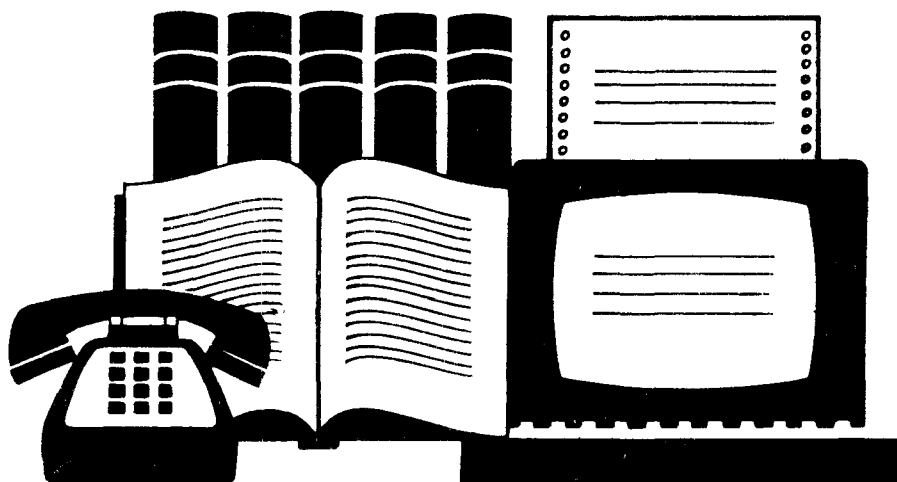




Bibliographic Series

Indoor Radon Pollution: Update



INDOOR RADON POLLUTION : UPDATE

DECEMBER 1988

BY

SHEILA A. RICHARD

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RADON BIBLIOGRAPHY

INTRODUCTION

Radon has become an increasingly important topic in recent years. EPA is concerned about the increased risk of lung cancer to those who are exposed to radon in their homes and in their work environment.

Radon is a colorless, odorless, tasteless, radioactive gas that occurs naturally in soil gas, underground water, and outdoor air. It exists at various levels throughout the United States. This bibliography, which is an update of Indoor Radon Pollution, has been compiled by Sheila Richard, Reference Librarian at the EPA Headquarters Library. Pertinent online databases have been searched and citations were selected for their relevance to EPA's radon program.

The bibliography focuses on indoor radon pollution problems and is organized according to the following major topic areas: I-Overview (covering general areas such as law and policy, popular press, communication and education, indoor air and books); II-Health Effects (epidemiology, risk estimates, and dosimetry); III-Exposure (house construction, geology, source, physical properties, and radon in water); IV-Surveys (national and international case studies); V-Mitigation; and VI-Measurement Techniques. Section VII-Appendix, lists State Contacts.

Most recent citations are listed first in each section, with the citations in this update covering January 1986-September 1988.

A descriptive abstract is included with each article citation. The source of the abstract is noted by an alphabetic code enclosed in parenthesis at the end of the entry. The databases and codes abbreviations are listed below:

- | | |
|-------|---|
| (BIO) | Biosis Previews Biosciences Information Services 2100 Arch Street Philadelphia, PA 19103 |
| (EMB) | Embase User Education Officer Elsevier Science Publishers/Excerpta Medica 52 Vanderbilt Avenue New York, NY 10017 |

(BIB) Environmental Bibliography
Environmental Studies Institute
2074 Alameda Padre Sierra
Santa Barbara, CA 93103

(ENV) Enviroline
Environment Information Center, Inc.
292 Madison Ave.
New York, NY 10017

(ERIC) Educational Resources Information Center
U.S. Department of Education
Washington, DC 20208

(GEO) Georef
American Geological Institute
One Skyline Place
5205 Leesburg Pike
Falls Church, VA 22041

(MED) Medline
Medlars Management Section
National Library of Medicine
8600 Rockville Pike
Bethesda, MD 20209

(MI) Magazine Index
Information Access Company
11 Davis Drive
Belmont, CA 94002

(NNI) Newspaper Abstracts
UMI, Inc.
Ann Arbor, MI

(NTIS) National Technical Information Service
U.S. Department of Commerce
5285 Port Royal Road
Springfield, VA 22041

(OSH) Occupational Safety & Health
Technical Information Branch
National Institute for Occupational Safety
and Health
4676 Columbia Parkway
Cincinnati, OH 45226

(PAIS) Public Affairs Information Service, Inc.
521 West 43rd Street
New York, NY 10036

- (POL) Pollution Abstracts
Cambridge Scientific Abstracts
5161 River Road
Bethesda, MD 20816
- (SCI) Scisearch
Online Customer Service Representative
Institute for Scientific Information
University City Science Center
3501 Market Street
Philadelphia, PA 19104
- (WRA) Water Resources Abstracts
Office of Water Research and Technology
U.S. Department of the Interior
Washington, D.C. 20240
- (SMH) Smoking and Health
Technical Information Center
Office of Smoking and Health
Park Building, Room 1-16
5600 Fishers Lane
Rockville, MD 20857

Those abstracts provided by the library have two alphabetic codes, the first listing the source of the citation and the second the provider of the abstract: either AUTH for author abstract as obtained through examining the hard copy of the article or HQL for abstract provided by the Headquarters Library.

The library staff wishes to thank Dr. Richard C. Cothorn, Executive Secretary for the Environmental Health Committee of the Science Advisory Board, US EPA, for his advice and direction in the development of this bibliography.

For additional information, you may wish to contact the EPA Office of Radiation Programs at (202) 557-9710, or your state radon contact (see the list of State Radon Contacts in the Appendix) or the Headquarters Library at (202) 382-5922. To obtain a copy of the original Indoor Radon Pollution bibliography, you may contact the National Technical Information Service (NTIS) at (800) 336-4700 or write to them at 5285 Port Royal Road, Springfield, VA 22161. The order number for the bibliography is PB 86-139375/AS.

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VII. Appendix

State Radon Contacts

I. OVERVIEW

A. BACKGROUND INFORMATION

Controlling indoor air pollution.

Nero, Anthony V., Jr.

Scientific American v258 p42(7) May, 1988

CODEN: SCAMAC

illustration; photograph; chart

Airborne combustion products, toxic chemicals and radioactivity are more concentrated indoors than outdoors. Should indoor air be regulated? If so, how? Putting the risks in perspective helps to answer both questions. (MAG) (HQL)

THE PENNSYLVANIA RADON STORY

GERUSKY THOMAS M.

PENNSYLVANIA DEPT ENV RESOURCES,

J ENV HEALTH, JAN-FEB 87, V49, N4, P197(4)

JOURNAL ARTICLE IN DECEMBER 1984, THE PENNSYLVANIA BUREAU OF RADIATION PROTECTION WAS NOTIFIED OF A HOME IN EASTERN PENNSYLVANIA HAVING THE HIGHEST LEVEL OF RADON DAUGHTERS EVER REPORTED FOR A PRIVATE RESIDENCE: 2600 PCI/L OF RADON GAS. A DECISION WAS MADE TO RECOMMEND THAT THE OCCUPANTS VACATE THE RESIDENCE, AND A DOOR-TO-DOOR SURVEY CAMPAIGN REVEALED ADDITIONAL HOMES WITH ELEVATED RADON LEVELS. THE BUREAU RESPONDED WITH A MASSIVE RADON MONITORING, EDUCATIONAL, AND REMEDIATION EFFORT. AS OF NOVEMBER 1986, OVER 18,000 HOMES HAD BEEN SCREENED FOR RADON DAUGHTERS, OF WHICH ABOUT 59% WERE FOUND TO HAVE LEVELS IN EXCESS OF THE 0.020 WORKING LEVEL GUIDELINE. (5 REFERENCES, 3 TABLES) (ENV)

Committee on Interagency Radiation Research and Policy Coordination: Third Annual Report, July 1, 1986 to June 30, 1987

NTIS Prices: PC A03/MF A01

Oak Ridge Associated Universities, Inc., TN.

Corp. Source Codes: 021305000; 4828000

Sponsor: Department of Energy, Washington, DC.

