#7406

Other Research

Environmental Protection Agency

Large Building Study

Research Results Used in New Buildings

After years of intensive study, researchers at the Environmental Protection Agency's (EPA) Office of Research and Development (ORD) believe they understand how to control radon levels in schools and other large buildings.

Investigators at ORD's Air and Energy Engineering Research Laboratory (AEERL) in North Carolina say the control techniques are being incorporated into the design and construction of new schools and other public buildings.

Tucson will incorporate mitigation systems recommended by EPA researchers in two new schools totalling 140,000 ft^2 to be completed in 1994.

Tucson Schools

The Tucson Unified School District, for example, will incorporate radon mitigation systems in two new schools to be completed in 1994 in Tucson. One is the Valencia Middle School, which will be seven buildings totalling 90,000 ft^2. The second is the Mary Robins Elementary School, to consist of two buildings totalling 50,000 ft^2.

Soils at both sites contain significant quantities of naturally occurring uranium, and elevated indoor radon levels are anticipated. During and after construction, diagnostic tests will be conducted by the Western Regional Radon Training Center with technical assistance from AEERL.

Control measures recommended by AEERL are designed to:

1. prevent elevated radon levels in completed buildings and
2. provide this protection at a small fraction of the cost of retrofit systems.

It is typically easier and much less expensive, the researchers say, to design and construct a new building with radon-resistant and/or easy-to-mitigate features than to add these features after the building is completed.

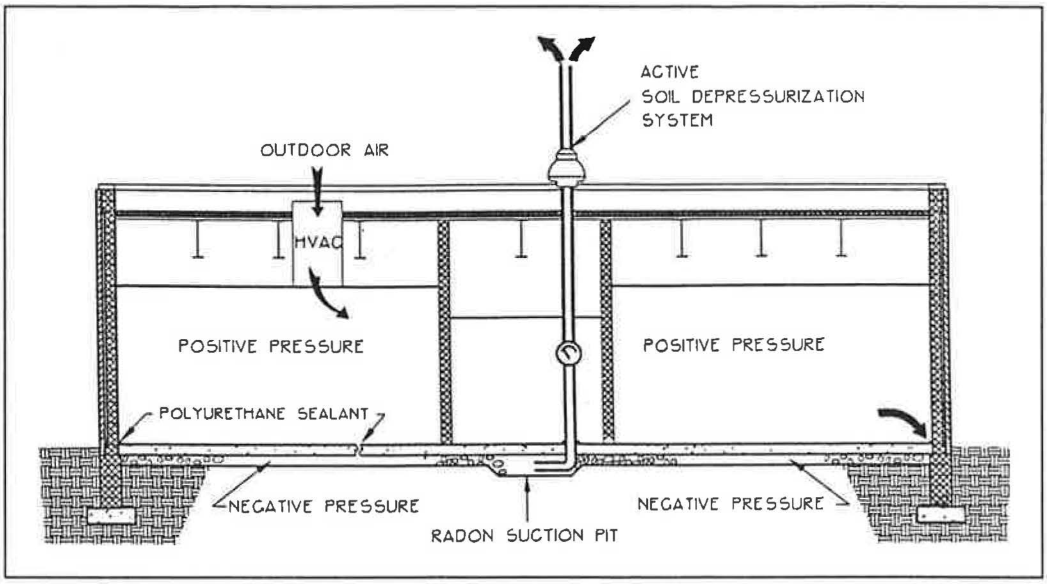
Architects and engineers, then, should use a combination of radon prevention construction techniques when they are constructing a building in an area with the potential for elevated radon levels.

Three Techniques

The investigators suggest three basic techniques:

1. Install an active soil depressurization (ASD) system.
2. Pressurize the building using the heating, ventilating, and air conditioning (HVAC) system.
3. Seal major radon entry routes.

EPA recommends using all three of these methods in new construction to



Schematic of large building that includes various features that EPA says may control radon levels.

ensure effective and reliable radon control.

The first technique, depressurization, is thought by the investigators to be one of the most effective radon reduction techniques found by AEERL investigators for use in large buildings and residences. It controls radon at its source, which is commonly thought to be a particularly effective way to reduce exposure. An ASD system creates a low-pressure zone beneath the slab by using a powered fan to exhaust radon-containing soil gas from under the slab and foundation. The low-pressure field beneath the slab prevents soil gas from entering the building. Effectiveness depends on the ability of the negative pressure field to extend to all potential radon entry routes through the slab. Thus, the fewer obstructions to communication between all areas of the subslab, the more effective the ASD system. Subslab barriers can readily be eliminated or adequately modified in new large buildings during the design stage.

The second technique, building pressurization, can be used to most effectively design new buildings as well as to mitigate radon in existing buildings. Researchers have been studying two Florida buildings, one an office building and the other a school, to determine the impact on radon levels of the operation of the HVAC system.

Data collected from the buildings indicate that the HVAC operation and ventilation rates to the occupied space can significantly reduce indoor radon concentrations. Radon levels were measured with the HVAC off and then with the systems providing varied outdoor air rates. Compared with the

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New Research Publication By EPA: *INSIDE IAQ*

A new publication, *INSIDE IAQ*, is being published by the Environmental Protection Agency (EPA) to provide information about research conducted by the agency's Office of Research and Development.

