National Radon Results: 1985 to 2003*

Brian Gregory[1]
Philip P. Jalbert, U.S. EPA

* Note: This report was initially entitled "National Radon Results: 1985 to 1999." This is an interim update that provides results through 2003 for radon mitigation in existing homes and the construction of new homes with radon-resistant features. A full update to the report with additional analyses and discussion is currently in development and, when completed, will supercede this interim update. (October 2004)

Since the mid-1980s the United States has made significant progress in reducing the risk from exposure to radon. This progress is the result of a long-term effort between EPA, citizens, non-profit organizations, state and local governments, the business community, and other Federal agencies working together. More adult Americans are knowledgeable about radon than at any time since the mid-1980s, when radon became a National health concern. Approximately two-thirds (66%) of Americans are generally aware of radon, and of those three-quarters (75%, on average) understand that radon is a health hazard. Since the mid-1980s, at least 18 million homes have been tested for radon and nearly 800,000 existing homes with elevated radon levels have been mitigated. Approximately 1.2 million new homes have been built with radon-resistant features since 1990. EPA will continue to focus its efforts, and those of its partners, on achieving actual risk reduction through the mitigation of existing homes and the building of new homes to be radon-resistant. EPA's estimates of risk reduction are predicated upon mitigation systems being properly installed, operated and maintained. As a result of these actions to reduce radon levels in homes through 2003, EPA estimates that approximately 650 future lung cancer deaths will be prevented each year. This annual rate is expected to rise as radon levels are lowered in more new and existing homes.

A. INTRODUCTION

For more than 15 years, the U.S. Environmental Protection Agency (EPA) has actively pursued a multi-faceted campaign to reduce the adverse effect on the health of Americans caused by exposure to radon in indoor air. This report presents recent findings and historic trends in radon-related activities. Measures of progress in the EPA radon program presented in this report fall into four major categories:

1. How aware the general public is about radon,
2. The number of homes tested to determine the radon level,
3. The number of existing homes with elevated radon levels that have been mitigated, and
4. The number of homes built with radon-resistant new construction features.

B. RADON AWARENESS

Background. The EPA obtained data regarding the public's awareness of the radon issues four times over the seven year period 1993-1999: in 1993, 1994, 1996, and 1999. These data were gathered through telephone interview surveys of randomly selected American adults. The first three of these surveys were conducted by a contractor for the Conference of Radiation Control Program Directors (CRCPD), under the terms of a cooperative agreement with EPA (CRCPD Radon Survey; 1993, 1994, and 1996). The last survey was contracted directly by the EPA to the Center for Survey Research and Analysis (CSRA), University of Connecticut (University of Connecticut; 1999), using a refined methodology similar to that of the CRCPD surveys.

The EPA has defined *knowledgeable* awareness as more than simply having heard of radon. In addition to having heard of radon, a respondent must be able to identify that exposure to radon is a health hazard, and that radon is a naturally occurring, colorless, odorless gas. The following three questions were posed to a sample of Americans in each of the four surveys. They represent the components of knowledgeable awareness.

1. Are you aware of radon? [that is, have you ever heard of radon?]
2. Is radon a health hazard? [yes or no]
3. What is radon? [selected from a multiple-choice list]

The following three bar graphs and discussion illustrate the survey responses to these questions.