Report No.: ORAU-87/J-78

30 Jun 87 15p

Languages: English

NTIS Prices: PC A03/MF A01 Journal Announcement: GRAI8810;
NSA1300
Country of Publication: United States
Contract No.: AC05-76OR00033

During its third year the Committee on Interagency Radiation Research and Policy Coordination (CIRRPC) issued two reports of national importance and addressed 12 issues, six of which will be discussed in reports scheduled for issuance within the first several months of its fourth year of operation. The two reports are the report on the guidance for US policy on use of the international system of units for radiation quantities and measurements, issued in December 1986, and the report identifying the radiation exposure issues associated with the exposure to radon naturally occurring in houses and buildings, issued in August 1986. A listing of the Executive Committee members, agencies' representatives, science panel members and science and policy panel participants are contained in section IV.A. CIRRPC's reporting and organizational structure and Oak Ridge Associated Universities (ORAU) technical assistance staff is contained in section IV.B. (ERA citation 13:011639) (NTIS)

THE INDOOR RADON PROBLEM EXPLAINED FOR THE LAYMAN (ENGLISH)
HOPKE PK
UNIV ILLINOIS, DEPT CIVIL ENGN/URBANA//IL/61801; UNIV
ILLINOIS, DEPT NUCL ENGN/URBANA//IL/61801; UNIV ILLINOIS,
INST ENVIRONM STUDIES/URBANA//IL/61801
ACS SYMPOSIUM SERIES, V331, P572-586, 1987

See full citation in the BOOKS Section I. D. (SCI)

Indoor radon: a residential radiation dilemma.
Brown DH
NC Med J (United States) Jan 1987 48(1) p25-7

Radon is not a new health hazard, it has existed for longer than humankind itself. The real questions posed are: how much of the non-smoking related lung cancer may be due to indoor radon, and what steps can be taken to reduce its incidence rate. (MED)
(HQL)

Indoor radon called a national problem
Mose, D.
George Mason Univ., Dep. Geol., Fairfax, VA, USA
Geotimes 32: 7, 1987 9-11p.
Country of Publ.: United States

ISSN: 0016-8556
CODEN: GEOTAJ
Subfile: B
Doc Type: SERIAL Bibliographic Level: ANALYTIC
Languages: English
illus.

Preliminary studies over most of the U.S. show that in some areas radioactive radon is accumulating in homes in levels that are much higher than anticipated. In the past year, studies done in the Appalachian states show that indoor radon levels are determined by the radon-emanation properties of the soil or rock on which homes are built. Those observations and others were reported at the day-long symposium, "Geological Factors Related to Indoor Radon," which was held in March at the meeting of the Southeastern Section of the Geological Society of America in Norfolk, Va. (GEO)(HQL)

Pennsylvania: Protecting the homefront
Gerusky, T.M.
ENVIRONMENT VOL. 29, NO. 1, vp, Publ.Yr: 1987
Languages: ENGLISH

After the incident at the Limerick nuclear power plant, health physicists and officials notified the Pennsylvania Bureau of Radiation Protection that they had detected 12 working levels (WL) of radon daughters in the living room of Stanley Watras's house in eastern Pennsylvania. Additional monitoring by the bureau verified radon levels of 13.5 WL, greater than any level ever reported in the literature. Thus began an effort that apparently has no end in sight. (POL)

Committee on Interagency Radiation Research and Policy
Coordination: Summary of CIRRPC Activities for the Period
July 1 Through September 30, 1987
NTIS Prices: PC A03/MF A01
Oak Ridge Associated Universities, Inc., TN.
Corp. Source Codes: 021305000; 4828000
Sponsor: Department of Energy, Washington, DC.
Report No.: DOE/OR/00033-T379
12 Nov 87 12p
Languages: English
NTIS Prices: PC A03/MF A01 Journal Announcement: GRAI8811;
NSA1300
Country of Publication: United States
Contract No.: AC05-76OR00033

This report describes the activities of the Committee on Interagency Radiation Research and Policy Coordination for a three month period in 1987. The report briefly summarizes the efforts of the Executive Committee; the Science Panel; Policy Subpanels on Radioepidemiological Tables and Indoor Radon; Science Subpanels on Radiation Protection Standards, High LET Radiation, and Research Needs in the Effects of Non-Ionizing Radiation; Radioepidemiological Tables; Predisaster Planning, and Risk Assessment. Brief reports on special projects are included. (ERA citation 13:011638) (NTIS)

RADON: PINPOINTING A MYSTERY

BARNES A. JAMES; GUIMOND RICHARD J.; DEBENEDICTIS NICHOLAS;
BASKIN ROBERTA; CHERN MICHAEL J.
EPA DEPUTY ADMINISTRATOR,
EPA J, AUG 86, V12, N6, P2(12)

JOURNAL ARTICLE RADON MAY POSE A THREAT TO THE POPULATION AT LARGE, AS RECENT STUDIES NOW SHOW THAT RADON CONTAMINATION MAY BE A PROBLEM IN MANY PARTS OF THE U.S. THE INDOOR RADON PROBLEM DOES NOT LEND ITSELF TO A REGULATORY APPROACH. IT IS A NATURALLY OCCURRING SUBSTANCE; RADON LEVELS VARY FROM REGION TO REGION, EVEN FROM HOME TO HOME, A PATTERN THAT INHIBITS A REGULATORY APPROACH. AN EPA RADON ACTION PROGRAM WAS ESTABLISHED IN 1985 TO ASSIST STATES IN DEALING WITH RADON PROBLEMS IN HOMES. THE FOUR ACTIVITIES CONTAINED IN THE PROGRAM ARE DISCUSSED: PROBLEM ASSESSMENT, MITIGATION AND PREVENTION, CAPABILITY DEVELOPMENT, AND PUBLIC INFORMATION. THE INDOOR RADON PROBLEM IN PENNSYLVANIA IS REVIEWED, AND INFORMATION IS COMPILED TO HELP THE PUBLIC UNDERSTAND THE DIMENSIONS OF THIS ENVIRONMENTAL THREAT. (ENV)

Final Report and Evaluation of the SAWORA Research Program on Background Radiation Levels from Natural Origin in the Netherlands.

In Dutch

U.S. Sales Only.

NTIS Prices: PC A04/MF A01

Hogeweg, B.

Ministerie van Volkshuisvesting, Ruimtelijke Ordening en Milieubeheer, The Hague (Netherlands). Directie Stralenbescherming.

Corp. Source Codes: 087985003; 4188735

Report No.: VROM-DSB-86-23; VROM-60793/8-86

Sep 86 66p

Languages: Dutch

NTIS Prices: PC A04/MF A01 Journal Announcement: GRAI8805

Country of Publication: Netherlands

In order to study the various factors which determine the dose resulting from background radiation, in particular for the indoor situation, the SAMORA-programme was initiated in 1982. The various aspects studied were: 1) a determination of the current background radiation level, for the indoor as well as the outdoor situation; 2) an inventory of the radioactivity of the building materials; 3) the radioecological aspects from fly-ash and gypsum deposits; 4) a risk estimation of lung tumour induction at low doses and for low dose rates; 5) technical factors determining the effective dose equivalent. In this report the connection of the results derived in the different studies will be discussed. From the study on radioconcentration it became clear that the indoor concentration is strongly determined by the concentration in the crawl space. On the basis of the results of the programme an estimation of the lung tumour risk for the Dutch population is presented. For the current levels it is calculated that the risk is approximately 2.1 lung tumours per 100,000 persons. Since in 1982 the mean lung tumour death rate for the Dutch population was 56.8 per 100,000, this result demonstrates that the calculated contribution is relatively low (4%). Furthermore it is calculated that the maximum increase of this contribution as a result of the introduction of active gypsum building materials will be of the order of 1%. (Auth.). Contains a list of SAWORA-publications (34 refs.); 51 refs.; 4 figs.; 6 tabs. (Atomindex citation 18:079207) (NTIS)

A CITIZEN'S GUIDE TO RADON: WHAT IT IS AND WHAT TO DO ABOUT IT
EPA REPORT OPA-86-004, AUG 86 (14)
FED GOVT REPORT

BASIC INFORMATION IS COMPILED ON THE OCCURRENCE, HEALTH EFFECTS, AND CONTROL OF RADON. ALTHOUGH RADON HAS ALWAYS BEEN PRESENT IN AIR, CASES OF HIGH INDOOR RADON LEVELS IN MANY HOMES HAVE MADE THIS PROBLEM A MAJOR ENVIRONMENTAL ISSUE. RADON SEEPS INTO HOMES FROM SOILS OR GROUNDWATER, OR IS RELEASED FROM MATERIALS USED IN HOME CONSTRUCTION. TOPICS COVERED INCLUDE THE USE OF RADON DETECTORS, TEST RESULT INTERPRETATION, AND REDUCING RISKS FROM EXPOSURE. (ENV)

Environmental Radiation and Cancer
Mossman, K.L., D.S. Thomas, and A. Dritschilo
Journal of Environmental Science and Health. Part C:
Environmental Carcinogenesis Reviews, Vol. 4, No. 2, pages
119-161, 65 references 1986
CODEN: JECREO

The sources of radiation exposure and population doses from

these sources, health implications (especially cancer induction) to exposed populations, and contemporary problems concerning environmental radiation are reviewed. Only ionizing radiations, including X-rays, gamma-rays, alpha particles, etc. are included. Sources include the natural background and the man made radiation environment, including medical applications, technologically enhanced exposure to natural radiation, fallout from nuclear weapons testing, occupational radiation exposure in the United States, radiation exposure from the nuclear fuel cycle, and radiation exposure from consumer products in the United States. Occupational radiation exposures include medical and dental X-rays, industrial radiography, various levels of industry associated with the production and use of nuclear fuels, and enhanced cosmic ray exposure in high altitude flight. The section on radiation carcinogenesis covers evidence of radiation carcinogenesis in human populations, principles of radiation carcinogenesis, and risk of cancer induction at environmental levels of radiation. Current issues include indoor radon (10043922) (sources and characteristics), radon and lung cancer, and reactor accidents. (OSH)

I. OVERVIEW

B. LAW AND POLICY

Implementation of the Environmental Protection Agency's radon action program

Chiles, B.L.; Rinck, R.T.; Wagner, D.C.

