

RADON EDUCATION IN VERMONT SCHOOLS
AN INNOVATIVE APPROACH TO AN ENVIRONMENTAL HEALTH ISSUE

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Vermont's Fairbanks Museum and Planetarium in St. Johnsbury, through grants from the Vermont Health Department's Radon Program and the federal Environmental Protection Agency, has developed a **Radon Education Program** for schools. The purpose of this program is to educate students, teachers, and community members about the nature of radon and radioactivity, radon's occurrence in the environment, and its potential health risks, and methods for dealing with these risks on a family and community level. The Program also assists the State of Vermont's efforts to survey the radon level of at least 40% of the dwellings in the state by the year 2000. Over 2000 students, educators, and community members have been directly involved in a statewide educational and radon testing program. A total of 2250 detectors have been distributed by students into their communities.

The Fairbanks Museum and Planetarium was founded in 1891 as a museum dedicated to science and history education. The Museum was a gift to the town of St. Johnsbury in Vermont's Northeast Kingdom by the 19th century industrialist Franklin Fairbanks.

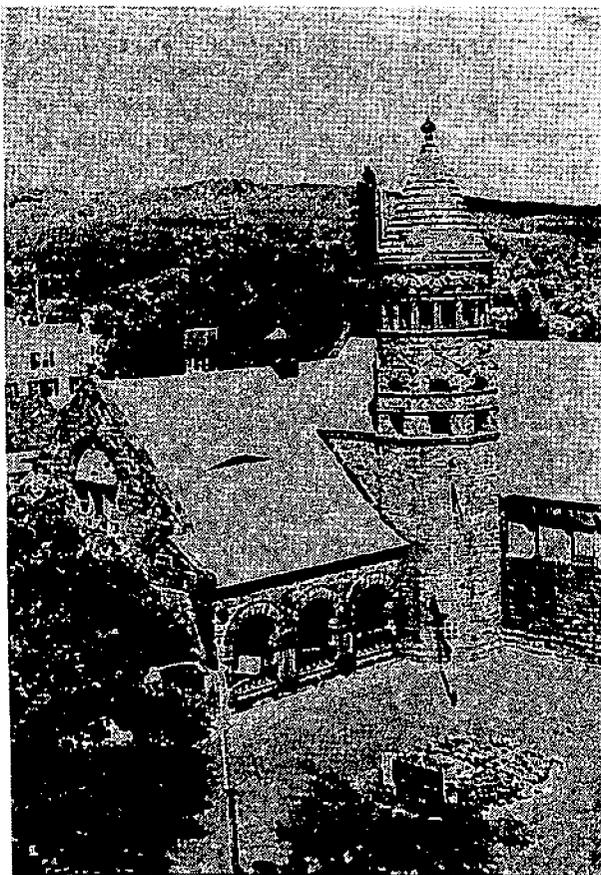


Fig. 1 The Fairbanks Museum and Planetarium of
St. Johnsbury, Vermont

The Northeast Kingdom, consisting of the three northeastern counties of the state, is noted for its natural beauty and its lack of an extensive tax base for the support of education. The Fairbanks Museum, following its mission statement, has provided enrichment in science education for many of the region's schools for over 100 years. Twenty-eight schools from nineteen towns contribute a large portion of the over 27,000 annual student visits to the Museum's extensive educational programs, which are presented by a professional staff of six educators. These programs include diverse subjects in natural, environmental, and physical sciences, geology, astronomy, meteorology, and regional history. Many other schools from outside the Northeast Kingdom also avail themselves of the Museum's services on an occasional basis.

Because of its well established reputation in the field of science education the Museum, in 1994 received a request from the Vermont Health Department's Radon Program to design a Radon Education Program. The purpose of this program would be to educate students, teachers, and community members about the nature of radon and radioactivity, radon's occurrence in the environment, its potential health risks, and methods for dealing with these risks on a family and community level. This radon education program would coordinate with the Health Department's on-going efforts to test the radon levels of at least 40% of the dwellings in Vermont by the year 2000. Through grants from the Vermont Health Department's Radon Program, and the federal government's Environmental Protection Agency, the Museum has developed a Radon Education Program for schools.

