April 2012). The Air Chek program manager mentioned that the EPA Zone designations do not tell the full story. The zone designations are typically good starting points, but peeling the onion provides a lot of interesting things as you go deeper. The program manager said that Georgia has several counties that should also be designated as Zone 1 and many years ago some of the moderate counties had been proposed to be Zone 1, but officials with the State of Georgia decided to lessen the designation to Zone 2 (Shawn Price, personal communication, April 2012). So if the maps were simply related to geology and test results, they would draw a better picture. But when bureaucrats or politicians are factored in, the picture becomes fuzzy at best. To see another example of a state that

chose different zone designations, the program manager pointed out the Iowa-Missouri border on the EPA map. Notice how Iowa border counties are all red (Zone 1) and right at the state line the radon appears to lessen and the Missouri counties are orange (Zone 2). The program manager was not sure which Georgia counties were downgraded for sure, but had heard it was in and around Atlanta (Shawn Price, personal communication, April 2012).

Radon test result data was consistent with what the UGA radon educator reported at about 15% of tested homes exceeding the EPA action level. In the four highest risk counties, three of the four had 15% or more of test results that came back at over 4pCi/L (See Table 1). In DeKalb County, of 1954 tests, a total of 15.9% of homes tested were recommended to remediate their home. In Cobb County, of 3576 tests, a total of 10% of were recommended to remediate. In Fulton County, of 3209 tests, a total of 16% of tested homes recommended to remediate. In Gwinnett County, of 3317 tests, a total of 24.8% of tested homes were recommended to remediate. Of the four highest risk counties, Gwinnett County appears to be at most risk for high levels of radon with at least 9% more homes recommended for remediation than the other three.

TABLE 1: Summary of Radon Test Results for Cobb, Fulton, DeKalb, and Gwinnett Counties

County	Total Tests Analyzed	4-10 pCi/L	10-20 pCi/L	20-50 pCi/L	50-100 pCi/L	Percentage of tested homes recommened for remediation
DeKalb	1954	13.4%	2.1%	0.4%	0	15.9%
Cobb	3576	9.1%	0.8%	0.1%	0	10%
Fulton	3209	14.1%	1.6%	0.3%	0	16%
Gwinnett	3317	20.1%	4%	0.7%	0	24.8%

Looking at all counties in Georgia, it is clear that other counties also need to be reassessed for EPA risk level. Also, many counties are not heavily targeted for testing with some counties only having one test result and many having fewer than 10 results. One county that particularly stands out with the data available is Taliaferro County which is designated as low risk. Although only four tests have been conducted for the county and it is the least populated county in the state with a population of 1,863, all have come back showing extremely high levels of radon. One test was 20-50pCi/L, two were 50-100pCi/L, and one was 128pCi/L. Although these figures seem high for this county, it could be due to insufficient data numbers coming out of this county and more testing needs to be conducted. There are high test results from counties all across Georgia, even those that are low risk. It is important to reach all residents across the state for radon education.

Summary

According to testing data there are many other counties with levels similar to the four designated high-risk counties. Few test results coming from some areas indicate many counties are not being reached to promote testing. Funding cuts to the UGA Radon Education Program are threatening to prevent future progress in radon outreach. Survey results also indicate a need to further educate and promote testing in Georgia, especially in those determined to be at high risk by test results.

CHAPTER 5

Introduction

Data collected through the KAP survey, Air Chek, and interview with a UGA radon educator revealed a failure to reach residents residing in high-risk counties about radon. Funding cuts also are threatening to stop all progress on radon outreach. Recommendations for change are necessary for progress to be made on dealing with radon in Georgia.

Summary of Study

A door-to-door KAP survey was conducted to assess knowledge, attitudes, and practices related to radon of residents within a Cobb County neighborhood, which is designated as a high-risk radon county in Georgia. In addition to the survey, radon test results were collected from Air Chek, a company that reads the test kits given out by the UGA Radon Education Program. Test result summaries were obtained for each of the zip codes in the four high-risk counties as well as overall county data for all counties in Georgia. An interview was also conducted with one of the five radon educators for the UGA Radon Education Program. The results indicate a need for further outreach to Georgia homeowners as the survey revealed many homeowners have not tested and do not know the acceptable level for their home. Radon levels above the recommended level are found in most Georgia counties, and many counties are not being adequately reached by the radon program.