U.S. EPA, Washington, DC 20460, USA 81. APCA Annual Meeting & Exhibition Dallas, TX (USA) 19-24 Jun 1988 81. APCA

ANNUAL MEETING & EXHIBITION p. 107, Publ.Yr: 1988

SUMMARY LANGUAGE - ENGLISH

Languages: ENGLISH

This paper discusses the development and implementation of the U.S. Environmental Protection Agency's Radon Action Program. The purpose of this paper is to examine the needs identified by the States and others following the discovery of highly elevated radon levels. It also highlights activities undertaken by the Radon Action Program to address these needs. The paper concludes that significant progress has been made but acknowledges that much still needs to be done. In addition, the paper takes a detailed look at EPA's efforts to establish National guidance levels for indoor radon and a program to ensure the accuracy and reliability of radon measurements. (PA)

RADON ANSWERS ARE SURFACING IN THE STATES

DAVIS JOSEPH A.

GOVERNING, FEB 88, V1, N5, P54(3)

JOURNAL ARTICLE EPA REPORTED IN AUGUST 1987 THAT 21% OF THE 11,600 HOMES TESTED IN 10 STATES HAD RADON LEVELS EXCEEDING 4 PCI/L, THE AGENCY'S SUGGESTED DANGER LEVEL. THE PROBLEM APPEARS TO BE ACUTE IN THE READING PRONE STATES, AFFECTING NEW YORK, NEW JERSEY, AND PENNSYLVANIA. IN THE ABSENCE OF AN EPA-SPONSORED REMEDIAL PROGRAM, THE STATES HAVE TAKEN ACTION ON THEIR OWN. NEW JERSEY HAS ENACTED A LAW REQUIRING A STATEWIDE SURVEY AND EPIDEMIOLOGICAL STUDY. A 1986 PENNSYLVANIA LAW AUTHORIZED THE STATE HOUSING FINANCE AGENCY TO RUN A LOW-INTEREST LOAN PROGRAM FOR RADON MITIGATION. NEW YORK GIVES FREE RADON DETECTORS TO HOMES ENROLLED IN ITS ENERGY CONSERVATION PROGRAM. (3 DRAWINGS) (ENV)

Indoor Air Quality Act of 1987: hearing, November 20, 1987, on S. 1629, a bill to authorize a national program to reduce the threat to human health posed by exposure to contaminants in the air indoors.

United States. Senate. Com. on Environment and Public Works. Subcom. on Environmental Protection.

'88 iii+146p

SERIES: 100th Cong., 1st sess.; S. hearing 100-387; SD cat. no. Y 4.P 96/10:S.hrg.100-387;

Threat from radon, asbestos, volatile organic chemicals, combustion by products, and respirable particles. (PAIS)

Pollution in the home

Dowd, R.M.

R.M. Dowd & Co., Washington, DC, USA

ENVIRON. SCI. TECHNOL VOL. 21, NO. 6, p. 535, Publ.Yr: 1987

Languages: ENGLISH

Journal Announcement: V18N6

In April EPA submitted a report to Congress, as required by the Superfund Amendments and Reauthorization Act of 1986 (SARA), on implementing indoor air pollution and radon research programs within the agency. This statutory provision reflects congressional determination over the past several years to establish such programs by restoring research funds to EPA's budget in the face of the administration's continuing attempts to eliminate research on indoor air pollution. (POL)

Environmental Radiation Standards and Risk Limitation

Annual meeting of the Society for Risk Analysis, Houston, TX, USA, 1 Nov 1987.

Portions of this document are illegible in microfiche products.

NTIS Prices: PC A03/MF A01

Kocher, D. C.

Oak Ridge National Lab., TN.

Corp. Source Codes: 021310000; 4832000

Sponsor: Department of Energy, Washington, DC.

Report No.: CONF-871188-2

1987 16p

Languages: English Document Type: Conference proceeding

NTIS Prices: PC A03/MF A01 Journal Announcement: GRAI8813; NSA1300

Country of Publication: United States

Contract No.: AC05-84OR21400

The Environmental Protection Agency and Nuclear Regulatory Commission have established environmental radiation standards for specific practices which correspond to limits on risk to the public that vary by several orders of magnitude and often are much less than radiation risks that are essentially unregulated, e.g., risks from radon in homes. This paper discusses a proposed framework for environmental radiation standards that would improve the correspondence with limitation of risk. This framework includes the use of limits on annual effective dose equivalent averaged over a lifetime, rather than limits on dose equivalent to whole body or any organ for each year of exposure, and consideration of exposures of younger age groups as well as adults; limits on annual effective dose equivalent averaged over a lifetime no lower than 0.25 mSv (25 mrem) per practice; maintenance of all exposures as low as reasonably achievable (ALARA); and establishment of a generally applicable de minimis dose for public exposures. Implications of the proposed regulatory framework for the current system of standards for limiting public exposures are discussed. 20 refs. (ERA citation 13:019565) (NTIS)

EPA guideline for indoor radon levels evokes response from nuclear medicine.

Hanson B

J Nucl Med (UNITED STATES) Jul 1987, 28 (7) p1087-94, ISSN 0161-5505

Journal Code: JEC

Languages: ENGLISH

Experts debate cost/benefit analysis and epidemiologic studies in this article. (MED) (HQL)

Radon gas may seep into your liability.

Treffer, Brough E.

Real Estate Appraiser and Analyst 53:21-4 Spring '87, tables

LANGUAGE: Engl

DOC TYPE: P

Description, testing, removal of and physiological effects of radon; implications for appraisers; U.S. Since radon exposure is known to increase the risk of cancer and real estate appraisers are required to report all factors that affect property value, appraisers may soon be subject to lawsuits for failure to identify radon problems in an appraisal statement. (PAIS) (HQL)

RADON PROGRAM DEVELOPMENT ACT OF 1987

SEN COMM ENV PUBLIC WORKS 100 CON 1 REPORT 214, JUN 30, 87
(21)

FED GOVT REPORT BILL S.744, THE RADON PROGRAM DEVELOPMENT ACT OF 1987, SEEKS TO ASSIST STATES IN RESPONDING TO THE THREAT TO HUMAN HEALTH POSED BY EXPOSURE TO RADON. THE ACT WILL DIRECT EPA TO EXPAND TECHNICAL ASSISTANCE TO STATES ON RADON ISSUES AND WILL PROVIDE SEED MONEY TO HELP STATES INITIATE RADON-RELATED PROGRAMS. ANOTHER PROVISION OF THE BILL WILL EXPAND AND IMPROVE THE RADON PROFICIENCY TESTING AND TRAINING PROGRAMS OF EPA. EPA IS ALSO CHARGED WITH DETERMINING THE EXTENT OF RADON CONTAMINATION IN SCHOOLS AND IN FEDERAL BUILDINGS. AN AUTHORIZATION OF \$10 MILLION PER YEAR FOR THREE YEARS IS PROVIDED TO SUPPORT THE STATE GRANT ASSISTANCE PROGRAM. (ENV)

Radon gas issues: joint hearings, April 2, 1987, on S. 743 and S. 744, before the Subcommittees on Environmental Protection and Superfund and Environmental Oversight. United States. Senate. Com. on Environment and Public Works. '87 iii+124p, charts
SERIES: 100th Cong., 1st sess.; S. hearing 100-52; SD cat. no. Y 4.P 96/10:S.hrg.100-52;

Problems in identifying and eradicating indoor radon in schools; role of the U.S. Environmental Protection Agency. (PAIS)

RADON POLLUTION CONTROL ACT OF 1987

HSE COMM ENERGY COMMERCE HEARINGS 100-20, APR 23, 87 (123)

HEARING TRANSCRIPT HEARINGS WERE HELD TO CONSIDER RADON AS ONE OF THE GREATEST ENVIRONMENTAL HEALTH HAZARDS FACING THE U.S. PUBLIC. LEGISLATIVE PROVISIONS OF H.R. 1697, THE RADON POLLUTION CONTROL ACT OF 1987, WERE DISCUSSED. EPA HAS DETERMINED THAT THERE IS NO SAFE LEVEL OF RADON; THE AGENCY ESTIMATES THAT 5,000-20,000 PEOPLE DIE OF LUNG CANCER ANNUALLY AS A RESULT OF EXPOSURE TO RADON GAS. THE ACT WOULD PROVIDE STATES WITH FUNDS FOR RESOURCES IN ORDER TO CONDUCT SURVEYS TO FIND AND TARGET THE PROBLEM AND FORMULATE REMEDIAL PROGRAMS. EPA'S EFFORTS TO DOCUMENT AND ERADICATE THE RADON PROBLEM TO DATE ARE SURVEYED. TESTIMONY WAS PRESENTED BY JAMES BARNES OF EPA; DEBORAH STEVA OF THE OHIO DEPT OF HEALTH; AND OTHERS. ASSOCIATED DOCUMENTS AND MEMORANDA ARE TRANSCRIBED. (ENV)

Residential radon contamination and indoor quality research needs: hearing,
September 17, 1986.

