

Project Summary

Identification of Candidate Houses for the North Florida Portion of the Florida Radon Mitigation Project

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This study was conducted to locate candidate houses for a proposed radon mitigation demonstration project in North Florida. The effort involved: 1) identification of target geographical areas, 2) radon monitoring in identified clusters, and 3) house characterization.

A review of a statewide radiation study completed in 1987 and a 1986 - 87 pilot study of the Gainesville area indicated that North Florida target areas could be selected on the basis of the near-surface occurrence of the Hawthorn geological formation.

Volunteer houses for radon monitoring in Alachua and Marion counties were obtained by announcing the study in newspaper articles. Single-sample screening measurements were made in approximately 400 area houses by the charcoal collector method. These houses were targeted based on geological evidence that they would have a high radon potential. The levels observed ranged from <0.1 to 128 pCi/L. The arithmetic mean was 11.2 pCi/L, and the geometric mean was 6.4 pCi/L. Of the houses, 32% were <4 pCi/L, 51% were between 4 and 20 pCi/L, and 17% were >20 pCi/L. Results were similar in the two counties, and the distributions were similar in both slab and crawl-space (unspecified ventilation) construction.

Criteria for selecting houses for further consideration included radon screening measurement--at least 4 pCi/L (the U.S. EPA action level);

ownership/occupancy--single-family, owner-occupied; house characteristics--detached, single-story, foundation system entirely slab or entirely crawl space, not >2000 ft² (186 m²); and water supply--community or municipal. Sorting on these criteria produced over 100 candidate houses in the two counties for further consideration in mitigation demonstration.

This Project Summary was developed by EPA's Air and Energy Engineering Research Laboratory, Research Triangle Park, NC, to announce key findings of the research project that is fully documented in a separate report of the same title (see Project Report ordering information at back).

Introduction

A statewide study in Florida has identified a number of counties with evidence of elevated indoor radon. These counties are concentrated in two geographic areas--the West Central Florida phosphate mining region and North Florida's Hawthorn formation region.

The project reported here was conducted to identify a candidate list of houses to be considered for a North Florida demonstration project. The work was carried out in two adjacent populated areas of North Central Florida, the Gainesville area (Alachua County) and the Ocala area (Marion County).



Procedures

The effort to identify candidate houses for inclusion in the North Florida Radon Mitigation Project involved:

- Task 1. Identification of Target Geographical Areas,
- Task 2. Radon Monitoring in Identified Clusters, and
- Task 3. House Characterization.

Task 1. Identification of Target Geographical Areas

Existing geological information and indoor radon monitoring data were used to identify areas in Alachua and Marion counties where sufficient clusters of 20-30 houses having indoor radon levels greater than 4 pCi/L (the EPA action level) would likely be found.

The report of the 1986-87 Florida Statewide Radiation Study was examined to determine the general geographic distribution of elevated indoor radon and possible association with geology. In addition, the results of an indoor radon study of the Gainesville area by the University of Florida during the winter of 1986-87 were examined for further definition of potential target areas.

Prompted by the knowledge that uranium can be associated with a local geological formation of poorly consolidated sands, clays, and limestone called the Hawthorn formation and by the general association of elevated indoor radon with this formation in the two studies, the available geological data were used to draw approximate boundaries of the near-surface occurrence of the Hawthorn formation on vicinity and street maps for Gainesville and Ocala. These maps were the basis for determining whether neighborhoods could be considered within a target area.

Task 2. Radon Monitoring in Identified Cluster

Homeowners were solicited by announcement of the study in newspaper articles in the two counties. Homeowners were informed of the purpose of the survey and its relation to EPA's Florida Radon Mitigation Project. Interested homeowners were asked to fill out an Information and Authorization Request form that recorded basic characteristics of their houses.

Indoor radon measurements were then conducted in approximately 400 houses located within the target areas. Measurements were short-term sampling (5 days) by the charcoal absorber method.

The study involved eight weekly sampling rounds of approximately 50 houses per week. Homeowners were notified by letter of test results. Homeowners whose screening measurements exceeded 4 pCi/L received a form for follow-up house characteristic information which they were requested to complete and return.