The Radon Education Program was first developed through a planning and implementation grant from the Vermont Health Department's Radon Program. In the school year 1994-95 it was included in the Museum's broad-based educational curriculum for schools in the Northeast Kingdom of Vermont. During the first year of the program, 35 radon education classes were given through this locally focused program. A total of 14 schools were served in 12 towns. During the first year of the grant a *Radon Education Workbook* was also produced by a Radon Education Team including members of the Museum's teaching staff and the Museum's graphic artist. The workbook includes materials used in the presentation, and materials for follow-up projects for classroom teachers, in a loose-leaf notebook format. The workbook was also designed as a stand-alone teaching aid for those schools who choose to incorporate all or part of the materials into an already existing syllabus. In December of 1995, copies of this workbook were sent to the principals of all 346 Vermont schools with a letter encouraging them to make it available to their teachers.

With continued funding in 1996, the Program expanded to include selected schools in other areas of northern Vermont. Visits were made to seven schools in north-central and northwestern Vermont. These schools do not attend the Museum's regular scheduled classes as they are too far away for this to be feasible. A total of 464 students and 21 educators were served during the second year of the grant. In an effort to increase outreach into the communities which were visited, time was planned for community members and parents to come to a question and answer session after each class presentation. Through this school exposure to the Program, an even greater number of family and community members were made aware of radon as a public health issue as the students would take the test kits home, and talk to parents about using it.

In 1996-97 visits were extended to schools in the southern counties of Vermont, and 12 more schools were included in the project. This added a further 749 students and their families and 47 more teachers to the number of contacts made by this school program. One of the limiting factors to expanding the Program to include even more schools is that the chief educator for the program is also involved in the Museum's meteorological site and in the Museum's regularly scheduled education programs. Trying to balance the competing needs of several programs is quite a challenge for small institutions on a tight budget. Since the Museum's grant is based on matching funds it is not financially possible to expand the program from its current staffing level.

At each school site, a one hour program is presented by Fairbanks Museum educator, Steve Maleski, for students and their teachers. This program follows, in part, the outline established in the workbook dealing with the following questions:

- What is Radon?
- Where does Radon come from?
- Why is Radon bad for you?
- What to do about Radon?

The presentation uses such visual materials as a Geiger counter, various rock samples, charts, diagrams, and fresh pig lungs to illustrate the nature of lung tissue. A member of the State's Radon Program is also present to discuss student and parent concerns and questions about mitigation. After the presentation, students with parental permission are given Alpha Track radon detectors to take home, along with instructions for their use and an questionnaire about the location of the detector in the home and the type of basement. This information sheet will be returned to the Museum with the radon detector after the testing period is over. The parental permission is necessary so that the Museum has a record of names and addresses of families for retrieval of detectors and notification of families of their test results. After an identified exposure period of at least one month, the detectors are collected and returned to the Fairbanks Museum for analysis by a professional laboratory. In many cases the teachers have helped with the retrieval process which has greatly increased the number of detector returns. The detectors and the testing are free to the participating families and are paid for by the State of Vermont under the terms of the Museum's grant. Results are sent by the Museum in the form of a letter to all participating households. The results of the testing are confidential, the state receives only the result and the town of residence of each test site, but many families share their results with the participating schools to make the research more meaningful to students. Four different letter formats are used to indicate radon levels of increasing concern. Retesting to confirm results can be done through the Museum but usually the families are referred to the state's Radon Program for help in interpreting their results and assessing the need for retesting or mitigation. As of July 1997, 2250 detectors have been distributed through the school Radon Education Program.

The Fairbanks Museum maintains a state-wide database of non-confidential information gathered from the testing which can be accessed by schools either by hard copy or through the Museum's newly created Radon Web site. Using this data students can create graphs, maps and charts relating to the occurrence and differing levels of radon in Vermont. This gives the program interdisciplinary value and exposes the students to a large state-wide scientific study in which they, themselves, are active participants. An example of the follow-up work done by one teacher of a 4th grade class was to prepare a display about radon for a parents' night at the school. Students made posters, manned the booth, explained to the parents the importance of radon as a health risk, and handed out postage paid request cards for free detectors which were supplied by the Museum.. A quote from the teacher's letter to Museum staff sums up the enthusiasm,

“ Our School Report Night was a huge success with over 650 people attending! The kids were so excited about telling people all about radon... The students were amazed and pleased at all the questions community members had about radon.” (Creelman, 1996.)

Starting with an original distribution of 86 detectors to that school, 30 more were sent out to the community. Of the total of 116, 74 have been returned and 42 are still testing. During the year prior to the Museum's visit a total of 17 tests for radon were done in that community!