Figure 1

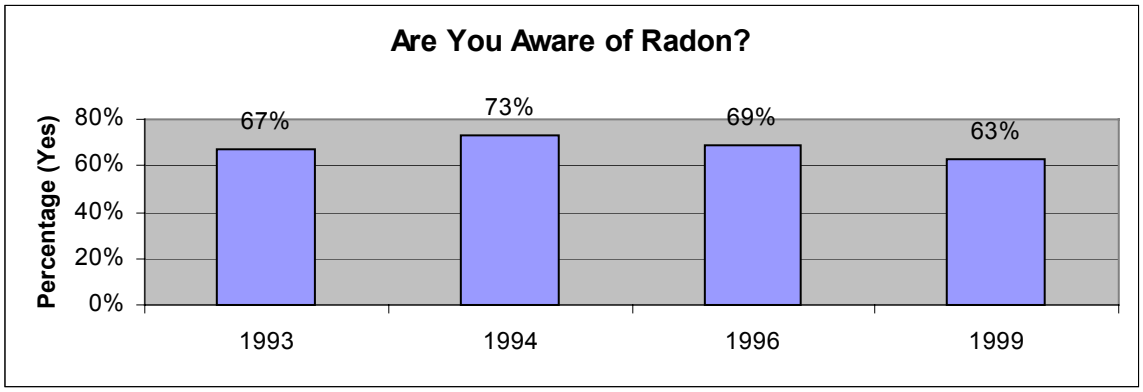


Figure 2

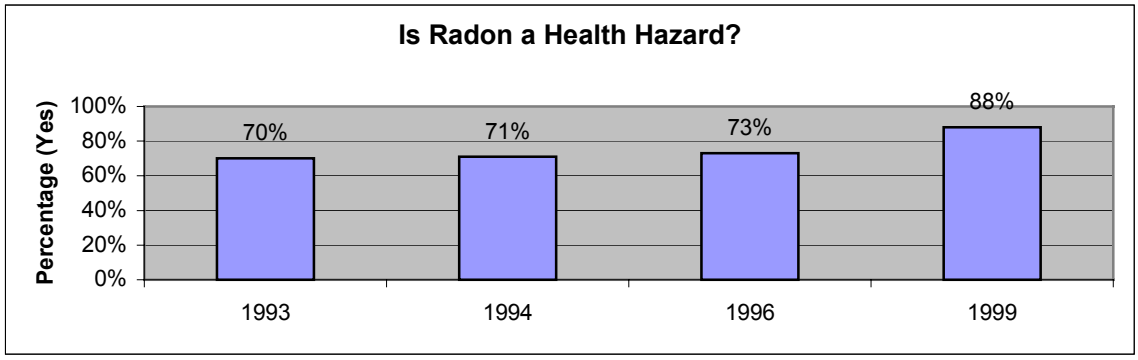
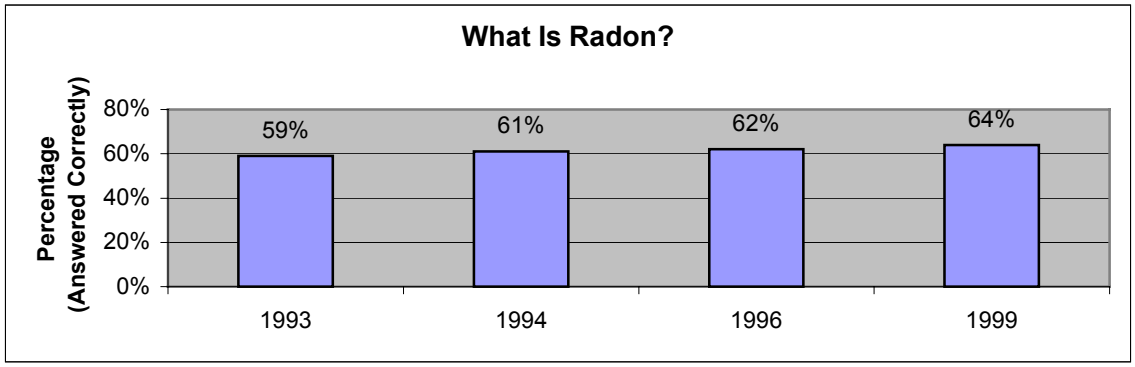