Task 3. House Characterization

The initial set of house characteristics was obtained from the Information and Authorization Request form completed by or on behalf of the homeowner. Data from these forms were entered into a data base for further retrieval and summarization.

Additional information on houses exceeding 4 pCi/L was obtained from the Construction Classification Questionnaire which was sent to the homeowner along with the results of the screening measurement. A limited number of houses were visited by project personnel, and additional information was obtained by interviews, visual observation, and radon grab samples from the indoor air and wall cavities.

The data files were sorted to select candidates for further consideration meeting several criteria:

1. Indoor radon-screening values 4 pCi/L or greater.
2. Ownership/occupancy:
 - a) single family,
 - b) owner-occupied, and
 - c) expected occupancy for 24 months.
3. House characteristics:
 - a) detached house
 - b) single story,
 - c) foundation/floor system entirely slab or entirely crawl space, and
 - d) not more than 2000 ft² (186 m²).
4. Water supply--community or municipal.

Results and Discussion

Task 1. Identification of Target Areas

The Florida Statewide Radiation Study conducted during 1986-87 identified counties having definite evidence of elevated radon potential. Two foci of expected elevated indoor radon in Florida include a West Central Florida region coincident with the geological formation known as the Bone Valley formation and

with near-surface occurrence of the underlying Hawthorn formation, and the North Central Florida cluster of counties coincident with the near-surface occurrence of the Hawthorn formation and the geologically similar Alachua formation.

The North Central Florida area includes two heavily populated areas--Alachua County with Gainesville, its suburbs and several smaller cities, and Marion County with Ocala and suburbs. Examination of the Statewide Study monitoring results on a subcounty scale for Alachua and Marion Counties indicated that, within the limitation of the spatial resolution used, elevated radon areas correspond generally with the Hawthorn formation and with soils identified as phosphatic soils.

A study conducted in the Gainesville area during the winter of 1986-87 by the University of Florida provided further definition within the Gainesville area. Single screening measurements were made in 67 houses chosen to provide a geographic distribution within the area and represent both slab and crawl-space houses in rough proportion to their occurrence in the community (about equal numbers). A significant fraction of the houses exceed 4 pCi/L and some exceed 20 pCi/L in the screening measurement. Similar distributions appeared in both slab and crawl-space houses (not differentiated as to degree of ventilation). A greater likelihood of elevated radon is associated with the Hawthorn formation.

Based on (1) knowledge that uranium can be associated with the Hawthorn formation, (2) the observation of the Statewide Study, and (3) the further confirmation of the Gainesville study, it was concluded that the Hawthorn formation provides a relatively good basis for the designation of target sampling areas. However, the scale of mapping is not adequate to accurately define ranked areas on a block-to-block basis.

Task 2. Radon Monitoring in Identified Clusters

The results of radon monitoring are summarized in Table 1. About 67% of the single sample screening measurements in the target areas were 4 pCi/L or higher. About 50% were between 4 and 20 pCi/L, and about 17% were above 20 pCi/L. The highest levels were concentrated almost entirely in the region of near-surface occurrence of the Hawthorn formation.

Table 2 shows the distribution of indoor radon concentrations by found-

Table 1. Summary of Indoor Radon Screening Measurements in Target Areas

Summary of Concentrations, pCi/L	Alachua	Marion	Total
Average	11.3	11.0	11.2
Geometric Mean	6.7	6.1	6.4
Minimum	0.4	0.0	0.0
Maximum	128.0	75.5	128.0
Distribution of Concentrations, pCi/L			
< 4	33%	32%	33%
4-20	50%	51%	50%
> 20	17%	17%	17%
Total	100%	100%	100%

Table 2. Distribution of Indoor Radon Concentrations by Foundation Type

Concentration Range, pCi/L	Slab	Crawl Space	Combination* Slab /Crawl	Total
< 4	31%	39%	7%	32%
4-20	55%	46%	40%	51%
> 20	14%	15%	53%	17%
Total	100%	100%	100%	100%

*Only 15 houses of this type were monitored.

tion type. The concentration distributions were not greatly different between slab houses (69% >4 pCi/L) and crawl-space houses (61% >4 pCi/L). The table suggests that the combination slab and crawl space foundations were especially susceptible to radon entry; however, these observations are based on only 15 houses.