Conclusion

According to Air Chek data, many counties had radon levels similar to those of the four high-risk counties. This indicates a need to reassess the assigned zones of each county. The data clearly shows that the designated high-risk counties have at least 10% of tested homes needing remediation. The UGA Radon Education Program heavily focused on the metro Atlanta region. This was evident in the number of test results compared to many of the other counties. However, looking at the statistics it is clear that other counties have similar percentages of homes needing remediation as the highest risk counties. Those counties reporting few test results show a need for the program to expand to reach these areas. However, this effort appears stalled by the EPA budget cuts threatening to close the program. The survey, interview and test result data makes it clear that there is a radon problem in Georgia, and more efforts need to be done to promote more testing and reach more residents to educate about the harms of radon exposure. There is a need to promote the state government to add laws regulating radon not only in residential homes but also in public buildings. Budgets for a radon program also need to be considered to continue the work that the radon education program has taken years to establish.

Implications

Georgia is currently unregulated when it comes to radon. There are no laws requiring the testing or mitigation of homes or public buildings. There are also no laws requiring radon resistant construction in new homes. The UGA Radon Education Program is currently the only organization reaching out to Georgians for education and

testing. If it is shut down, all progress made on radon education in Georgia will come to a halt. The Georgia legislature needs to be approached to create laws regarding testing and disclosure of radon. Funding needs to be established to continue to the UGA program or create another entity responsible for radon outreach, which would be a difficult endeavor given present economic conditions. This creates an opportunity for Georgia to create a model for other unregulated states to adopt. There is no consistency to how any states deal with radon. A successful and sustainable program in Georgia would provide a model for all areas dealing with the same issue and in the end could save many lives.

Recommendations

Georgia needs to allocate funding towards either the UGA Radon Education Program or a new organization that would take on the outreach effort that has been underway for the past several years. Health departments are one entity that could take an active role in educating and promoting testing for their residents. Additional effort needs to be made to reach more Georgia counties to promote testing and educate residents based off of incoming data from test kits. The EPA map also needs to be rezoned according to geology and test results to paint a better picture as to the true radon risk for Georgia counties. The state legislature needs to be targeted to add radon laws requiring testing of homes before real estate transactions and in public buildings. New building codes requiring radon resistant construction also should be established. With these changes, Georgia residents will be better protected from the silent but deadly impact of radon gas.

While promoting action in the legislature in terms of increasing regulations and spending will be difficult, the state can also look at established programs in other regulated states or reach out to national organizations such as CANSAR or AARST to help create a self-sustaining radon program. Smoking cessation programs are another opportunity to promote radon education since smokers are at higher risk of developing lung cancer as a result of radon exposure.

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APPENDIX

Appendix A

Radon KAP Survey

Knowledge:

1. Have you heard of radon gas?

2. Do you think radon can: Cause asthma? Yes/no Cause cancer yes/no

3. Do you think you would be able to sense radon if it was in your home?

4. Do you know how to test for radon?

5. What do you think the EPA recommends as being the highest concentration of radon before you take corrective measures? 4pCi/L , 10pCi/L, 20pCi/L, 40pCi/L

6. Do you think people have to tell prospective buyers their homes radon level as a requirement of GA real estate law?

Attitudes:

6. Do you feel radon exposure is harmful, somewhat harmful, or not harmful?

7. Do you feel state health departments do a) too little, b) about the right amount, or c) too much with regard to informing the public on this issue?

8. Do you think radon disclosure should or should not be required in Georgia real estate law?

9. What communication method(s) do you prefer public health officials to use to educate and inform about issues such as radon? Newpaper? Internet? Email? HOA? Other resources?

Actual Practices:

10. Have you tested your home for radon?

11. If no to #10, why have you decided not to test your home?

Appendix B

Radon Test Result Summary by Zip Code – Cobb County, GA 4/4/2012

Zip	TOTAL TESTS	AVG pCi/L	MAX pCi/L	EPA RISK	0–3.9 pCi/L	4–10 pCi/L	10–20 pCi/L	20–50 pCi/L	50–100 pCi/L	100+ pCi/L
30006	5	1.4	2.4	HIGH	5	0	0	0	0	0
30007	3	2.8	4.0	HIGH	2	1	0	0	0	0
30008	57	1.7	7.2	HIGH	55	2	0	0	0	0
30060	97	2.2	18.3	HIGH	84	11	2	0	0	0
30061	4	0.8	1.8	HIGH	4	0	0	0	0	0
30062	516	1.8	11.3	HIGH	465	48	3	0	0	0
30064	239	1.7	23.6	HIGH	222	13	3	1	0	0
30065	5	1.5	5.6	HIGH	4	1	0	0	0	0
30066	528	1.5	18.4	HIGH	484	42	2	0	0	0
30067	161	2.4	11.7	HIGH	130	29	2	0	0	0
30068	345	2.1	16.6	HIGH	308	32	5	0	0	0
30080	434	1.3	12.2	HIGH	409	23	2	0	0	0
30081	1	1.2	1.2	HIGH	1	0	0	0	0	0
30082	136	2.8	23.6	HIGH	108	24	3	1	0	0
30090	1	0.0	0.0	HIGH	1	0	0	0	0	0
30101	242	1.5	11.1	HIGH	225	16	1	0	0	0
30106	32	4.5	35.1	HIGH	24	5	1	2	0	0
30126	138	3.1	20.2	HIGH	101	31	5	1	0	0
30127	131	1.7	8.7	HIGH	119	12	0	0	0	0
30144	210	1.2	8.2	HIGH	203	7	0	0	0	0
30152	170	1.6	7.1	HIGH	153	17	0	0	0	0
30156	1	0.6	0.6	HIGH	1	0	0	0	0	0
30168	46	1.3	4.6	HIGH	45	1	0	0	0	0
30339	74	2.0	8.6	HIGH	64	10	0	0	0	0
Grand Totals	3576	1.8	35.1		3217 90.0%	325 9.1%	29 0.8%	5 0.1%	0 0.0%	0 0.0%

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Radon Test Result Summary by Zip Code – Dekalb County, GA 4/4/2012

Zip	TOTAL TESTS	AVG pCi/L	MAX pCi/L	EPA RISK	0–3.9 pCi/L	4–10 pCi/L	10–20 pCi/L	20–50 pCi/L	50–100 pCi/L	100+ pCi/L
30002	27	1.7	9.9	HIGH	24	3	0	0	0	0
30021	33	1.3	11.5	HIGH	31	1	1	0	0	0
30030	185	1.9	26.9	HIGH	170	10	2	3	0	0
30031	2	2.2	3.8	HIGH	2	0	0	0	0	0
30032	88	2.0	12.4	HIGH	75	12	1	0	0	0
30033	163	1.8	9.4	HIGH	147	16	0	0	0	0
30034	56	1.6	6.0	HIGH	53	3	0	0	0	0
30035	19	1.4	7.5	HIGH	17	2	0	0	0	0
30036	1	1.0	1.0	HIGH	1	0	0	0	0	0
30037	3	2.8	5.1	HIGH	2	1	0	0	0	0
30038	80	3.1	20.2	HIGH	61	16	2	1	0	0
30058	65	3.0	43.1	HIGH	55	8	1	1	0	0
30072	1	2.5	2.5	HIGH	1	0	0	0	0	0
30074	2	4.5	6.7	HIGH	1	1	0	0	0	0
30079	7	1.2	4.5	HIGH	6	1	0	0	0	0
30083	62	1.7	9.0	HIGH	57	5	0	0	0	0
30084	137	3.0	26.3	HIGH	111	19	6	1	0	0
30085	2	0.8	0.9	HIGH	2	0	0	0	0	0
30086	6	1.3	2.1	HIGH	6	0	0	0	0	0
30087	193	3.0	19.4	HIGH	146	41	6	0	0	0
30088	31	3.2	24.0	HIGH	26	3	1	1	0	0
30294	31	3.9	16.3	HIGH	22	4	5	0	0	0
30317	35	0.8	7.2	HIGH	34	1	0	0	0	0
30319	141	2.5	14.7	HIGH	114	25	2	0	0	0
30322	3	0.8	0.9	HIGH	3	0	0	0	0	0
30329	71	2.6	8.9	HIGH	54	17	0	0	0	0
30338	150	2.8	17.3	HIGH	124	19	7	0	0	0
30340	54	2.8	10.1	HIGH	41	12	1	0	0	0

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Radon Test Result Summary by Zip Code – Dekalb County, GA 4/4/2012

