

THE FLORIDA RADON RESEARCH PROGRAM:  
TECHNICAL SUPPORT FOR THE DEVELOPMENT OF RADON  
RESISTANT CONSTRUCTION STANDARDS

by

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ABSTRACT

The 1988 Florida Legislature mandated the development of standards for the construction of radon-resistant buildings. In support of this development, a program of research and development was initiated involving the State University System, the Florida Department of Community Affairs (DCA), and the U.S. Environmental Protection Agency (EPA). The Florida Radon Research Program (FRRP) will complete two years of concentrated effort to develop, test, and demonstrate a sound technical basis for radon resistant construction standards. The FRRP using a research committee structure has developed a coordinated, interdisciplinary approach to project management in the major task areas of buildings research and radon source potential.

This paper provides a description of the technical direction of the FRRP, its current objectives and accomplishments to date. It has been reviewed in accordance with the U.S. Environmental Protection Agency's and the Florida Department of Community Affairs peer and administrative review policies, and has been approved for presentation and publication.

## BACKGROUND AND HISTORY

The Florida Legislature on July 5, 1988, enacted legislation which provided comprehensive requirements for a statewide radon protection program (Committee 1988). The statutory requirements called for:

- (1) Development of radon resistant building codes for new construction and existing buildings,
- (2) Certification of radon measurement and mitigation companies,
- (3) Provision of public information service about radon,
- (4) Notification on real estate sales contracts regarding the health risks of radon,
- (5) Maintenance of the current radon standard (as low as reasonably achievable not to exceed 0.02 working level (WL) or 4 picocuries per liter (pCiL<sup>1</sup>))
- (6) Conducting a coordinated, cooperative program of research, training, and service activities related to the detection, control, and abatement of radon, and
- (7) Creating a trust fund to ensure that provisions of the statutes are carried out.

These provisions, especially the last, have distinguished the Florida effort from other federal and state initiatives. (IRAA 1988; PA 1986; NJ 1985) The Florida legislature provided for a program that could support problem assessment, the development of fundamental (technology) evaluation criteria, the field evaluation of developed technology, and finally training. In addition the Florida legislature through the statute determined the sequencing and life of the program by keying the trust fund financing to the adoption of standards and provision for a year of training in their use.

### FLORIDA RADON RESEARCH PROGRAM STRUCTURE AND STATUS

The Florida Radon Research Program (FRRP) is a program for the research, development, testing, and validation of criteria and standards for radon resistant features and procedures applicable to new and existing construction. The program is under the management of the Florida Department of Community Affairs (DCA) with major technical program management responsibilities jointly shared with the U.S. Environmental Protection Agency (EPA) through

an interagency agreement.

The structure of the FRRP is based on a cooperative, interdisciplinary, research committee basis for the identification and development of technical approaches to management defined task area goals. Integration of management defined technical priorities with research committee defined approaches and project objectives has been accomplished within the FRRP through the development of committee and management reviewed project work plans. This interactive development has been accomplished through the project management process and has been enhanced by making use of quarterly program reviews. The FRRP has also used technical workshops to evaluate and scope out new program initiatives (Nielson and Rogers 1991a ; Hintenlang 1991).

Figures 1 and 2 present the fiscal year 1989 and 1990 projects that have been undertaken by the FRRP. The figures identify (1) the major task areas of the program: buildings research and source potential studies, and (2) the main FRRP technical committees: large buildings, research house studies, new house evaluation, and radon potential cartography of the FRRP.