United States. House. Com. on Science and Tech. Subcom. on Natural Resources, Agric. Research, and Environment.

'87 iii+333p, bibls il tables diag chart

SERIES: 99th Cong., 2d sess.; (Pubn.) no. 159; SD cat. no. Y 4.Sci 2:99/159;

Status of the radon research programs of the Department of Energy and the Environmental Protection Agency. (PAIS)

NATIONAL CONTROL STRATEGY SOUGHT FOR RADON GAS

ANON

J AIR POLLUT CONTROL ASSOC 37 (1). 1987. 70, 72-73.

CODEN: JPCAA

Language: ENGLISH

Subfile: BARRM (Biological Abstracts/RRM)

Discusses studies done at the Lawrence Berkeley Laboratory by physicist Anthony Nero, leading expert on indoor air quality. Studies have determined that buildings can draw large amounts of radon out of the ground. (BIO)(HQL)

The Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (Superfund) (P.L. 96-510), December 1986; as amended by the Superfund Amendments and Reauthorization Act of 1986 (P.L. 99-499).

United States. Laws, statutes, etc.

'87 v+226p

SERIES: 99th Cong., 2d sess.; Com. print; S. print 99-217;

SD cat. no. Y 4.P 96/10:S.prt.99-217;

Prepared for the Committee on Environment and Public Works, U.S. Senate.

Partial contents: Hazardous substances releases, liability, compensation; Pollution insurance; Emergency planning and community right-to-know; Radon gas and indoor air quality research. (PAIS)

Radon and indoor air pollution: hearing, October 10, 1985.

United States. House. Com. on Science and Tech. Subcom. on Natural Resources, Agric. Research, and Environment.

'86 iii+291p, il tables diags charts map

SERIES: 99th Cong., 1st sess.; (Pubn.) no. 66;

Dangers associated with radiation emanating from radon, a decay product of naturally occurring radioactive substances; control measures. (PAIS)

Radon gas: contractor liability for an indoor health hazard.

Shuko CM

Am J Law Med (UNITED STATES) 1986, 12 (2) p241-72, ISSN 0098-8588

Journal Code: 3IP

Languages: ENGLISH

Many families throughout the United States have recently detected dangerously high concentrations of radon gas inside their homes. Radon, a carcinogenic gas produced from uranium, has been discovered in structures overlying uranium-bearing rock. This discovery may result in litigation to determine contractor liability for building upon radon-releasing rock sites. This Note examines the strengths and weaknesses of the various theories of contractor liability and considers potential statutory claims under the Clean Air Act. The Note suggests, as an alternative approach to recovery, a proposed regulatory scheme and implementation plan. (214 Refs.) (MED)

WHO ENVIRONMENTAL HEALTH 13. INDOOR AIR QUALITY RADON AND FORMALDEHYDE

WHO

COPENHAGEN, DEN.

WHO. WHO ENVIRONMENTAL HEALTH, 13. INDOOR AIR QUALITY: RADON AND FORMALDEHYDE. X+40P. WHO REGIONAL OFFICE FOR EUROPE: COPENHAGEN, DENMARK.

ILLUS. PAPER. 0 (0). 1986 (RECD. 1987). X+40P. CODEN: ENVHE

Language: ENGLISH

Document Type: BOOK

Subfile: BARRM (Biological Abstracts/RRM)

This report originated from a WHO meeting that was held August 26-30, 1985 in Dubrovnik whose goal was to evaluate air quality guidelines. This separate report reviews guidelines specifically for radon and formaldehyde. Each pollutant is described in terms of sources, levels in air, kinetics, and routes of exposure. The health effects in human and laboratory animals is presented as well as an evaluation of the human health hazard. Conclusions and recommendations are presented for both radon and formaldehyde. Tables, graphs, and references supplement the text. (BIO)

Radon in Dwellings. How Much Are the Procedures Allowed to Cost. Documentation from a Symposium, Arranged by the Royal Swedish Academy of Engineering Sciences

In Swedish. Conference on radon in dwellings: how much are the procedures allowed to cost, Stockholm, Sweden, 4 Dec 1985.

U.S. Sales Only.

NTIS Prices: PC A06/MF A01

Ingeniors Vetenskaps Akademien, Stockholm (Sweden).

Corp. Source Codes: 012777000; 9860159

Report No.: IVA-301; CONF-851283-

1986 118p

Languages: Swedish Document Type: Conference proceeding

NTIS Prices: PC A06/MF A01 Journal Announcement: GRAI8707; NSA1100

Country of Publication: Sweden

The object of this meeting was to discuss radon problems and to elucidate the considerations on cost-benefit calculations. One of the problems was the difference in terms and definitions as used by technicians and economists. This inconvenience of communication was to overcome. The lectures were concentrated on building constructions and radon monitoring. (ERA citation 11:054678) (NTIS)

RADON AND INDOOR AIR POLLUTION

HSE COMM SCIENCE TECH HEARINGS 99 CON 1 66, OCT 10, 85 (295)

HEARING TRANSCRIPT HEARINGS WERE HELD TO DISCUSS THE EMERGING ENVIRONMENTAL AND PUBLIC HEALTH PROBLEM CAUSED BY INDOOR RADON RADIATION. EPA HAS FORMULATED A STRATEGY AND MANAGEMENT PLAN FOR ASSESSMENT AND MITIGATION OF RADON EXPOSURE, AND RECOMMENDS THAT \$10.7 MILLION BE COMMITTED TO ATTACK THE RADON PROBLEM. EMPHASIS SHOULD BE PLACED ON MITIGATION OF EXPOSURE IN EXISTING STRUCTURES AS WELL AS ON PREVENTION OF EXPOSURE IN FUTURE CONSTRUCTION. HEALTH EFFECTS ASSOCIATED WITH INDOOR RADON POLLUTION ARE CITED. TESTIMONY WAS PRESENTED BY SHELDON MEYERS OF EPA; JOHN MILLHON OF DOE; AND OTHERS. ASSOCIATED DOCUMENTS AND MEMORANDA ARE TRANSCRIBED. (ENV)

THE BPA ENVIRONMENTAL IMPACT STATEMENT

THOR PHIL

US BONNEVILLE POWER ADMIN,

WASHINGTON ENERGY/OREGON STATE UNIV INDOOR AIR CONF,
BELLEVUE, WA, NOV 15-16, 84, P125(8)

CONF PAPER THE ENVIRONMENTAL IMPACT STATEMENT PREPARATION PROCESS EMPLOYED BY THE U.S. BONNEVILLE POWER ADMIN. IN ASSESSING THE EFFECTS OF ENERGY CONSERVATION ON INDOOR AIR QUALITY IN RETROFITTED RESIDENCES IS DESCRIBED. BEFORE STARTING A WEATHERIZATION PROGRAM, THE AGENCY LOOKS FOR POTENTIAL IMPACTS. COMPUTER MODELING ENABLES ESTIMATION OF THE RANGE OF INHABITANT EXPOSURE TO EACH POLLUTANT TYPE. IF, AFTER HOUSE TIGHTENING, THE RADON LEVEL EXCEEDS A CERTAIN LEVEL, THE AGENCY OFFERS TO SHARE THE COST OF AN AIR-TO-AIR HEAT EXCHANGER THAT CAN OFFSET THE EFFECTS OF TIGHTENING. (ENV)

POLICY MAKING IN AN UNCERTAIN ENVIRONMENT

O'NEAL GARY

EPA, WASHINGTON ENERGY/OREGON STATE UNIV INDOOR AIR CONF, BELLEVUE, WA, NOV 15-16, 84, P117(8)

CONF PAPER POLICY MAKING IS DISCUSSED IN THE CONTEXT OF REGULATING INDOOR AIR POLLUTANTS. FOR SOME CONTAMINANTS LIKE RADON, ASBESTOS, AND TOBACCO SMOKE, THERE IS A REASONABLE SCIENTIFIC CONSENSUS OF SOME OF THE ASSOCIATED HEALTH RISKS. HOWEVER, THE TOXICOLOGICAL AND EPIDEMIOLOGICAL DATABASE IS FAR FROM COMPLETE. UNCERTAINTY ALSO EXISTS IN THE ADEQUACY AND CONSISTENCY OF THE MONITORING TECHNIQUES USED TO GENERATE SUCH DATA. ISSUES OF RISK ASSESSMENT AND RISK MANAGEMENT ARE EXPLORED. (ENV)

I. OVERVIEW

C. POPULAR PRESS

Testing for radon: how dangerous radiation sneaks into our homes and what to do about it.

Better Homes and Gardens v66 p82(2) Feb, 1988

CODEN: BHGHA

Recommends obtaining the EPA booklet "A Citizen's Guide to Radon: What It Is and What To Do About It," and describes two types of radon test kits: activated charcoal-type detectors and alpha track type detectors. Procedures for lowering radon levels are described. (MI) (HQL)

Radon: the silent killer in your home.

Smith, James V., Jr.