Zip	TOTAL TESTS	AVG pCi/L	MAX pCi/L	EPA RISK	0–3.9 pCi/L	4–10 pCi/L	10–20 pCi/L	20–50 pCi/L	50–100 pCi/L	100+ pCi/L
30341	110	2.0	10.1	HIGH	99	9	2	0	0	0
30345	138	3.0	16.0	HIGH	109	25	4	0	0	0
30346	11	2.0	3.6	HIGH	11	0	0	0	0	0
30359	2	1.8	2.1	HIGH	2	0	0	0	0	0
30360	42	2.6	11.5	HIGH	33	8	1	0	0	0
30366	3	0.5	1.1	HIGH	3	0	0	0	0	0
Grand Totals	1954	2.4	43.1		1643 84.1%	262 13.4%	42 2.1%	7 0.4%	0 0.0%	0 0.0%

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Radon Test Result Summary by Zip Code – Fulton County, GA 4/4/2012

Zip	TOTAL TESTS	AVG pCi/L	MAX pCi/L	EPA RISK	0–3.9 pCi/L	4–10 pCi/L	10–20 pCi/L	20–50 pCi/L	50–100 pCi/L	100+ pCi/L
30004	156	2.1	23.9	HIGH	139	12	4	1	0	0
30005	176	1.9	23.2	HIGH	157	16	2	1	0	0
30009	12	2.5	7.3	HIGH	10	2	0	0	0	0
30022	248	2.0	16.7	HIGH	230	16	2	0	0	0
30023	1	0.0	0.0	HIGH	1	0	0	0	0	0
30075	564	2.5	19.5	HIGH	464	93	7	0	0	0
30076	319	2.2	11.5	HIGH	276	42	1	0	0	0
30077	6	0.8	2.5	HIGH	6	0	0	0	0	0
30213	34	1.3	5.8	HIGH	32	2	0	0	0	0
30268	10	4.0	8.7	HIGH	6	4	0	0	0	0
30291	35	2.2	10.0	HIGH	28	6	1	0	0	0
30301	5	2.7	4.8	HIGH	4	1	0	0	0	0
30302	1	0.5	0.5	HIGH	1	0	0	0	0	0
30303	14	1.3	5.2	HIGH	13	1	0	0	0	0
30304	2	1.4	2.4	HIGH	2	0	0	0	0	0
30305	102	1.8	10.4	HIGH	93	8	1	0	0	0
30306	148	2.2	12.0	HIGH	122	25	1	0	0	0
30307	117	1.7	12.1	HIGH	105	9	3	0	0	0
30308	30	3.0	18.9	HIGH	24	4	2	0	0	0
30309	59	3.0	15.2	HIGH	45	13	1	0	0	0
30310	12	1.7	9.3	HIGH	10	2	0	0	0	0
30311	25	3.6	12.0	HIGH	17	7	1	0	0	0
30312	39	1.6	10.5	HIGH	35	3	1	0	0	0
30313	5	0.8	2.3	HIGH	5	0	0	0	0	0
30314	11	1.8	5.3	HIGH	10	1	0	0	0	0
30315	25	1.4	7.2	HIGH	23	2	0	0	0	0
30316	81	1.2	6.1	HIGH	75	6	0	0	0	0
30318	155	3.5	23.1	HIGH	113	33	6	3	0	0

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Radon Test Result Summary by Zip Code – Fulton County, GA 4/4/2012

Zip	TOTAL TESTS	AVG pCi/L	MAX pCi/L	EPA RISK	0–3.9 pCi/L	4–10 pCi/L	10–20 pCi/L	20–50 pCi/L	50–100 pCi/L	100+ pCi/L
30320	1	1.5	1.5	HIGH	1	0	0	0	0	0
30321	2	1.8	3.6	HIGH	2	0	0	0	0	0
30324	71	2.9	20.7	HIGH	58	8	4	1	0	0
30325	1	0.0	0.0	HIGH	1	0	0	0	0	0
30326	18	2.7	7.1	HIGH	14	4	0	0	0	0
30327	125	3.4	17.1	HIGH	88	31	6	0	0	0
30328	156	2.5	12.9	HIGH	126	27	3	0	0	0
30330	2	1.6	1.8	HIGH	2	0	0	0	0	0
30331	59	2.2	21.3	HIGH	50	6	2	1	0	0
30332	2	1.4	2.7	HIGH	2	0	0	0	0	0
30334	1	0.6	0.6	HIGH	1	0	0	0	0	0
30337	11	1.4	7.3	HIGH	10	1	0	0	0	0
30342	125	3.2	21.1	HIGH	88	33	2	2	0	0
30344	39	1.9	11.1	HIGH	32	6	1	0	0	0
30347	1	6.6	6.6	HIGH	0	1	0	0	0	0
30349	41	1.4	4.3	HIGH	39	2	0	0	0	0
30350	123	2.5	8.9	HIGH	101	22	0	0	0	0
30354	21	0.7	5.3	HIGH	20	1	0	0	0	0
30355	2	8.4	14.9	HIGH	1	0	1	0	0	0
30357	3	2.2	2.5	HIGH	3	0	0	0	0	0
30364	2	0.6	1.1	HIGH	2	0	0	0	0	0
30371	1	1.4	1.4	HIGH	1	0	0	0	0	0
30379	1	3.5	3.5	HIGH	1	0	0	0	0	0
31106	2	3.0	4.0	HIGH	1	1	0	0	0	0
31139	5	2.7	4.3	HIGH	3	2	0	0	0	0
31150	2	0.7	1.4	HIGH	2	0	0	0	0	0
Grand Totals	3209	2.3	23.9		2695 84.0%	453 14.1%	52 1.6%	9 0.3%	0 0.0%	0 0.0%