Task 3. House Characterization

The sorting of the data files resulted in a list of 101 elevated radon houses meeting the criteria for further consideration (i. e. single-family, owner-occupied, detached, single-story slab or crawl space, not >2000 ft² (186 m²), and not in a community or municipal water system). Table 3 summarizes these houses by indoor radon category, and by foundation type for slab and crawl-space construction.

Conclusions

Identification of Target Areas

Based on a review of prior data, the investigators concluded that elevated radon target areas in North Central Florida could be identified on the basis of near-surface occurrence of the geologic feature known as the Hawthorn formation. The results of the subsequent monitoring (2, below) confirmed the use of this approach in identifying areas with high potential for elevated radon.

2. Radon Monitoring in Identified Clusters

There are a substantial number of houses in the Gainesville and Ocala areas with elevated indoor radon levels. Single, charcoal collector samples, taken under closed-house conditions, in nearly 400 houses in the selected target areas showed that 32% were <4 pCi/L, 51% were between 4 and 20 pCi/L, and 17% were >20 pCi/L.

.NOTE: These measurements were taken in target neighborhoods selected for geological evidence of high radon potential. They do not necessarily represent the overall indoor radon picture in these cities and counties.)

Crawl-space houses had roughly the same proportion of elevated radon as did slab houses.

3. House Characterization

As a result of this work, there is now available a list of over 100 houses in the Gainesville and Ocala areas for further consideration for a mitigation demonstration project. This list was developed by sorting house characteristic data to select owner-occupied, single story, simple foundation style, houses of not >2000 ft² (186 m²) with indoor radon concentrations of >4 pCi/L by a single screening measurement. The foundation systems of the houses on this list are 90% slab and 10% crawl space.

Recommendations

The "climate" is favorable for the North Florida Mitigation Project to

proceed. Homeowner interest is high, and homeowners, contractors, and local government officials appear to be looking forward to receiving the mitigation advice that such a demonstration should produce.

Some initial steps that could precede the actual demonstration are:

1. Further Development of the Homeowner Data Base

Additional file data are available from the second questionnaire which was provided to all homeowners with indoor radon levels of 4 pCi/L or greater. In addition, many participants exercised the option to have a 90-day alpha track measurement to assist in the verification of the screening measurements; these results will begin coming in shortly. Information has also been obtained through visits by project personnel to a limited number of houses. Information from each of these sources could be incorporated into the data base to assist in making the final selection of houses for mitigation.

2. Screening the Candidate List

This could be approached by first generating house dossiers from the more detailed homeowner database. Ranking candidate houses using the detailed data base would provide a shorter list for follow-up visits and interviews with homeowners.