Figure 3



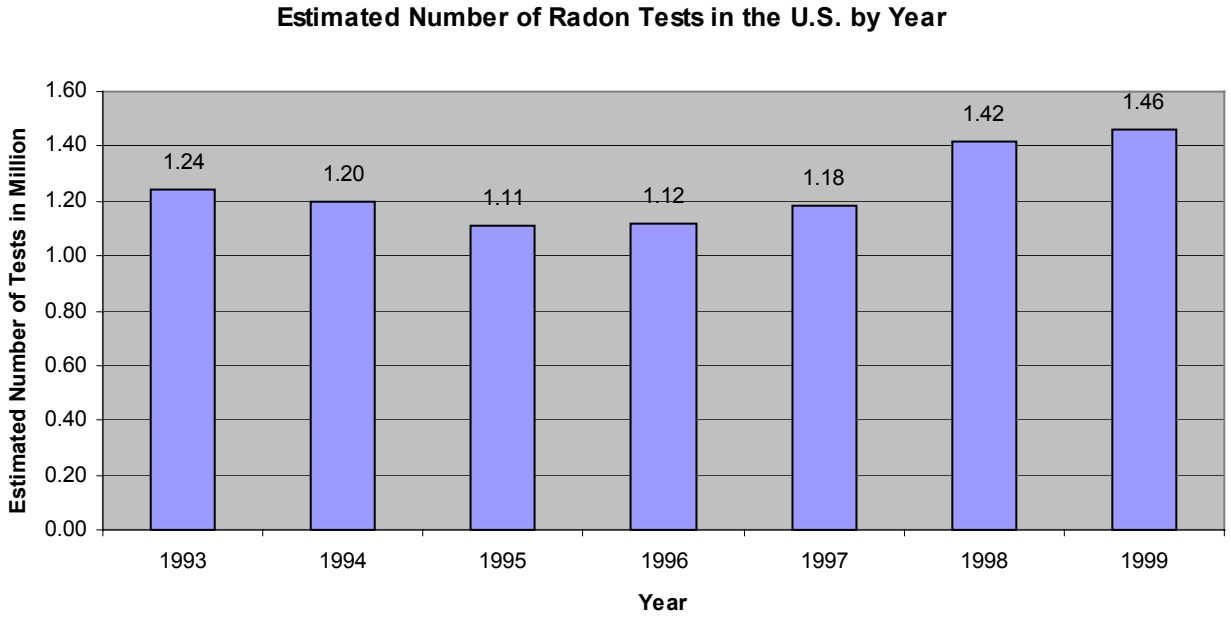
Discussion. In 1999, approximately 63% of respondents indicated that they were aware of radon. Of that group, 88% said they were aware that radon poses a health hazard, and 64% were able to correctly identify radon's characteristics from a multiple-choice list. On average, about 68% of those surveyed between 1993-1999 were aware of radon. However, as **Figure 1** shows, after its 1994 peak the overall level of radon awareness has decreased somewhat. In part, this drop may be due to less media coverage of the radon issue in recent years.

The data in **Figure 2** and **Figure 3** show that among those aware of radon (Figure 1), understanding of radon as a health hazard has remained steady or risen only slightly over time. Within this same group, knowledge about what radon is has also remained steady. Combined with other influences, these two factors have contributed to a rising trend in the number of homes mitigated since the mid-1990's. Apparently, many people aware of radon's risk are taking action. See endnote[2] for further details on Figures 1, 2 and 3.

C. RADON TESTING

Background. Radon testing activity is the most difficult of the four radon progress measures to track at this time. This difficulty stems from the lack of a reliable and consistent sources of data at all geographic levels.

Figure 4



For example, homeowners often cannot accurately recall when or if their home was tested. Also, a homeowner may not know if a test was done before they purchased their home. In addition, most States don't collect testing information or require companies to provide it. Furthermore, there is no Federal requirement for test companies to report testing or related information.

As a result, an indicator[3] composed of several sources has been developed as a tool for estimating the level of radon testing activity. **Figure 4** shows the number of radon tests estimated to have been completed each year, from 1993 to 1999. These sources of data include the State of New Jersey's mandatory reporting

records; national data from several testing laboratories who helpfully provided their data voluntarily; data on radon test kit sales from the National Safety Council (NSC) and its affiliates; and data from the 1993, 1994, and 1996 CRCPD national radon surveys. However, for the time period prior to 1993, the estimate is not composite based, but based solely on the 1993 CRCPD radon survey results.