American Legion v124 p20(3) Feb, 1988

CODEN: ALMGA

Describes the increased interest and concern with radon; how it enters the home and health effects. There is a brief discussion of some radon studies, types of detectors, and methods for reducing levels of radon in the home. (MI) (HQL)

The unrecognized danger. (radon) (column)

Asimov, Isaac

Fantasy and Science Fiction v74 p108(10) Feb, 1988

CODEN: FSFIBT

ARTICLE TYPE: column

Radon occurs naturally because it is constantly being produced by uranium atoms breaking down in the soil. Whenever uranium exists, radon is produced and subsequently percolates up through the soil and into the atmosphere. It is suspected that exposure to indoor concentrations of radon is the number two cause of lung cancer in the United States. (MI) (HQL)

Radon death risk called 3 times more than believed.

Stammer, Larry B.

Los Angeles Times v107 Section I p1 Jan 6, 1988

EDITION: Wed 027 col. in.
SIC CODE: 9511

A three-year study by the National Council reveals that the risks of dying from lung cancer as a result of indoor exposure to radon is much greater than previously thought and is especially true for smokers. (NNI) (HQL)

RADIATION ESTIMATE IN U.S. ALMOST DOUBLED IN REPORT
LEARY WARREB E.
NEW YORK TIMES, NOV 20, 87, PA14(1)

NEWS ARTICLE A NEW FEDERAL REPORT HAS NEARLY DOUBLED THE AVERAGE AMOUNT OF RADIATION A U.S. CITIZEN IS EXPOSED TO IN A YEAR. THE NEW CALCULATIONS INCLUDE THE EFFECTS OF RADON GAS SEEPING INTO HOMES. THE ESTIMATED EXPOSURE, WHICH WOULD BE EQUIVALENT TO THE RADIATION OF MORE THAN 25 CHEST X-RAYS, REMAINS FAR BELOW THE LIMITS SET BY FEDERAL SAFETY STANDARDS. THE REPORT DOUBLED THE COMMONLY USED FIGURE FOR AVERAGE RADIATION EXPOSURE TO 360 MREM FROM 170 MREM, ALTHOUGH DOSES PEOPLE RECEIVE HAVE NOT INCREASED. MORE THAN 80% OF THE AVERAGE EXPOSURE, ABOUT 100 MREM, COMES FROM BACKGROUND SOURCES SUCH AS RADIOACTIVE ROCKS AND NUCLEAR FALLOUT. (1 DIAGRAM) (ENV)

House bill to curb radon danger being pushed.

Lichtblau, Eric

Los Angeles Times v106 Section I p4 Nov 6, 1987

EDITION: Fri 006 col. in.

DESCRIPTORS: Radon--physiological aspects; Radioactive pollution--law and legislation; United States. Congress. House--environmental policy

The House Energy and Commerce subcommittee is considering a bill similar to one previously passed by the Senate that would offer States technical guidance and funding to combat radon. (NNI) (HQL)

A special report on radon.

Vara, Jon

Country Journal v14 p16(5) Nov, 1987

CODEN: BKCJDL

illustration; chart

CAPTIONS: (Radon entry points in various rooms in a house.)

Unlike most forms of background radiation, radon occurs in high concentrations indoors, where it poses a severe health

threat. The gas unerringly makes its way through cracks or fissures in concrete foundation walls and floors and accumulates within confined areas. In some instances radon also enters a house through the water supply. The only way to be sure that your home is safe is to test it. (MI)(HQL)

Radon; up to 25% of all U.S. homes may have hazardous levels of radioactive gas. (includes related article on do-it-yourself radon testing)

Mother Earth News p50(4) Sept-Oct, 1987

CODEN: MEAND

illustration; chart

CAPTIONS: Ventilation techniques.

The author concludes that there are a few simple-though not necessarily easy-things you can do to reduce the risk of radon. First, test different areas of the house: radon levels are seldom consistent throughout a building. Try to spend most of your time in the areas where radon concentrations are lowest. Second, smokers should either quit or move. Recent information suggests that radon may have a synergistic effect with cigarette smoke, increasing the risk greatly for smokers. (MI) (HQL)

Radon revisited. (update on contamination and control)

Gilmmore, V. Elaine

Popular Science v231 p92(3) Sept, 1987

CODEN: POSCD

illustration; chart

CAPTIONS: How radon gets in - and how to get it out.

Lawrence Stanley Watras, an engineer at a nuclear power plant in Pennsylvania, set off an alarm as he passed through a radiation monitor in December 1984. Since then it has been determined that: 1-Radon is the second leading cause of lung cancer, and 2- The longer the exposure and the higher the level, the greater the risk. Fortunately, radon levels can be brought down to acceptable levels. (MI)(HQL)

The pollution within. (indoor air pollution from radon gas; includes related articles on air poisons, heat recovery ventilator, and reasons for ventilation)

Fossel, Peter V. Country Journal v14 p44(6) Sept, 1987

CODEN: BKCJDL

illustration; chart

CAPTIONS: (How a heat-recovery ventilator works.); (Manufacturers of heat-recovery ventilators.)

Indoor air pollution from radon gas and other sources is pervasive and insidious. This article addresses various ways you can identify and correct the problem. (MI) (HQL)

Danger just downstairs. (Radon hazards; EPA survey of houses)

Time v130 p72(1) Aug 17, 1987

CODEN: TYMEA

illustration; photograph

The EPA announced that the health threat posed by radon may be greater than previously thought. (MI) (HQL)

10-state survey finds peril from radon in 1 in 5 homes. (Environmental Protection Agency)

Shabecoff, Philip

New York Times v136 p8(N) pA14(L) Aug 5, 1987

EDITION: Wed 028 col. in.

CODEN: NYTIA

SIC CODE: 9511

The EPA announced that health-threatening levels of radon gas have been found in one of every five homes tested in a ten state survey. Soil permeability and home ventilation, as well as the existence of deposits of uranium ore, granite, limestone, shale or phosphate, influence radon levels. (NNI) (HQL)

Household hazards; how to learn if your home could be dangerous to your health. (includes related article) (column)

Reiger, George

Field and Stream v92 p12(3) June, 1987

CODEN: FISTB

ARTICLE TYPE: column

The Lawrence Berkeley Laboratory found cancer risks posed by the inhalation of radon to be 100 to 1000 times greater than those for many of the chemicals for which the EPA has already issued cautionary guidelines. Radon in homes can be tested and remedial action taken. (MI) (HQL)

I. OVERVIEW

D. COMMUNICATION AND EDUCATION

RADON RISK INFORMATION AND VOLUNTARY PROTECTION: EVIDENCE FROM A NATURAL EXPERIMENT,
JOHNSON F. REED ; LUKE RALPH A.
EPA, RISK ANALYSIS, 1987, V7, N1, P97(11)

JOURNAL ARTICLE THIS STUDY EXAMINES THE PERCEIVED RISKS AND MITIGATING BEHAVIOR OF MAINE HOUSEHOLDS WHO RECEIVED NEW INFORMATION ON THEIR EXPOSURES TO SIGNIFICANT HEALTH RISKS FROM INDOOR RADON. THE OBSERVED RESPONSES OF THESE HOUSEHOLDS ILLUSTRATE CONCEPTUAL ISSUES RELATED TO DESIGNING AN EFFECTIVE RISK INFORMATION PROGRAM. IT IS CONCLUDED THAT THE RISK INFORMATION APPROACH USED IN MAINE FAILED TO INDUCE VOLUNTARY PROTECTION. THESE RESULTS SUGGEST THAT THE FORMATION OF RISK PERCEPTIONS AND SUBSEQUENT BEHAVIORAL ADJUSTMENTS INVOLVE COMPLEX INTERACTIONS AMONG INFORMATIONAL, CONTEXTUAL, SOCIOECONOMIC, AND PSYCHOLOGICAL VARIABLES. (26 REFERENCES, 4 TABLES) (ENV)

Communicating Risk: Some basic

Sandman, P.M.

Environ. Commun. Res. Program, Rutgers Univ., New Brunswick,
NJ 08903, USA

HEALTH ENVIRON. DIG VOL. 1, NO. 11, pp. 3-4, Publ.Yr: 1987

Languages: ENGLISH

Journal Announcement: V19N3

Thirty percent of northern New Jersey homes have enough radon to pose more than a 1/100 lifetime risk of lung cancer, according to state and federal estimates. But despite considerable media attention, only five percent of affected homeowners have monitored their homes for radon. Even among these, distress is modest. State officials, initially concerned about panic, are finding apathy a bigger problem. The source of radon in these homes is geological uranium; it's been there since time immemorial, and no one is to blame. But three New Jersey communities - Montclair, Glen Ridge, and West Orange - face a different radon problem: landfill containing radioactive industrial wastes. (POL)

Education reduces radon scare

Spears, M.

Environ. Manage. News, P.O. Box 7573, Waco, TX 76714-7573, USA

ENVIRON. MANAGE. NEWS VOL. 1, NO. 6, pp. 6-7, Publ.Yr: 1986

Languages: ENGLISH

Some areas of the United States, bound by particular geographic formations, may be harboring a silent, deadly killer. Its name is radon - an invisible gas naturally created by decaying radium. Radon exists in many areas across the country, although in different concentrations. Dr. Steven Schery, associate professor of physics at the New Mexico Institute of Mining and Technology and a member of the Atmospheric Radioactivity Group, said the average dose received in most homes is the equivalent of smoking one to two cigarettes per day. The threat of radon is relative to the type of environment that surrounds it. For example, radon is not a significant health threat in open air because although some soils naturally give off the gas, it quickly breaks down with other air particles. But when radon is trapped and not allowed to diffuse in open air, scientists have found that the gas can cause lung cancer. (POL)

I. OVERVIEW

E. INDOOR AIR

CHEMICAL EXPOSURES INDOOR AIR POLLUTION

SPENGLER J D

BOSTON, MASS.