Air Chek, Inc. 1936 Butler Bridge Rd, Mills River, NC 28759–3892 Phone: (828) 684–0893 Fax: (828) 684–8498

Radon Test Result Summary by Zip Code – Gwinnett County, GA 4/4/2012

Zip	TOTAL TESTS	AVG pCi/L	MAX pCi/L	EPA RISK	0–3.9 pCi/L	4–10 pCi/L	10–20 pCi/L	20–50 pCi/L	50–100 pCi/L	100+ pCi/L
30003	2	2.5	4.3	HIGH	1	1	0	0	0	0
30010	1	1.2	1.2	HIGH	1	0	0	0	0	0
30017	161	4.5	26.8	HIGH	91	56	13	1	0	0
30019	271	4.3	28.8	HIGH	170	77	19	5	0	0
30024	294	2.0	13.1	HIGH	266	24	4	0	0	0
30026	1	0.5	0.5	HIGH	1	0	0	0	0	0
30029	1	5.5	5.5	HIGH	0	1	0	0	0	0
30039	196	4.2	34.9	HIGH	119	67	6	4	0	0
30042	1	0.6	0.6	HIGH	1	0	0	0	0	0
30043	341	2.9	28.3	HIGH	272	53	13	3	0	0
30044	248	2.2	26.1	HIGH	210	32	5	1	0	0
30045	203	4.1	37.0	HIGH	142	40	20	1	0	0
30046	37	3.5	18.5	HIGH	25	10	2	0	0	0
30047	319	3.0	54.4	HIGH	243	68	6	1	1	0
30048	2	1.8	2.6	HIGH	2	0	0	0	0	0
30049	5	2.5	4.8	HIGH	3	2	0	0	0	0
30071	33	1.4	6.5	HIGH	31	2	0	0	0	0
30078	270	3.6	28.1	HIGH	176	81	11	2	0	0
30092	203	2.3	14.4	HIGH	177	21	5	0	0	0
30093	75	1.6	4.9	HIGH	70	5	0	0	0	0
30096	205	2.4	14.9	HIGH	173	29	3	0	0	0
30097	142	2.4	11.9	HIGH	122	18	2	0	0	0
30098	3	1.4	1.6	HIGH	3	0	0	0	0	0
30518	114	2.0	18.0	HIGH	96	17	1	0	0	0
30519	189	5.3	27.4	HIGH	99	63	22	5	0	0
Grand Totals	3317	3.2	54.4		2494	667	132	23	1	0
					75.2%	20.1%	4.0%	0.7%	0.0%	0.0%

Air Chek, Inc. 1936 Butler Bridge Rd, Mills River, NC 28759–3892 Phone: (828) 684–0893 Fax: (828) 684–8498