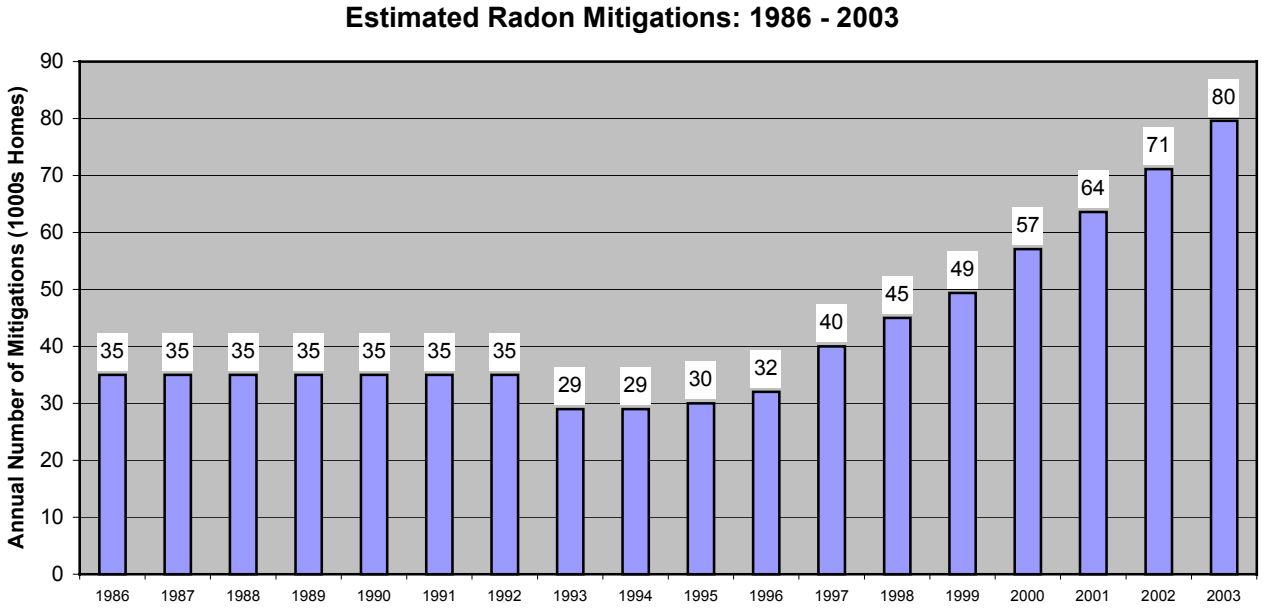
Discussion. In 1999, an estimated 1.5 million homes were tested for radon. Prior to 1993, approximately 9 million homes were tested for radon[4]. According to the indexed estimates used to construct **Figure 4**, the trend in radon testing has been rising since the mid-1990s. These data yield a conservative estimated total of nearly 18 million homes that were tested between the mid-1980s and 1999.

Since a large percentage of radon tests are associated with real estate transactions, the trend in the volume of radon testing tends to follow the volume of real estate transactions. Although the testing rates rose steadily through most of the 1990s, the estimate does not seem to fully reflect the strong rise in the volume of real estate transactions during 1999. It may be that in a particularly strong market (a seller's market), prospective buyers demand fewer contingencies, including requests to test for radon, and sellers are less likely to agree to similar contingencies.

D. MITIGATION OF EXISTING HOMES

Background. Data on radon mitigation for 1994 to 2003 were obtained in cooperation with the three largest U.S. radon mitigation fan manufacturers, which account for the bulk of the vent fan market. These manufacturers claim that the fans, a critical component for radon mitigation, have not to this point been used in significant numbers for purposes other than radon mitigation.