44TH ANNUAL CONVENTION OF THE AMERICAN COLLEGE OF ALLERGISTS, BOSTON, MASSACHUSETTS, USA, NOVEMBER 14-18, 1987. ANN ALLERGY 60 (2). 1988.

169. CODEN: ANAEA

Language: ENGLISH

Document Type: CONFERENCE PAPER

Subfile: BARRM (Biological Abstracts/RRM)

It is now apparent that elevated contaminant concentrations are common inside some private and public buildings. Concerns about potential public health problems due to indoor air pollution are based on evidence that urban residents typically spend more than 90% of their time indoors, concentrations of some contaminants are higher indoors than outdoors, and for some pollutants, personal exposures are not characterized adequately by outdoor measurements. (BIO) (AUTH)

Health Effects Associated with Indoor Air Pollutants

NTIS Prices: PC A03/MF A01

Ammann, H.M.; Berry, M.A.; Childs, N.E.; Mage, D.T.

**Environmental Protection Agency, Research Triangle Park, NC
Environmental Criteria and Assessment Office.**

Corp. Source Codes: 034680061

Report No.: EPA/600/D-87/324

Oct 87 23p

Languages: English

NTIS Prices: PC A03/MF A01 Journal Announcement: GRAI8805

Country of Publication: United States

A state-of-information survey concerning health effects of indoor air pollutants in the categories of formaldehyde, volatile organics, radon, particulates, and combustion products has been prepared by the U.S. Environmental Protection Agency's Environmental Criteria and Assessment Office, RTP, N.C. Included in each category are human effects, animal exposure experiments, mutagenicity, and carcinogenicity information. In addition to those health implications associated with each category of pollutants, the problems of measuring exposure to the complex

mixtures actually breathed by people in homes is addressed.
(NTIS)

Indoor Air Pollution. November 1986-October 1987 (Citations from the Energy Data Base)
(Rept. for Nov 86-Oct 87)
Supersedes PB86-877362. Prepared in cooperation with Department of Energy, Washington, DC.
U.S. sales only.
NTIS Prices: PC N01/MF N01
National Technical Information Service, Springfield, VA.
Corp. Source Codes: 055665000
Oct 87 123p
Languages: English Document Type: Bibliography
NTIS Prices: PC N01/MF N01 Journal Announcement: GRAI8724
Country of Publication: United States

This bibliography contains citations concerning the types and sources of indoor air pollution, the impact of energy efficient construction, and measures to relieve the problem. Radon and radon-daughters, nitrogen oxide, carbon monoxide, asbestos, formaldehyde, and particulates are discussed as potential pollutants, and recirculated air, insulation material, water, and natural gas are considered as potential sources of pollution. Mechanical ventilation systems with air to air exchangers are briefly discussed. (This updated bibliography contains 228 citations, all of which are new entries to the previous edition.) (NTIS)

THE CARCINOGENIC RISK OF SOME ORGANIC VAPORS INDOORS A THEORETICAL SURVEY
TANCREDE M; WILSON R; ZEISE L; CROUCH E A C
ENERGY AND ENVIRON. POLICY CENT., HARV. UNIV., CAMBRIDGE, MASS. 02138, USA.
ATMOS ENVIRON 21 (10). 1987. 2187-2206. CODEN: ATENB
Language: ENGLISH
Subfile: BA (Biological Abstracts)

This exploratory report examines the risk of selected organic air pollutants measured in homes in the United States and the Netherlands. After several theoretical assumptions, estimates are made for the carcinogenic potency of each chemical; combined with the exposure measurements these give estimates of cancer risk. These estimates are compared with risks of these same pollutants outdoors and in drinking water and also with other well known indoor air pollutants: cigarette smoke, radon gas and formaldehyde. These comparisons indicate priorities for action. Some suggestions are made for future studies. (BIO)

Indoor Air Pollution. November 1984-October 1986 (Citations from the Energy Data Base)

(Rept. for Nov 84-Oct 86)

Prepared in cooperation with Department of Energy, Washington, DC.

U.S. sales only.

NTIS Prices: PC N01/MF N01

National Technical Information Service, Springfield, VA.

Corp. Source Codes: 055665000

Oct 87 196p

Languages: English Document Type: Bibliography

NTIS Prices: PC N01/MF N01 Journal Announcement: GRAI8724

Country of Publication: United States

This bibliography contains citations concerning the types and sources of indoor air pollution, the impact of energy efficient construction, and measures to relieve the problem. Radon and radon-daughters, nitrogen oxide, carbon monoxide, asbestos, formaldehyde, and particulates are discussed as potential pollutants, and recirculated air, insulation material, water, and natural gas are considered as potential sources of pollution. Mechanical ventilation systems with air to air exchangers are briefly discussed. (This updated bibliography contains 386 citations, none of which are new entries to the previous edition.) (NTIS)

INDOOR AIR QUALITY POSITION PAPER

ASHRAE REPORT, AUG 11, 87 (14)

ASSN REPORT ASHRAE'S PAST, PRESENT, AND FUTURE INTERESTS IN AND RESPONSIBILITIES FOR INDOOR AIR QUALITY ARE OUTLINED. INDOOR AIR POLLUTION IS AN EMERGING CONCERN OF ENVIRONMENTAL INTEREST, DUE TO POSSIBLE HEALTH EFFECTS ASSOCIATED WITH CONTAMINANTS TRAPPED INSIDE OF ENERGY-EFFICIENT BUILDINGS. ASHRAE IS COMMITTED TO CONTRIBUTING TO THE DEVELOPMENT AND IMPLEMENTATION OF BUILDING DESIGN AND CONTROL TECHNIQUES TO OPTIMIZE INDOOR AIR QUALITY AND ENERGY CONSERVATION. HEALTH EFFECTS AND SOURCES OF CARBON MONOXIDE, NITROGEN OXIDES, RESPIRABLE PARTICLES, TOBACCO SMOKE, VOLATILE ORGANIC COMPOUNDS, RADON, FORMALDEHYDE, ASBESTOS, CARBON DIOXIDE, AND ALLERGENS AND PATHOGENS ARE DISCUSSED. CONTROL OPTIONS ARE RECOMMENDED, AND IMPORTANT AREAS WARRANTING FURTHER RESEARCH ARE CITED. (ENV)

Summary of Indoor Air Quality Research Through 1984

(Final rept. Jan-Jun 86)

Supersedes PB84-206515. Sponsored by Environmental Protection Agency, Research Triangle Park, NC. Air and Energy Engineering Research Lab.

NTIS Prices: PC A10/MF A01
Sickles, J. E.; Chessin, R.L.; Kashdan, E.R.; Chrume, Y.;
Ranade, M.B.
Research Triangle Inst., Research Triangle Park, NC.
Corp. Source Codes: 045968000
Sponsor: Environmental Protection Agency, Research Triangle
Park, NC. Air and Energy Engineering Research Lab.
Report No.: EPA/600/9-87/020
Aug 87 214p
Languages: English Document Type: Bibliography
NTIS Prices: PC A10/MF A01 Journal Announcement: GRAI8724
Country of Publication: United States
Contract No.: EPA-68-02-3992

The report reviews indoor air quality research from 1980 through December 1984. It is also a compilation of two documents that review relevant literature on the subject and summarize the efforts of leading research scientists. The first effort involved: (1) a review of journal articles, symposium presentations, and bibliographic reports from 1980 through 1983; (2) a list of contacts with approximately 30 prominent researchers in the indoor air quality field; and (3) a list of significant articles that appeared prior to 1980. The second effort updated the initial literature review to January 1985. Again, articles, symposium proceedings, and reports were screened in developing the update report. The vast majority of material found in the two reports, 'Review of Recent Research in Indoor Air Quality' (EPA-600/2-84-099) and 'Update of Indoor Air Quality Bibliography' (draft), has been retained in the document. The report integrates the material from the two reports, following the organization of the earlier. (NTIS)

**EPA INDOOR AIR QUALITY IMPLEMENTATION PLAN: APPENDIX A.
PRELIMINARY INDOOR AIR POLLUTION INFORMATION ASSESSMENT, EPA
REPORT 600/8-87/014, JUN 87 (319)**