Radon Test Result Summary by County for the State of Georgia – 4/4/2012

County	TOTAL TESTS	AVG pCi/L	MAX pCi/L	EPA RISK	0–3.9 pCi/L	4–10 pCi/L	10–20 pCi/L	20–50 pCi/L	50–100 pCi/L	100+ pCi/L
	373	3.2	144.0	UNKNOWN	310	45	11	5	1	1
Appling	1	0.0	0.0	LOW	1	0	0	0	0	0
Bacon	2	0.0	0.0	LOW	2	0	0	0	0	0
Baldwin	21	1.8	10.6	LOW	19	1	1	0	0	0
Banks	77	3.3	21.8	MODERATE	56	17	3	1	0	0
Barrow	350	4.9	85.8	MODERATE	200	120	24	4	2	0
Bartow	95	3.0	12.8	MODERATE	65	28	2	0	0	0
Ben Hill	8	0.5	1.2	LOW	8	0	0	0	0	0
Berrien	4	0.4	1.1	LOW	4	0	0	0	0	0
Bibb	217	1.3	25.5	LOW	204	11	1	1	0	0
Bleckley	5	0.6	1.1	LOW	5	0	0	0	0	0
Brooks	4	0.8	1.6	LOW	4	0	0	0	0	0
Bryan	2	0.1	0.2	LOW	2	0	0	0	0	0
Bulloch	16	0.7	6.5	LOW	15	1	0	0	0	0
Burke	5	0.6	1.3	LOW	5	0	0	0	0	0
Butts	35	3.3	15.5	MODERATE	25	9	1	0	0	0
Camden	14	0.5	3.1	LOW	14	0	0	0	0	0
Candler	2	0.7	0.9	LOW	2	0	0	0	0	0
Carroll	138	3.3	26.5	MODERATE	105	27	3	3	0	0
Catoosa	36	2.9	24.2	MODERATE	29	6	0	1	0	0
Charlton	2	0.0	0.0	LOW	2	0	0	0	0	0
Chatham	94	1.8	42.0	LOW	84	9	0	1	0	0
Chattahoochee	2	0.2	0.5	LOW	2	0	0	0	0	0
Chattooga	16	2.8	11.2	LOW	12	3	1	0	0	0
Cherokee	518	1.6	17.9	MODERATE	479	36	3	0	0	0
Clarke	1147	2.0	25.2	MODERATE	1013	110	21	3	0	0
Clay	1	0.0	0.0	LOW	1	0	0	0	0	0
Clayton	172	2.3	8.9	MODERATE	134	38	0	0	0	0

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Radon Test Result Summary by County for the State of Georgia – 4/4/2012

County	TOTAL TESTS	AVG pCi/L	MAX pCi/L	EPA RISK	0–3.9 pCi/L	4–10 pCi/L	10–20 pCi/L	20–50 pCi/L	50–100 pCi/L	100+ pCi/L
Clinch	3	2.5	6.7	LOW	2	1	0	0	0	0
Cobb	3576	1.8	35.1	HIGH	3217	325	29	5	0	0
Coffee	3	1.2	2.1	LOW	3	0	0	0	0	0
Colquitt	20	0.5	1.9	LOW	20	0	0	0	0	0
Columbia	101	1.2	7.5	LOW	98	3	0	0	0	0
Cook	2	2.1	3.9	LOW	2	0	0	0	0	0
Coweta	140	2.2	10.2	MODERATE	119	20	1	0	0	0
Crawford	4	4.0	7.7	LOW	2	2	0	0	0	0
Crisp	11	0.1	1.0	LOW	11	0	0	0	0	0
Dade	16	2.0	6.0	LOW	13	3	0	0	0	0
Dawson	183	2.3	12.7	MODERATE	160	21	2	0	0	0
Decatur	13	0.9	2.0	LOW	13	0	0	0	0	0
DeKalb	1954	2.4	43.1	HIGH	1643	262	42	7	0	0
Dodge	1	0.0	0.0	LOW	1	0	0	0	0	0
Dooly	4	0.2	0.8	LOW	4	0	0	0	0	0
Dougherty	39	0.9	11.0	LOW	38	0	1	0	0	0
Douglas	201	4.2	31.3	MODERATE	127	55	15	4	0	0
Early	2	2.8	5.5	LOW	1	1	0	0	0	0
Effingham	8	0.3	1.3	LOW	8	0	0	0	0	0
Elbert	534	2.6	71.0	MODERATE	437	83	11	2	1	0
Emanuel	7	0.7	3.3	LOW	7	0	0	0	0	0
Evans	2	0.7	1.2	LOW	2	0	0	0	0	0
Fannin	143	4.0	17.0	MODERATE	88	43	12	0	0	0
Fayette	319	2.7	13.1	MODERATE	257	53	9	0	0	0
Floyd	85	1.6	12.0	MODERATE	78	6	1	0	0	0
Forsyth	342	1.5	9.0	MODERATE	318	24	0	0	0	0
Franklin	140	2.9	26.0	MODERATE	111	22	4	3	0	0
Fulton	3209	2.3	23.9	HIGH	2695	453	52	9	0	0