Figure 5



National Radon Results: 1985 to 2003

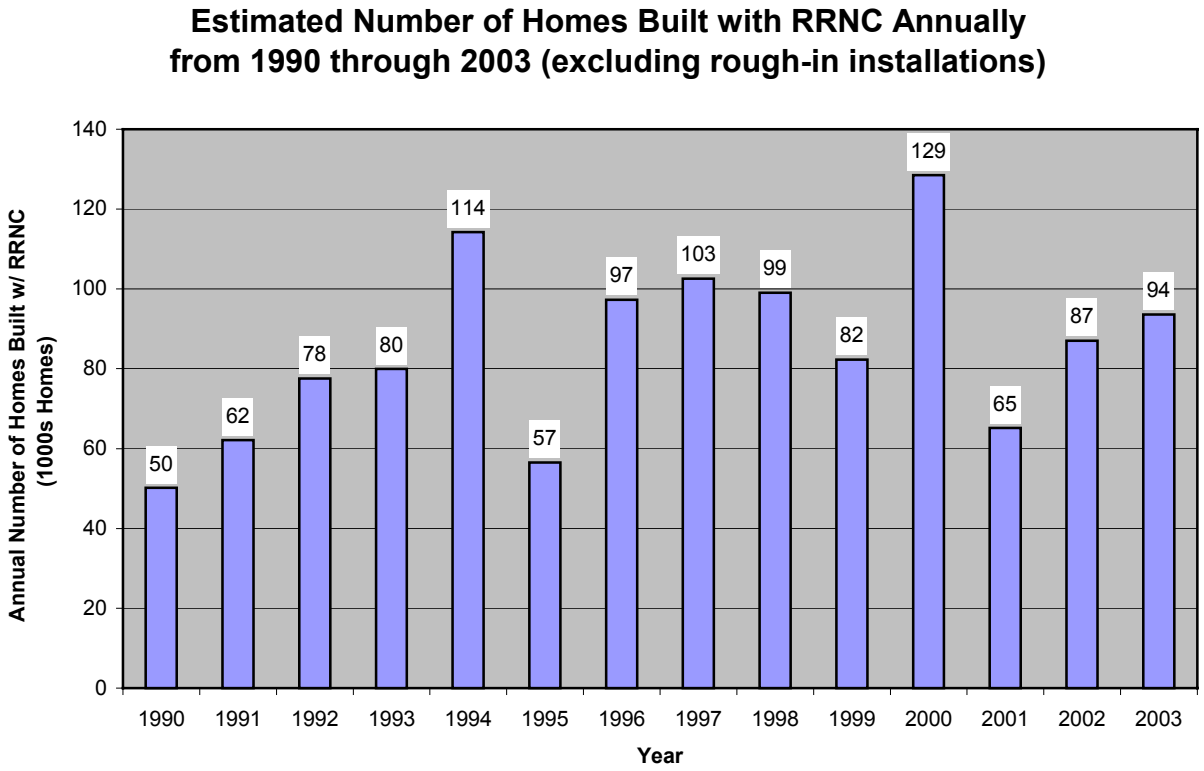
Discussion. Approximately 800,000 homes that previously had elevated radon levels (i.e., 4 picoCuries (pCi/L) or more) have been mitigated since the mid-1980s. In 2003, an estimated 80,000 homes were mitigated for elevated radon levels. Prior to 1993, approximately 245,000 homes with elevated radon levels were mitigated. Data for the years prior to 1993 (1986-1992) have been estimated based on the 1993 CRCPD radon survey.

As **Figure 5** indicates, radon mitigations have increased steadily since 1994. The steady increase in the rate of mitigation activity is a significant indicator of the Agency's success in recent years. The upward trend in mitigation activity is consistent with available State level data. For example, New Jersey recorded 2,042 mitigations in 1992, and that number increased steadily over the years to 2,822 mitigations in 1999 for an increase of nearly 40% over the 7-year period.

E. RADON-RESISTANT NEW CONSTRUCTION

Background. Each year the National Association of Home Builders (NAHB) Research Center conducts a nationwide survey of home builders to track the number of homes built and to learn more about specific construction techniques and practices being used. One of those practices is Radon-Resistant New Construction (RRNC), about which the NAHB Research Center has collected information since 1990[5]. **Figure 6** shows the annual number of homes estimated to have been built with RRNC features.

