European Research Evaluated for 90-91

CEC Research

The following is a brief evaluation by the Commission of European Communities (CEC) of its 1990-1991 radon research program. It outlines the various elements of the scientific studies and how they proceeded.

Projects Included Geology, Assessment, Aerosols, Sources, Models, and Remediation

The research, most of which is continuing, was conducted at laboratories in Belgium, Ireland, England, Spain, Italy, Netherlands, Denmark, Greece, Sweden, Portugal, and France. The projects were funded by more than $1 million in grants from the CEC's Office of Science, Research and Development.

Radon Sources, Models, and Remedial Actions

Effectiveness of practical radon remedial measures was studied in 150 homes. The remedial actions adopted were classified according to householders' replies to questionnaires.

Results of the study indicated that subfloor depressurization was the most effective and reliable method to reduce radon, generally by an order of magnitude. The next most effective technique was creating positive ventilation in homes with limited natural ventilation.

A three-dimensional finite-difference code was applied to model soil-gas movement and was used to predict the performance of radon remediation techniques. Calculations in this model can incorporate:

- indoor-outdoor pressure differences,
- joints and cracks in the floor,
- permeabilities of soil and building materials, and
- the presence of remedial measure

Practical radon remediation measures also were examined for use in schools with hig radon levels. After tests in one school researchers installed mechanical ventilation systems that created an overpressure, which substantially reduced radon levels. In a second school, the sealing of soil-gas entry routes and improved ventilation unde floors reduced radon concentrations t an acceptable level.

Detailed measurements were made of radon in soil gas, gamma-ray spectra, and uranium and radium levels in soil in two areas of the United Kingdom. In both areas, researchers found statistically significant correlations between lithology and radon in soil gas and between radon in soil gas and radon in homes.

Retrospective Assessment

The aim of this project was to investigate the prerequisites for using long-

lived radon decay products in dwellings as retrospective risk estimators.

The quotients of implanted ^{210}Po in indoor glasses and radon exposure are scattered about 10^{-3}. Researchers found, however, that because the true radon exposure value is not known it is difficult to calibrate the glass-polonium system by in situ sampling of glass panes.

The influence of all indoor parameters, including electrical fields and advectory air-current, was examined. The results indicate that trapping of alpha recoils by dirt and dust is a minor problem but that advectory current can seriously affect the quotient.

A device that measures plate-out characteristics of short-lived radon decay products was developed and improved.

Characteristics of Radon and Thoron Aerosols

The deposited fraction of the total amount of inhaled radon daughters and the deposition site in the bronchial tree depend on parameters such as:

- the physical and chemical characteristics of the airborne particles carrying the radon decay products,
- characteristics of various ways of breathing,
- the rate of breathing, and
- the size and form of the airway.

The particle size of the aerosol-attached activities and the particle size of the unattached activities are important parameters in all dosimetric models for estimation of natural human radiation exposure.

Progress was achieved in the design, construction, and calibration of improved size-fractionating instruments. Similar progress was made in work on radon chambers and instruments designed to determine deposited activity in the human airway.

Although improvement and development of experimental techniques had the highest priority in this project, researchers also made progress in:

- determining aerosol size characteristics,
- determining activity concentrations of ^{222}Rn and ^{220}Rn and their short-lived decay products in the domestic environment,
- determining activity deposition in the human lung, and
- conducting controlled chamber studies concerning the plate-out rates of radon progeny.

Geological Factors Influencing Hazard areas

The primary goal of this project was to conduct an integrated, multidisciplinary investigation of the geological factors controlling the occurrence of certain high radon exhalation sites in western Ireland.

Specifically, the study set out to:

- determine the geological controls of radon production and migration in karstic limestone terrain; and
- develop a more efficient and effective field sampling methodology for radon detection and test the use of soil-gas helium mapping as an aid in delineating radon migratory routes.

Researchers found that geological mapping, when supported by combined Rn-He soil gas surveys can succeed in defining radon availability over broad geographic areas of varied geology and pedology.▲

By Dr. Martial Olast, CEC

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