It will include information from the Air and Energy Engineering Research Laboratory, the Atmospheric Research and Exposure Assessment Laboratory, the Environmental Criteria and Assessment Office, and the Health Effects Research Laboratory).

INSIDE IAQ's first issue (EPA 600/N-93-010) was distributed in June 1993. It provides information on several ongoing and recently completed projects. It also summarizes recent ORD indoor air research publications.To be added to the mailing list, fax 919/541-2157 or write to:

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such as fractures, faults, etc., which are defined by linear arrays of elevated ^4He soil gas values (Fig. 3). At specific house sites, the radon entry routes are likely to be very localized subsurface physical pathways that may be amenable to detection by appropriate geophysical methods including ground-probing radar.

The findings to date support the view that rock permeability is a key factor influencing radon availability at the surface, even in poorly uraniferous rock types such as limestone. The implications are that heavily populated areas of the European Community that are sited on highly permeable bedrock—such as limestone—may also have serious indoor radon problems that should be assessed.▲

Reported by Patrick O'Connor, Geological Survey of Ireland

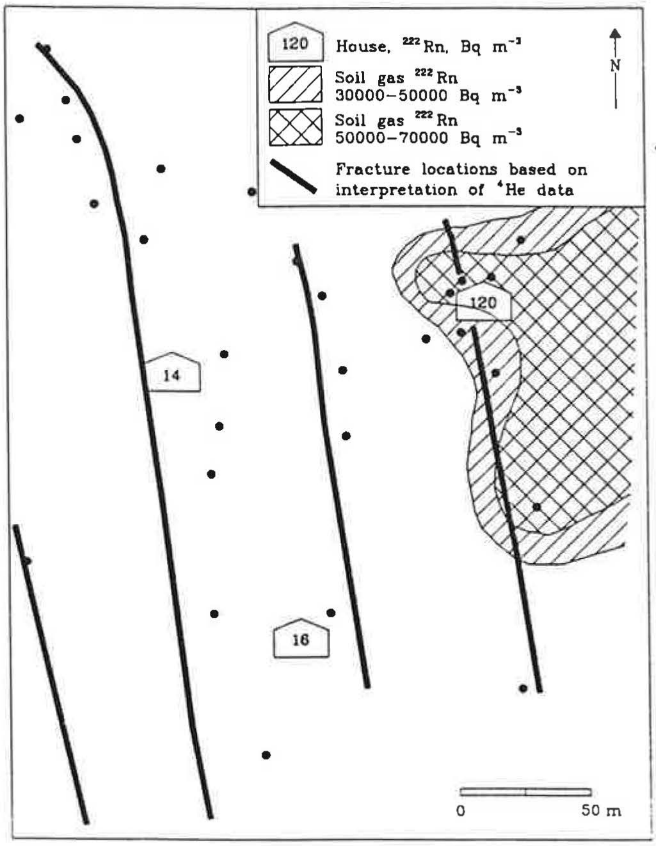

Fig. 3. Radon migratory routes in bedrock appear to be mainly controlled by zones of enhanced permeability, such as fractures and faults, which are defined by linear arrays of elevated ^4He soil gas values.

EPA Large Building Study (From Page 7)

HVAC systems off, levels were reduced by:

- 71% with the systems on and minimal delivery of outdoor air,
- 71 to 86% with an outdoor air delivery of 5 ft^3/min (cfm) person, and
- 86 to 89% with an outdoor air delivery of 15 cfm per person.

By comparison, a good ASD system installed during construction can reduce radon by 99% to near-ambient levels.

Passive tracer gas emitters were placed in all rooms, and sets of detectors were placed in all zones on the first and second floors for each change in outdoor air intake level.

The reductions are attributed primarily to dilution, although, at the higher ventilation rates, pressurization reduced the entry of radon through the ground-contact floor.

EPA researchers are using the Florida Solar Energy Center computer model to study the internal dynamics, air balance, and ventilation inherent to a building, including the outer shell.

The researchers said that the following radon mitigation measures should be incorporated into new building construction:

- A 4- to 6-in. layer of clean, coarse aggregate (ASTM #5 is preferred) should be evenly placed under the building slab with care taken not to include any soil.
- Internal barriers to subslab communication, such as subslab walls, should be avoided. If they must be used, they should be minimized, and openings through them to all slab areas should be included in the design.
- The radon vent pipe should extend beneath the slab into a suction pit that is open to the aggregate. The suction pit should have an exposed aggregate surface area of 5 to 7 ft^2. Six-in.-diam. polyvinyl chloride (PVC) vent pipes are often used.

EPA has prepared a document, *Radon Prevention in the Design and Construction of Schools and Other Large Buildings*. It includes technical details needed to apply the features. It is available from the National Technical Information Service (telephone 703/487-4650). For free copies, contact A.B. "Chick" Craig at AEERL, 919/541-2824, or Marc Menetrez 919/541-7981.▲

From reports by A.B. "Chick" Craig, Marc Menetrez, Kelly Leovic, and D. Bruce Harris, EPA