#### BUILDINGS RESEARCH OF THE FRRP

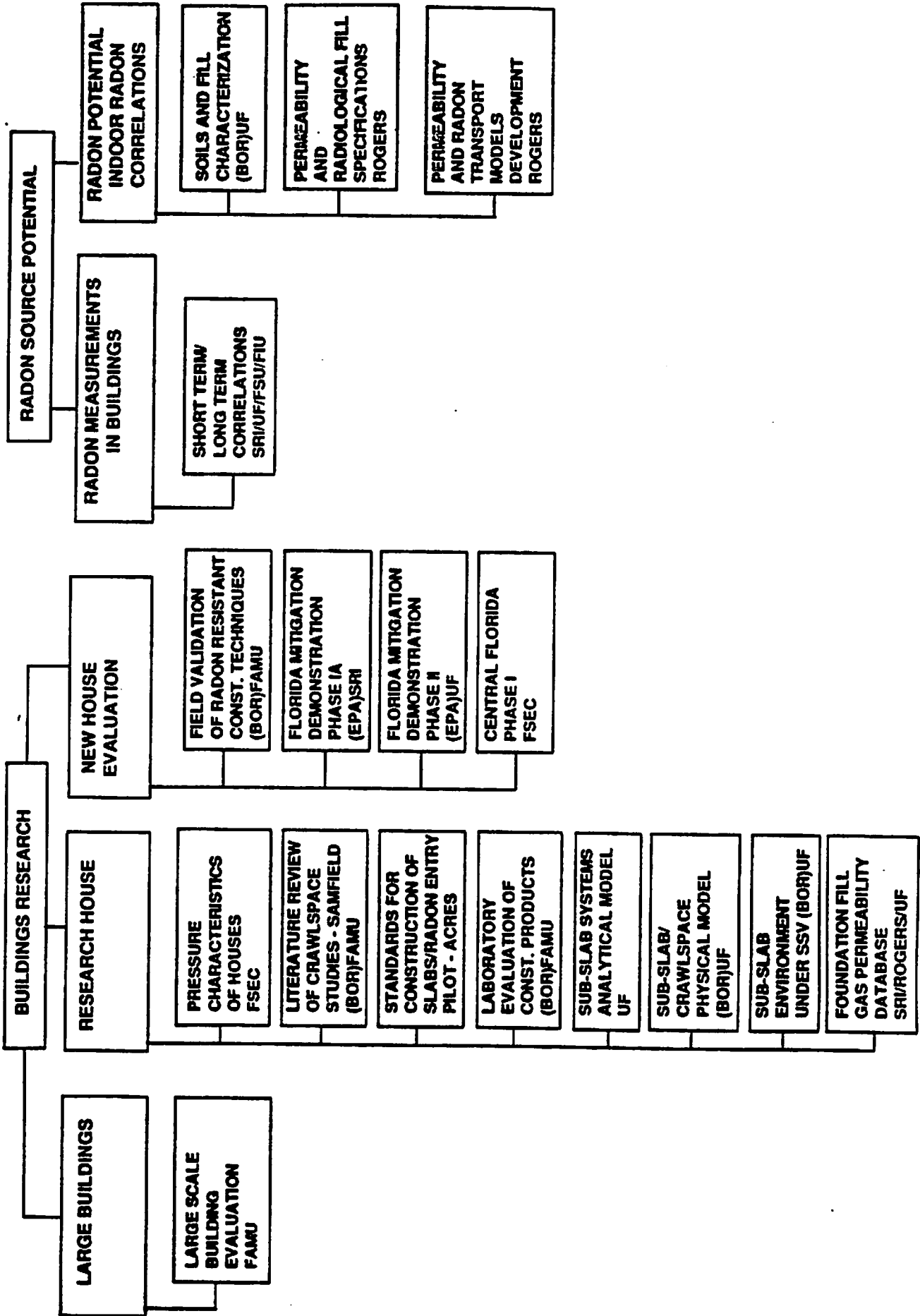
The Building Research component of the FRRP focuses on the physical construction basis and dynamic conditions affecting the entry of radon into structures. The FRRP studies in this component have placed emphasis on problem assessments, investigating fundamental processes, developing empirical and model based guidance, and obtaining validation of the effectiveness of new construction techniques and procedures. Research to date has focused on single-family residential buildings.