FED GOVT REPORT INFORMATION IS AMASSED TO SERVE AS THE SCIENTIFIC BASIS FOR THE DEVELOPMENT OF A COORDINATED EPA RESEARCH PROGRAM FOCUSING ON RISK REDUCTION FROM INDOOR AIR POLLUTION. KNOWN SOURCES AND HEALTH EFFECTS ARE DISCUSSED FOR COMBUSTION GASES, PARTICULATES, ORGANIC COMPOUNDS, ENVIRONMENTAL TOBACCO SMOKE, NONCOMBUSTION PARTICLES, NONCOMBUSTION GAS-PHASE ORGANIC COMPOUNDS, BIOLOGICAL CONTAMINANTS, RADON, AND PESTICIDES. RESEARCH SPECIFIC TO THE INDOOR MONITORING OF SULFUR DIOXIDE, POLYCYCLIC AROMATIC HYDROCARBONS, NITROGEN DIOXIDE, WOODSMOKE, ASBESTOS, AND VIRUSES IS SURVEYED. THE BUILDING SYSTEM IS DISCUSSED AS A SOURCE OF INDOOR AIR QUALITY PROBLEMS, AND A RANGE OF MITIGATIVE MEASURES IS IDENTIFIED. (1 DIAGRAM, 1 GRAPH, 99 REFERENCES, 52 TABLES) (ENV)

Applied Science Division (Lawrence Berkeley Laboratory)
Indoor Environment Program: Annual Report, FY 1986
Portions of this document are illegible in microfiche
products. Original copy available until stock is exhausted.
NTIS Prices: PC A03/MF A01
Cairns, E. J.; Grimsrud, D. T.
Lawrence Berkeley Lab., CA.
Corp. Source Codes: 086929000; 9513034
Sponsor: Department of Energy, Washington, DC.
Report No.: LBL-22153
May 87 48p
Languages: English
NTIS Prices: PC A03/MF A01 Journal Announcement:
GRAI8802; NSA1200
Country of Publication: United States
Contract No.: AC03-76SF00098

Separate abstracts have been prepared for papers describing
individual research programs. (ERA citation 12:043980) (NTIS)

HOW SAFE IS THE AIR INSIDE YOUR HOME?,
LIPSKE MIKE
NATL WILDLIFE, APR-MAY 87, V25, N3, P34(6)

JOURNAL ARTICLE CONSTRUCTION MATERIALS, APPLIANCES, AND
CIGARETTES CAN BE OFFENSIVE IN TERMS OF INDOOR AIR POLLUTION,
ESPECIALLY FOLLOWING THE INSTALLATION OF ENERGY CONSERVATION
MEASURES THAT TIGHTEN A HOME'S ENVELOPE. THE AIR BREATHED INSIDE
A HOME OR OFFICE BUILDING MAY BE JUST AS HEALTH-THREATENING AS
OUTSIDE AIR. FUMES FROM HOUSEHOLD PRODUCTS, AIRBORNE
MICROORGANISMS, TOBACCO SMOKE, FORMALDEHYDE, ASBESTOS, RADON, AND
PRODUCTS OF COMBUSTION POLLUTE THE INDOOR ATMOSPHERE, IN SOME
CASES RENDERING IT MORE POLLUTED THAN OUTSIDE AIR. TESTING FOR
RADON IN HOMES AND IMPROVING VENTILATION RATES AND SYSTEMS ARE
SOLUTIONS THAT CAN PROVIDE BENEFITS BOTH IN TERMS OF INDOOR AIR
QUALITY AND ENERGY CONSERVATION. (1 DRAWING, 3 PHOTOS) (ENV)

Hazardous Dust Control
Presented at Symposium on Hazardous Dust and Materials,
Japan Institute of Electrostatics, Tokyo, Japan, 4-5 Jun 86.

NTIS Prices: PC A02/MF A01
Plaks, N.
Environmental Protection Agency, Research Triangle Park, NC.
Air and Energy Engineering Research Lab.
Corp. Source Codes: 034680076

Report No.: EPA/600/D-86/153

Jul 86 24p

Languages: English

NTIS Prices: PC A02/MF A01 Journal Announcement: GRAI8622

Country of Publication: United States

Hazardous particles or dusts, for purposes of the paper, are considered to be those whose size or chemical species cause harm to the population through deposition in the lungs and other portions of the pulmonary tract. A small number of pollutants, some of which are particles, have been designated under the program from the Clean Air Act for National Emission Standards for Hazardous Air Pollutants (NESHAP); a larger number are being considered for NESHAP. Several R&D needs are listed including: sensing of excess emission of hazardous dust from control equipment; need to retrofit for improved capture of small particles; improved collection of fine condensable aerosols; and modeling of control technology for hazardous particles. Indoor air particles and dusts are discussed with emphasis on characterization, indoor air cleaners, and asbestos in residences. Radon in the indoor environment is discussed as an emerging problem. Finally, an indoor air/radon model is discussed linking indoor air dusts to lung deposition. (NTIS)

THE DYNAMICS OF INDOOR AIR QUALITY,

WAYNE MARY .

EPRI J, MAR 86, V11, N2, P20(6)

JOURNAL ARTICLE HOME ENERGY CONSERVATION MEASURES THAT REDUCE AIR EXCHANGE RATES HAVE RAISED CONCERNS THAT HARMFUL LEVELS OF POLLUTANTS COULD ACCUMULATE INDOORS. RADON, NITROGEN OXIDES, FORMALDEHYDE, AND OTHER POLLUTANTS EMITTED BY APPLIANCES AND BUILDING MATERIALS CAN BE TRAPPED INSIDE BY WEATHERSTRIPPING AND HOUSE TIGHTENING. HOWEVER, RESEARCH INDICATES THAT TIGHT CONSTRUCTION AND GOOD INDOOR AIR QUALITY CAN BE COMPATIBLE GOALS. AIR-TO-AIR HEAT EXCHANGERS CAN BE INSTALLED TO REALIZE ENERGY SAVINGS WHILE ENHANCING VENTILATION. CENTRAL CIRCULATION FANS PROVE EQUALLY EFFECTIVE IN REDUCING INDOOR RADON LEVELS. (ENV)

INDOOR AIR QUALITY AND HEALTH IMPACTS OF ENERGY CONSERVATION: SOME CONGRESSIONAL OPTIONS,

SIMPSON MICHAEL

US LIBRARY OF CONGRESS CONGRESSIONAL RESEARCH SERVICE REPORT IB83074, JAN 2, 86 (18)

FED GOVT REPORT INDOOR AIR QUALITY CAN DETERIORATE DUE TO ENERGY CONSERVATION MEASURES. USE OF INSULATION OR NEW APPLIANCES

CAN REDUCE AIR EXCHANGES AND VENTILATION WHILE INCREASING THE INDOOR BUILD-UP OF VARIOUS POLLUTANTS. POLLUTANTS OF CONCERN AND THEIR MAJOR HEALTH EFFECTS ARE DISCUSSED. RISKS OF LUNG CANCER, RESPIRATORY DISORDERS, AND EYE IRRITATION ARE ASSOCIATED WITH RADON, TOBACCO SMOKE, FORMALDEHYDE, AND COMBUSTION PRODUCTS. PRACTICAL REMEDIES AND POSSIBLE CONGRESSIONAL OPTIONS ARE SUMMARIZED. (ENV)

Indoor air: The problem looms large

Anon.

ENERGY REV VOL. 13, NO. 2, p. 34, Publ.Yr: 1986

SUMMARY LANGUAGE - ENGLISH

Languages: ENGLISH

Indoor concentrations of chemicals are often 10 times greater than outdoor concentrations and maximum exposures can be more than 100 times greater. People often spend 90 percent or more of their time indoors and scientists are greatly concerned about the hazards of indoor pollutants. Pollutants include radon, volatile organic chemicals, indoor pesticides, combustion products, and natural, airborne pathogens. The reduced ventilation in most new houses and office buildings exacerbates the problem. A political strategy to study and cope with the problem has not evolved. More research is needed before a comprehensive control strategy is formulated. Congress has provided about \$2 million in funding for the last few years. Many mitigating measures are available, such as source control, using air-to-air heat exchangers, and opening windows. Originally this article appeared in Conservation Foundation Letter, September-October 1985, 1-7. (POL)

Indoor Air. Volume 6. Evaluations and Conclusions for Health Sciences and Technology. Proceedings of the International Conference (3rd) on Indoor Air Quality and Climate Held in Stockholm on August 20-24, 1984

See also PB85-104222. Sponsored by Commission of the European Communities, Luxembourg, Gas Research Inst., Chicago, IL., Environmental Protection Agency, Washington, DC., and Electric Power Research Inst., Palo Alto, CA.

NTIS Prices: PC E05/MF E01

Swedish Council for Building Research, Stockholm.

Corp. Source Codes: 060307000

Sponsor: Commission of the European Communities, Luxembourg.; Gas Research Inst., Chicago, IL.; Environmental Protection Agency, Washington, DC.; Electric Power Research Inst., Palo Alto, CA.