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Radon Test Result Summary by County for the State of Georgia – 4/4/2012

County	TOTAL TESTS	AVG pCi/L	MAX pCi/L	EPA RISK	0–3.9 pCi/L	4–10 pCi/L	10–20 pCi/L	20–50 pCi/L	50–100 pCi/L	100+ pCi/L
Gilmer	104	4.6	33.4	MODERATE	71	24	4	5	0	0
Glascock	4	1.3	2.3	LOW	4	0	0	0	0	0
Glynn	39	0.8	6.8	LOW	37	2	0	0	0	0
Gordon	17	2.8	5.9	LOW	12	5	0	0	0	0
Grady	1	0.0	0.0	LOW	1	0	0	0	0	0
Greene	27	2.3	8.0	MODERATE	20	7	0	0	0	0
Gwinnett	3317	3.2	54.4	HIGH	2494	667	132	23	1	0
Habersham	173	3.4	56.8	MODERATE	126	42	3	1	1	0
Hall	1343	3.4	45.9	MODERATE	931	357	50	5	0	0
Hancock	4	2.8	7.4	LOW	3	1	0	0	0	0
Haralson	23	3.7	12.4	MODERATE	15	6	2	0	0	0
Harris	41	9.7	224.9	MODERATE	35	2	1	1	1	1
Hart	77	3.8	34.2	MODERATE	53	18	5	1	0	0
Heard	9	1.6	5.0	MODERATE	8	1	0	0	0	0
Henry	307	2.6	14.2	MODERATE	242	63	2	0	0	0
Houston	62	1.2	6.5	LOW	61	1	0	0	0	0
Jackson	540	3.9	30.1	MODERATE	336	175	25	4	0	0
Jasper	28	2.7	8.9	MODERATE	23	5	0	0	0	0
Jeff Davis	1	0.0	0.0	LOW	1	0	0	0	0	0
Jefferson	6	2.0	4.0	LOW	5	1	0	0	0	0
Johnson	1	2.2	2.2	LOW	1	0	0	0	0	0
Jones	20	1.8	6.3	LOW	18	2	0	0	0	0
Lamar	16	4.7	14.5	MODERATE	9	4	3	0	0	0
Laurens	30	1.4	5.3	LOW	27	3	0	0	0	0
Lee	8	0.8	2.6	LOW	8	0	0	0	0	0
Liberty	7	0.3	1.2	LOW	7	0	0	0	0	0
Lincoln	9	0.4	2.1	LOW	9	0	0	0	0	0
Lowndes	21	1.0	3.1	LOW	21	0	0	0	0	0

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Radon Test Result Summary by County for the State of Georgia – 4/4/2012

County	TOTAL TESTS	AVG pCi/L	MAX pCi/L	EPA RISK	0–3.9 pCi/L	4–10 pCi/L	10–20 pCi/L	20–50 pCi/L	50–100 pCi/L	100+ pCi/L
Lumpkin	109	3.3	15.8	MODERATE	73	34	2	0	0	0
Macon	3	0.4	1.3	LOW	3	0	0	0	0	0
Madison	585	2.1	26.1	MODERATE	497	74	12	2	0	0
Marion	15	1.5	10.2	LOW	13	1	1	0	0	0
McDuffie	18	3.7	36.2	LOW	14	3	0	1	0	0
McIntosh	10	0.8	2.1	LOW	10	0	0	0	0	0
Meriwether	23	1.4	3.4	MODERATE	23	0	0	0	0	0
Mitchell	13	0.8	4.5	LOW	12	1	0	0	0	0
Monroe	141	3.1	21.5	MODERATE	110	23	5	3	0	0
Montgomery	2	1.0	2.0	LOW	2	0	0	0	0	0
Morgan	63	1.4	9.4	MODERATE	58	5	0	0	0	0
Murray	11	1.1	3.1	LOW	11	0	0	0	0	0
Muscogee	240	1.0	13.7	LOW	233	6	1	0	0	0
Newton	315	2.5	16.7	MODERATE	257	49	9	0	0	0
Oconee	587	1.8	33.2	MODERATE	525	54	7	1	0	0
Oglethorpe	71	2.5	15.1	MODERATE	58	11	2	0	0	0
Paulding	88	2.4	17.2	MODERATE	77	6	5	0	0	0
Peach	6	2.1	5.1	LOW	5	1	0	0	0	0
Pickens	90	4.0	22.3	MODERATE	56	29	3	2	0	0
Pierce	19	0.3	1.9	LOW	19	0	0	0	0	0
Pike	27	1.4	5.8	MODERATE	24	3	0	0	0	0
Polk	55	3.9	21.5	LOW	37	12	5	1	0	0
Pulaski	3	1.1	1.7	LOW	3	0	0	0	0	0
Putnam	31	7.0	90.4	LOW	21	7	1	1	1	0
Rabun	91	3.6	21.6	MODERATE	67	16	7	1	0	0
Randolph	6	1.6	3.6	LOW	6	0	0	0	0	0
Richmond	170	1.3	12.1	MODERATE	164	4	2	0	0	0
Rockdale	205	3.2	29.0	MODERATE	162	34	4	5	0	0