#### Problem Assessment Studies

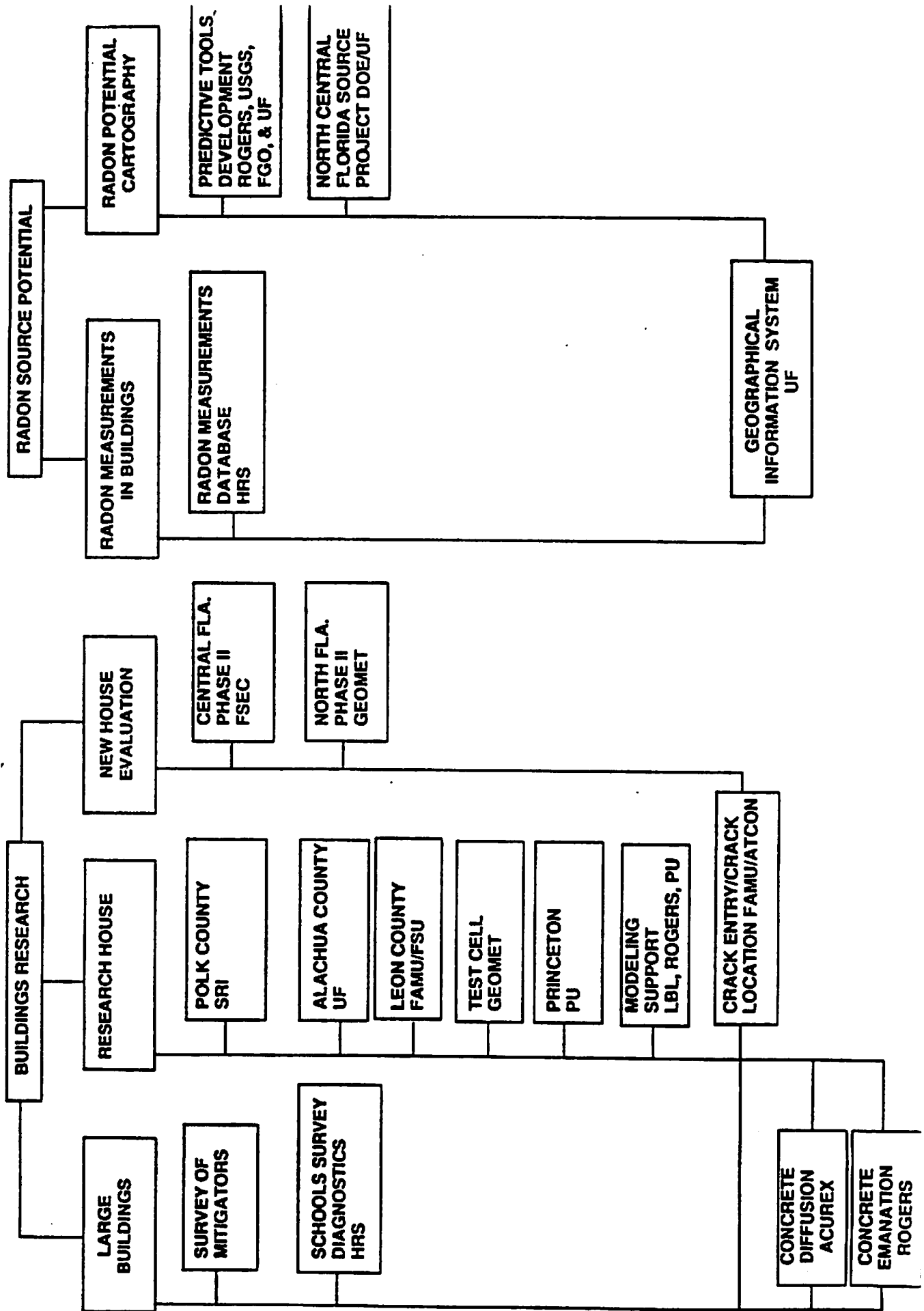
The FRRP in 1989 initiated problem assessment studies of residential structures. These studies focused on (1) establishing the dynamic pressure conditions and ventilation characteristics of typical Florida residences, (2) identifying characteristics of concrete slab construction that could effect its effectiveness as a radon barrier, and (3) identifying the state of the art guidance for radon resistant crawlspace construction (Cummings, et al. 1991; Eggink, et al. 1991; Samfield 1989). Ongoing problem assessment type studies are investigating the characteristics of large buildings with indoor radon problems and the practices used by commercial mitigators to prevent radon entry.