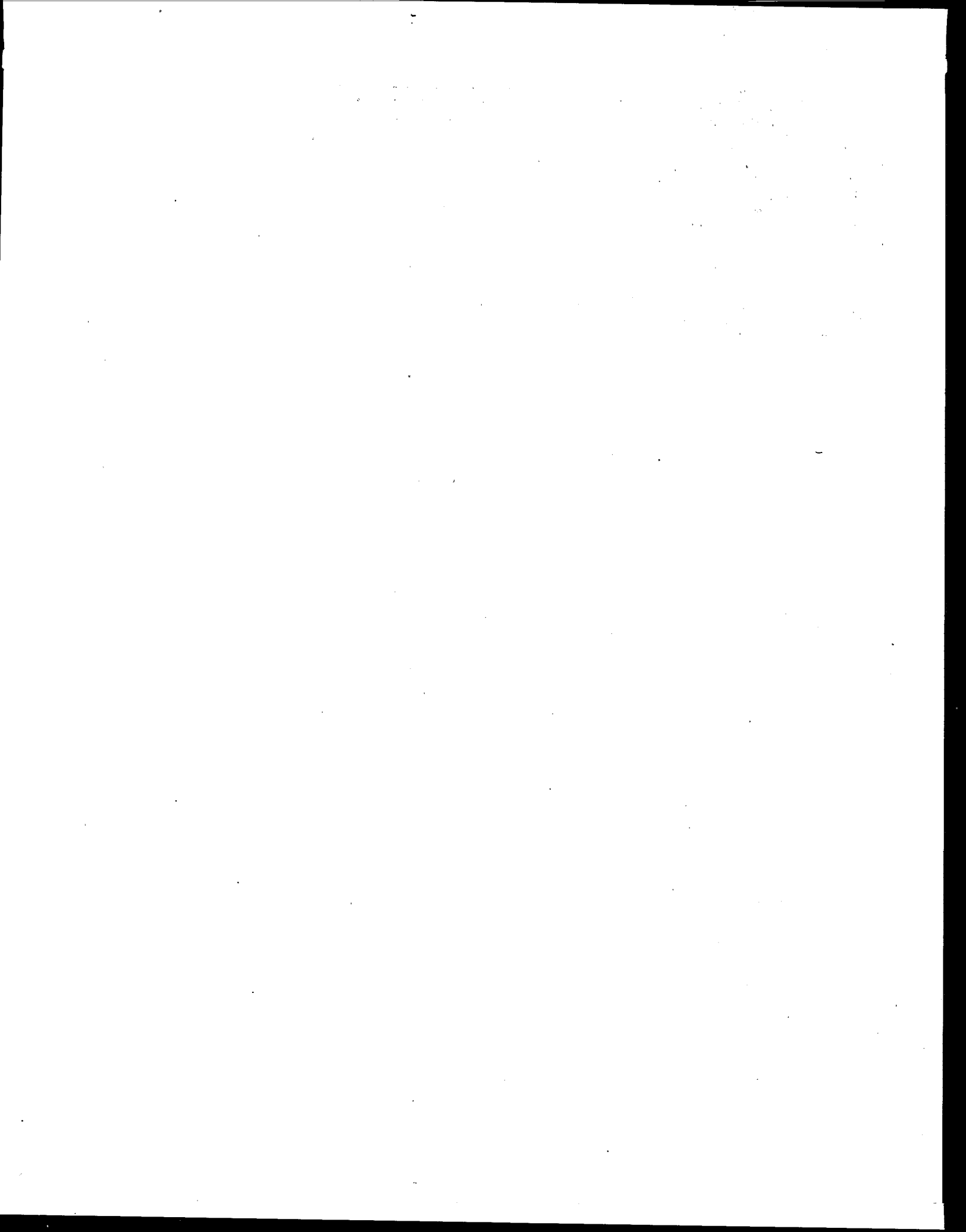
Table 3. Summary of Houses Meeting Initial Criteria for Further Consideration*

	Slab	Crawl Space	Total
Distribution of Radon Concentrations:			
4-20 pCi/L	69	11	80
> 20 pCi/L	20	1	21
Total houses 4 pCi/L or higher	89	12	101
Location:			
Alachua County (Gainesville vicinity)	51	8	59
Marion County (Ocala vicinity)	38	4	42
Total houses 130.02	89	12	101

*At least 4 pCi/L; owner-occupied; detached; single-story; simple slab or crawl-space construction; and not >2000 ft² (186 m²).

3. House Characterization and Final Selection of Mitigation Candidates

A next step could then be house characterization visits to the screened list of candidates. The results of the interviews, observations, and measurements during these visits should permit development of the final list of mitigation project participants.



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David C. Sanchez is the EPA Project Officer (see below).

The complete report, entitled "Identification of Candidate Houses for the North Florida Portion of the Florida Radon Mitigation Project," (Order No. PB 90-274 077IAS; Cost: \$23.00, subject to change) will be available only from:

National Technical Information Service

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Springfield, VA 22161

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The EPA Project Officer can be contacted at:

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