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Radon Test Result Summary by County for the State of Georgia – 4/4/2012

County	TOTAL TESTS	AVG pCi/L	MAX pCi/L	EPA RISK	0–3.9 pCi/L	4–10 pCi/L	10–20 pCi/L	20–50 pCi/L	50–100 pCi/L	100+ pCi/L
Schley	1	0.0	0.0	LOW	1	0	0	0	0	0
Screven	9	0.5	1.1	LOW	9	0	0	0	0	0
Spalding	54	3.9	20.5	MODERATE	40	10	3	1	0	0
Stephens	233	2.6	31.0	MODERATE	187	39	5	2	0	0
Stewart	7	0.6	1.8	LOW	7	0	0	0	0	0
Sumter	140	0.9	8.3	LOW	135	5	0	0	0	0
Talbot	2	0.5	1.0	MODERATE	2	0	0	0	0	0
Taliaferro	4	80.7	128.0	LOW	0	0	0	1	2	1
Tattnall	2	0.6	1.0	LOW	2	0	0	0	0	0
Telfair	3	0.4	1.0	LOW	3	0	0	0	0	0
Terrell	1	1.1	1.1	LOW	1	0	0	0	0	0
Thomas	10	1.5	6.1	LOW	9	1	0	0	0	0
Tift	45	0.9	4.7	LOW	43	2	0	0	0	0
Toombs	9	0.4	1.6	LOW	9	0	0	0	0	0
Towns	110	3.7	41.3	MODERATE	79	23	6	2	0	0
Troup	38	2.5	11.1	MODERATE	30	6	2	0	0	0
Turner	1	0.9	0.9	LOW	1	0	0	0	0	0
Twiggs	2	5.3	10.7	LOW	1	0	1	0	0	0
Union	115	4.4	36.6	MODERATE	67	39	7	2	0	0
Upson	102	1.1	13.4	MODERATE	96	4	2	0	0	0
Walker	55	2.1	16.8	MODERATE	47	7	1	0	0	0
Walton	1414	3.5	37.3	MODERATE	1004	335	55	20	0	0
Ware	20	0.4	1.5	LOW	20	0	0	0	0	0
Warren	4	1.1	2.5	LOW	4	0	0	0	0	0
Washington	37	1.1	6.4	LOW	34	3	0	0	0	0
Wayne	7	0.4	1.0	LOW	7	0	0	0	0	0
Webster	1	0.5	0.5	LOW	1	0	0	0	0	0
Wheeler	3	0.4	0.7	LOW	3	0	0	0	0	0

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Radon Test Result Summary by County for the State of Georgia – 4/4/2012

County	TOTAL TESTS	AVG pCi/L	MAX pCi/L	EPA RISK	0–3.9 pCi/L	4–10 pCi/L	10–20 pCi/L	20–50 pCi/L	50–100 pCi/L	100+ pCi/L
White	96	2.8	28.0	MODERATE	78	16	1	1	0	0
Whitfield	96	2.3	11.4	MODERATE	71	24	1	0	0	0
Wilcox	5	1.3	4.4	LOW	4	1	0	0	0	0
Wilkes	17	0.5	1.4	LOW	17	0	0	0	0	0
Wilkinson	2	1.6	2.6	LOW	2	0	0	0	0	0
Worth	1	2.7	2.7	LOW	1	0	0	0	0	0
Grand Totals	26297	2.6	224.9		21410 81.4%	4112 15.6%	627 2.4%	135 0.5%	10 0.0%	3 0.0%

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