In an attempt to recruit schools beyond the Museum's normal catchment area for the Radon Education Program several methods have been used:

1. Mailing copies of the *Radon Education Workbook* to all school principals in the State of Vermont. This approach was not the most helpful as often the *Workbooks* were shelved and did not even make it out of the principal's office!
2. Attending the annual conference of the Vermont Education Association which takes place in October, a perfect time for recruiting schools. Teachers have settled into a routine with their new assignments and are looking for

ways to enhance their educational program at minimal expense. Since the Museum's program is free it can be quite appealing!

3. Sending out a mailing to school nurses in all Vermont schools not already involved in Radon Program. The letter explained what the program had to offer them as health professionals who are often involved in delivering health education in their schools. Included with the letter was a postage paid card for a free radon detector for their personal or school use. Several nurses brought the program into their schools either in the usual format or by making radon detectors available through sign-up lists for teachers and staff.

Although the Program is especially designed for students from 4th through 8th grades, it has been successfully used in modified form with high school students. Often the focus at that level is toward environmental education and specifically indoor air quality in the school and workplace. Some science teachers of the higher grades have devised projects to test labs, classrooms and other areas of the school buildings. They have been made aware of the EPA'S guidelines for testing schools (EPA 402-R-92-014) and advised to use caution in publicizing the results they obtain if they do not follow the protocols.

One of the other positive effects of introducing the Radon Program through the schools is that many school administrators have now been exposed to the concept of testing school buildings for radon. The word "testing" as applied to a school's physical plant always arouses deep concern because of the costs which inevitably come with mitigation for whatever problem is of present concern. The last major testing program in schools in Vermont was for asbestos, the removal of which caused great disruption and financial problems in many Vermont communities. Maybe for this reason officially mandated radon testing has not been proposed in Vermont. Many schools have been encouraged to begin testing classrooms as a spin-off from the Museum's school radon presentations and also by individually contacting school principals of those schools whose buildings are very old or with classrooms below grade. Because the Museum staff assures confidentiality and support for all those testing through the Program, clients know that they will receive help in approaching problem results.

In 1996-97 a further part of the Museum's grant was used to create a Radon web site on the Internet (<http://www.connriver.net/radon/home>). This is linked with other sites of interest related to the topics covered by the Radon Program's presentations. Some of these links include the design of a geiger counter, radio-active decay, lung structure and function, and DNA's structure and replication. The web site also allows browsers to take an interactive quiz about radon, to sign up for radon detectors (Vermonters only), and to download the Museum's database for schools. The database allows students to see how their town results look compared with other participating areas of the state. Browsers can also request more detailed data from the state Health Department's much larger database. The Museum has attempted several methods of visually representing the results of the testing program. The most successful is a large state map divided into townships, results in each town are represented by map pins of different colors representing the radon levels <4, 4 -7.9, 8-16, and >16 picoCuries/liter of air. This gives an immediate picture of the "hot spots" as located by our testing program.

The final project to be undertaken under the Museum's 1996-97 grant is to design a travelling educational display. This will be a "stand alone" exhibit, easily understood and visually appealing. The purpose of such a display is to extend awareness of radon, its health aspects, and its testing procedures to communities which have not been served by the Museum's educational program or the State's outreach. The hoped for outcome is to get radon test kits into these communities. The exhibit, in the final stages of its construction, will be deployed by the end of 1997.

The results of the Radon Education Program are very positive. Based on data collected by the Vermont Department of Health and the Fairbanks Museum, in communities where school presentations have been made there has been a noticeable increase in the number of Alpha track radon test kits distributed to that community. In the first year of the Program a comparison can be made in Detector distribution between those towns where schools were exposed to radon education and those which were not. In Table 1, the second column shows the number of test kits distributed through the state's outreach from 1988, when the state-wide testing program began, to September 1994

and the third column shows the number of test kits distributed after the Museum's Radon Education Program began in September 1994:

TABLE 1.

Town which HAD Radon classes in their schools starting in 9/94	Number of Alpha track detectors distributed prior to 9/94	Number of Alpha track detectors distributed after 9/94
St Johnsbury	21	137
Barnet	1	23
Waterford	0	19
Walden	0	10
Lyndon	6	69
Sutton	5	16
Sheffield/Wheelock	1	54
Gilman	1	1
East Haven	2	3
Danville	6	47
Concord	1	15

Table 2. below, shows a similar situation except in these towns, of approximately the same size and demographics, the school did not elect to participate in the Radon Education Program:

TABLE 2.