Problem assessment studies have been used by the FRRP to provide recommended standards for new construction (Cummings 1991; Rogers and Nielson 1991a; Eggink, et al. 1991; Hintenlang and Roessler 1991; Williamson et al. 1991) and they have been used by

**FRFP RESEARCH ACTIVITIES — 1989 Projects By Program Areas**



**FRRP RESEARCH ACTIVITIES — 1990 Projects by Program Area**  
*Note: These projects begin the Long Range Phase of the Research Program Plan.*



the program to design various aspects of the FRRP's research house studies.

### Sub-slab Systems and Entry Modeling

In addition to these problem assessment studies the FRRP concurrently, in 1989-90, undertook studies to develop the design basis, a mathematical model, for sub-slab depressurization radon removal systems. (Roessler, et al. 1990) and mathematical descriptions of radon entry processes into slab-on-grade houses (Sextro and Fisk 1991; Nielson and Rogers 1991a). The results of these studies have been used to support a recommended design basis for the installation and operation of sub-slab (depressurization) systems and for benchmarking other radon transport and entry models.

### Large Building Studies

In 1989 the FRRP collaborated in the design of a state-of-the-art radon resistant large building which made use of both passive and active radon resistance enhancing features (Pugh 1991). Work in 1990-91 in large buildings is focused on the identification of practices and techniques used by mitigators for radon control in large buildings and identification of those large building characteristics associated with radon entry.

### Research House Studies

Research House Studies of the FRRP have been designed to use a comprehensively monitored and controlled environment for studying house construction, house operation/occupancy, and environmental effects on radon entry. The buildings and sites used in these studies are representative of Florida's regional construction practices. Research house studies will provide for (1) refinements of diagnostic tools used in the assessment of the causes of indoor radon problems, (2) the definition of what factors contribute the most to indoor radon problems, and (3) the development of comprehensive mathematical and computer models for assessing the effects and/or designing for optimum construction features or house operating conditions (Gadsby and Reddy 1991a and 1991b).

Initial reports of assessments, experimental work, and preliminary model developments of the FRRP research houses will be reported at the FRRP's Eighth Program Review scheduled for the end of October 1991.

## New House Evaluation Studies

New House Evaluation Studies have been undertaken by the FRRP to evaluate, using diagnostic measurements and statistical analysis tools, the effectiveness of radon resistant construction features in newly constructed houses. Studies are ongoing in the Central and North Florida areas.

## RADON SOURCE POTENTIAL RESEARCH

The FRRP initiated research, in 1989, to investigate the source and radon barrier potential of fill soils typically used beneath Florida slab-on-grade buildings. This initial effort consisted of problem assessment type activities to characterize the radiometric and permeability and diffusion transport characteristics of fill materials (Rogers and Nielson 1991b). Results of this initial effort led directly to the FRRP's recommended foundation fill materials construction standards (Rogers and Nielson 1991a).

In 1990-91 efforts were begun to develop, apply, and extend radon transport models to evaluate entry into slab-on-grade residential buildings. Also begun in 1990-91, after conducting a feasibility assessment (Nielson and Rogers 1991c) were projects to develop a lithologic and geologic data base for relating radon availability to soil and geologic parameters and a project to develop an algorithm for predicting indoor radon based on neighborhood scale diagnostic data (Nielson et al. 1991).

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