Figure 6



Notes for Figure 6:
1. 2003 data projection based on 2000-2002 average.
2. A recent EPA review of historical NAHB Research Center reports revealed that a significant number of rough-in installations have been reported as radon-reducing features since 1990. A rough-in installation typically involves a capped pipe in the basement that could later be used for connecting to a radon-reduction system and, as such, does not provide any benefit unless it is connected. EPA presently excludes rough-in installations when estimating the number of new homes built with RRNC.

Discussion. The total number of homes built with RRNC features since 1990 is estimated to be 1.2 million. In 2002, approximately 87,000 (7%) of all new single-family detached homes built in the U.S. included RRNC features. Also, about 18% of all new homes built in Zone 1 (high radon potential areas) during 2002 included radon-resistant features, which translates to about 49,000 homes. Since 1990, an estimated 700,000 homes in Zone 1 have been built radon-resistant.

F. METHODOLOGY

The most recent national survey yielding information on testing and mitigation rates, was conducted by the Center for Survey Research and Analysis (CSRA), Storrs, Connecticut. Respondents were interviewed by telephone and selected using a random digit dialing (RDD) method. Up to four attempts were made per household selected. The data from the 1,005 telephone interviews was weighted to be representative of national population estimates for gender, education and age, i.e., a person over 18 within a household. These methods were designed with a sampling error of ±3% at the 95% confidence level [see Reference (1)].

The earlier surveys conducted by Survey Communications Inc., queried a representative sample of persons over 18 (households only). For example, the 1996 survey included 45,000 adults; 30,500 in the base and 14,500 in an over-sample for the high radon activity areas. Respondents were selected by random digit dialing (RDD) and interviewed by telephone during evening hours. The interview included 21 closed-end questions, and averaged 5.5 minutes. The national survey was designed to a ±0.6% margin of error, and the over-sample had a ±0.8% margin of error at the 95% confidence level [see Reference (4)].

Information and data on the number of new U.S. homes built radon-resistant is derived primarily from the National Association of Home Builders (NAHB) Research Center's annual survey of homebuilders. The number of U.S. homes built radon-resistant is extrapolated from a combination of the survey data and U.S. Census data, weighted for key factors, e.g., differences in survey results and Census Division new housing starts.

References.

(1) *Survey On Radon Awareness And Environmental Tobacco Smoke Issues*, Center for Survey Research and Analysis (CSRA), University of Connecticut (Storrs), 1999, 22 pages.
(2) 1995-1999 Radon Testing (dbf) Data File, Key Technology, Inc., 4-November-1999.
(3) 1995-1999 Radon Test Results (dbf) Data File, Radalink, 8-November-1999
(4) *CRCPD Radon Risk Communication and Results Study* (1993, 1994, 1996), by Survey Communications, Inc. (SCI), for the Conference of Radiation Control Program Directors (CRCPD).
(5) *Builder Practices Report: Radon Reducing Features in New Construction*, National Association of Home Builders (NAHB) Research Center, Inc. (similar titles exist for annual surveys).

Endnotes.

[1] When this paper was originally drafted, Mr. Gregory was a staff member in the Indoor Environments Division (IED), Office of Radiation and Indoor Air (ORIA), Office of Air and Radiation (OAR), U.S. Environmental Protection Agency (EPA), Washington, D.C. 20460 (Mr. Jalbert is a senior IED staff member).

[2] For the answers to each of the questions Figure 1, 2 and 3 (above), the margin of error for the 1993, 1994, and 196 surveys is ±0.6% at the 95% confidence level; the margin of error for the 1999 survey is ±3% at the 95% confidence level. Also, see also methodology (above).

[3] The index was composed primarily of radon testing data from the State of New Jersey's mandatory reporting records; National data from several testing laboratories that provided data voluntarily; National Safety Council (NSC) radon test kit sales data; and, CRCPD data from the 1993, 1994, and 1996 National radon surveys. However, for the time period prior to 1993, the estimate is based solely on CRCPD's 1993 radon survey data.

[4] The margin of error for this question from the 1993 survey is about ±0.6% at the 95% confidence level.

[5] Except for 1992, for which the data are estimated.

* * *