Towns which did NOT HAVE Radon classes in their schools	Number of Alpha Track detectors distributed prior to 9/94	Number of Alpha Track detectors distributed after 9/94
Peacham	1	10
Guildhall	4	2
Lunenburg	0	1
Wells River/Ryegate	3	8
Newark	0	4
Hardwick	7	30

In the second and third years of the program the results are also indicative of the effectiveness of the program. Since the state's program had been up and running for a longer period of time than when the previous comparison was made the decision was made to compare the number of test kits distributed during the year preceeding each school presentation with those distributed after a community visit. Table 3. shows that in all cases the Museum's Radon Education Program has made a positive impact on radon testing in a community.

TABLE 3.

Town/Area	Dates shown are 1 year prior to school visit	Number of detectors distributed	School visit on date shown to July 31,1997	Number of detectors distributed
Colchester	Jan 19,1995-Jan18,1996	86	Jan 19, 1996	143
Underhill / Jericho	Feb 2,1995-Feb1,1996	51	Feb2 1996	116
Middlebury	Feb 15,1995 -Feb 14 1996	41	Feb 15,1996	223
Swanton	Mar 12,1995-Mar 11, 1996	21	Mar 12,1996	126
Barton/Orleans	April 5 1995-April 5, 1996	12	April 5, 1996	59
Marshfield/Plainfield	Sept11, 1995-Sept10, 1996	16	Sept 11, 1996	43
Rochester	Sept18, 1995-Sept17, 1996	5	Sept 18, 1996	80
Manchester	Sept 25, 1995-Sept 24, 1996	5	Sept 25, 1996	98
Wallingford	Oct 9, 1995-Oct 8, 1996	7	Oct 9, 1996	91
Barnard / Woodstock	Nov 18, 1995-Nov 17, 1996	25	Nov 18, 1996	85
Middletown Springs	Dec 4, 1995-Dec3, 1996	0	Dec 4, 1996	26
Sheldon	Dec 11, 1995- Dec 10, 1996	3	Dec 11, 1996	108
Albany	Jan 29, 1996-Jan28, 1997	5	Jan 29,1997	49
Ludlow	Feb 11, 1996-Feb 10, 1997	19	Feb 11, 1997	35
E. Montpelier & District	Mar 12, 1996- Mar11, 1997	85	Mar 12, 1997	147
Danville	April 1, 1996-Mar 31, 1997	5	April 1, 1997	26
Addison/Vergennes	May 14,1996-May 13, 1997	17	May 14, 1997	26
Richford	Feb17, 1996-Feb 16, 1997	12	Feb17, 1997	52

What has been the impact of this program on the state's goal of testing dwellings in Vermont? The State of Vermont's radon testing program began in 1988. Between September 1994, when the Museum's education program began, and July 1997 the state of Vermont's Radon Program distributed a total of 6372 radon detectors. Of these, 2250 detectors, or 35% have been directly distributed through the Museum's program. This is a significant contribution to the State's testing program especially considering the size and remote location of the Fairbanks Museum. In ways other than numbers the real success of the Museum's program is twofold. The primary goal of the Museum's Program is the education, of children specifically but also of adults, about radon. In this area the Museum has succeeded very well having directly served 2088 students and 103 teachers and innumerable family and community members. The second goal of the Education Program has been to target specific areas of the state which had not been approached in other ways by the Health Department's radon outreach. By offering a high quality product for free the Museum has made an impact on radon education in areas of the state where more expensive methods would not have worked.

Why has this Radon Education Program been so successful and would it work in other states? Undoubtedly the small geographic size of the State of Vermont has made the Radon Education Program possible on the scale which a small institution can provide. The intimate working relationships and mutual respect which the Museum has fostered as an institution with other Vermont educators over the years provided a fertile ground for developing this program. The Museum's credibility in the field of science and environmental education is well known in Vermont and New Hampshire and has lead to the Museum's association with Vermont's Department of Health. The fact that the Museum has been able to maintain confidentiality for clients and yet provide the state with enough data for its purposes has made this Program acceptable to both parties. It should be possible for larger states with more teaching institutions such as the Fairbanks Museum to use some of the materials, and administrative procedures developed by the Fairbanks Museum to introduce similar programs. Even in a different presentation format this program has much to offer classroom teachers who are trying to develop more environmental awareness amongst their students and provide them with an authentic learning experience. Educationally the program is a great example of the "ladder of learning" concept. Starting with the workbook and its integration into the regular classroom curriculum and following this with a visiting presenter, students themselves become educators for their parents and communities. Studying testing methods and using data gathered in the statewide study, available through the Internet. students gain awareness of how to access and use information to answer questions about the world around them.

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