Report No.: D13:1986; ISBN-91-540-4582-7

1986 109p

Languages: English Document Type: Conference proceeding
NTIS Prices: PC E05/MF E01 Journal Announcement: GRAI8704
Country of Publication: Sweden

Table of contents includes the following: Characterization of indoor pollution and sources; Formaldehyde: Sources, methods of analysis, exposure and health effects; Radon in dwellings: Exposure and risk analysis; Air ions and electrical fields; Fibres and particulates in the indoor environment; Passive smoking and health effects; Microorganisms related to buildings; The importance of indoor air pollution to personal exposures in industrialized societies; The importance of indoor air pollution to personal exposures in developing countries; Epidemiological studies of health disorders related to housing; Odors and sensory irritants: Effects on health and comfort; Allergies and other hypersensitivity reactions to indoor pollutants; Indoor thermal climate: Requirements for comfort, health and performance; Ventilation criteria: Biological demands and formulation of standards; Building performance assessment; Technical solutions to providing adequate indoor air quality and thermal climate; Sick buildings: Physical and psychosocial features, effects on humans and preventive measures; Policy and regulatory issues; The 'sick' building syndrome. (NTIS)

Indoor Air Quality Measurements in 38 Pacific Northwest Commercial Buildings

Air Pollution Control Association annual meeting and exhibition, Minneapolis, MN, USA, 22 Jun 1986.

Portions of this document are illegible in microfiche products.

NTIS Prices: PC A03/MF A01

Turk, B.H.; Brown, J.T.; Geisling-Sobotka, K.; Froehlich, D.A.; Grimsrud, D. T.

Lawrence Berkeley Lab., CA.

Corp. Source Codes: 086929000; 9513034

Sponsor: Department of Energy, Washington, DC.

Report No.: LBL-21453; CONF-860606-21

Jun 86 26p

Languages: English Document Type: Conference proceeding

NTIS Prices: PC A03/MF A01 Journal Announcement: GRAI8710; NSA1200

Country of Publication: United States

Contract No.: AI79-83BP12921; AC03-76SF00098

A Bonneville Power Administration-funded study monitored ventilation rates and a variety of indoor air pollutants in 38 Pacific Northwest commercial buildings. The buildings ranged in age from 6 months to 90 years, in size from 864 to 34,280 m², and occupancy from 25 to 2500 people. Building average formaldehyde (HCHO) concentrations were below the 20 ppB

detection limit in 48% of the buildings. Nitrogen dioxide (NO sub 2) concentration averages ranged from 5 ppB to 43 ppB and were lower than outdoor concentrations in 8 of 13 buildings. At only one site, an elementary school classroom, did carbon dioxide (CO sub 2) exceed 1000 ppM. Radon (Rn) levels were elevated in one building with an average concentration of 7.4 pCiL sup -1. Respirable particles (RSP) concentrations in smoking areas in 32 buildings had a geometric mean of 44 mu g m sup -3 and ranged up to 308 mu g m sup -3 at one site. In non-smoking areas the geometric mean RSP was 15 mu g m sup -3. Outside air ventilation rates did not appear to be the single dominant parameter in determining indoor pollutant concentrations. Measured pollutant concentrations in 2 ''complaint'' buildings were below accepted guidelines. The cause of the complaints was not identified. (ERA citation 12:005180) (NTIS)

INDOOR AIR QUALITY IN COLD CLIMATES: HAZARDS AND ABATEMENT MEASURES, SUMMARY OF AN APCA INTERNATIONAL SPECIALTY CONFERENCE

WALKINSHAW DOUGLAS S.

APCA J, MAR 86, V36, N3, P235(7)

JOURNAL ARTICLE HIGHLIGHTS OF THE 67 PRESENTATIONS TO THE FIRST APCA SPECIALTY CONF. ON INDOOR AIR POLLUTION, HELD APRIL 29-MAY 1, 1985, IN OTTAWA, CANADA, ARE FEATURED. INDOOR AIR QUALITY CONCERNS IN COLD CLIMATES HAVE BEEN CLOSELY LINKED TO ENERGY CONSERVATION MEASURES, PARTICULARLY THOSE REDUCING AIR EXCHANGE. SOURCES AND EFFECTS OF RADON, MICROBIAL AGENTS, PARTICULATES, NITROGEN OXIDES, ASBESTOS, TOBACCO SMOKE, AND FORMALDEHYDE ARE REVIEWED. RELEVANT RESEARCH HAS RESULTED IN THE DEVELOPMENT OF SOME EFFECTIVE AIR POLLUTANT ABATEMENT MEASURES. (ENV)

Indoor Air Quality: Radon and Formaldehyde. Report on a WHO (World Health Organization) Meeting Held at Dubrovnik (Yugoslavia), August 26-30, 1985 (Environmental health series)

NTIS Prices: PC E04/MF E01

World Health Organization, Copenhagen (Denmark). Regional Office for Europe.

Corp. Source Codes: 032694002

Report No.: EH-13

1986 52p

Languages: English

NTIS Prices: PC E04/MF E01 Journal Announcement: GRAI8714

Country of Publication: Other

The report is of a working group held in 1985. The group

reviewed radon and formaldehyde in relation to the ongoing indoor air quality program of the Regional Office and also as part of the Air Quality Guidelines being developed for Europe. The report covers radon's sources, observed levels, conversion factors, routes of exposure, kinetics and dose considerations, health effects, evaluation of human health hazards, strategies of identification and control and conclusions and recommendations. For formaldehyde it covers sources, occurrence in air, routes of exposure, kinetics and metabolism, health effects, organoleptic properties, evaluation of human health hazard, and conclusions and recommendations. (NTIS)

Overview of Trends and Problems in Indoor Air Quality

Georgia technical symposium on indoor air quality, Atlanta, GA, USA, 23 Sep 1986.

Portions of this document are illegible in microfiche products.

NTIS Prices: PC A03/MF A01

Gammage, R. B.

Oak Ridge National Lab., TN.

Corp. Source Codes: 021310000; 4832000

Sponsor: Department of Energy, Washington, DC.

Report No.: CONF-8609248-2

1986 25p

Languages: English Document Type: Conference proceeding

NTIS Prices: PC A03/MF A01 Journal Announcement: GRAI8807; NSA1300

Country of Publication: United States

Contract No.: AC05-84OR21400

This overview covers some historical perspectives of indoor air quality, the importance of perception and reality in some of the adverse human health effects, and standards and guidelines. Some possible reasons for the difficulties in identifying causative agents are considered. 2 figs. (ERA citation 13:006412) (NTIS)

Participant Evaluation Results for Two Indoor Air Quality Studies 80. annual meeting of the Air Pollution Control Association, New York, NY, USA, 1 Jun 1987.

Portions of this document are illegible in microfiche products.

NTIS Prices: PC A02/MF A01

Hawthorne, A.R.; Dudley, C.S.; Cohen, M.A.; Spengler, J.D.

Oak Ridge National Lab., TN.

Corp. Source Codes: 021310000; 4832000

Sponsor: Harvard Univ., Boston, MA. School of Public Health.; Department of Energy, Washington, DC.

Report No.: CONF-870695-3
1987 9p
Languages: English Document Type: Conference proceeding
NTIS Prices: PC A02/MF A01 Journal Announcement: GRAI8720;
NSA1200
Country of Publication: United States
Contract No.: AC05-84OR21400

After two surveys for indoor air pollutants (radon and other chemicals) the homeowners were surveyed for their reactions. The results of these participant evaluation surveys, assuming that the participants that responded to the survey were representative, indicate that homeowners will accept a significant level of monitoring activity as part of an indoor air quality field study. Those participants completing surveys overwhelmingly enjoyed being in the studies and would do it again. We believe that the emphasis placed on positive homeowner interactions and efforts made to inform participants throughout our studies were positive factors in this result. There was no substantial differences noted in the responses between the 70-house study, which included a homeowner compensation payment of \$100, and the 300-house study, which did not include a compensation payment. These results provide encouragement to conduct future complex, multipollutant indoor air quality studies when they are scientifically sound and cost effective. (ERA citation 12:028698) (NTIS)

Radon and Its Decay Products in Indoor Air
William W. Nazaroff; Anthony V. Nero, Jr.
John Wiley and Sons, New York, 1987, 505pp.

This book examines the current state of knowledge of all major aspects of the indoor radon problem. Divided into four major sections, the book deals with the following topics: generation and migration of radon in source materials and its entry into buildings; the physical and chemical behavior of radon and its decay products; health effects and risks of exposure; and finally strategic and tactical aspects of controlling exposure to radon. The appendix provides a summary of measurement techniques and instrumentation. (HQL)

I. OVERVIEW

F. BOOKS AND CONFERENCE PROCEEDINGS

Citizen's Guide to Radon: What It Is and What To Do About It. US EPA, US GPO. (OPA-86-004) 15 pp. 1986.

Communicating Radon Risk Effectively: A Mid-Course Evaluation. Smith, VK; Desvousges, WH; Fisher, A; Johnson, FR. Office of Policy Analysis, US EPA, Washington, D.C. 1987. (EPA 230/07-87-029)

Environmental Radon. Editor, Cothorn, CR; Smith, JE, Jr. Environmental Science Research Series. Volume 35. Plenum Press. 378 pp. 1988.

Handbook of Radon in Buildings: Detection, Safety, and Control. Compiled by SYSCON Corporation Staff and Brookhaven National Laboratory Staff. Hemisphere Publications. 1988.

Health Risks of Radon and Other Internally Deposited Alpha-Emitters: BEIR IV. National Research Council. National Academy Press. 600 pp. 1988.

Indoor Radon and Its Hazards. Editor, Bodansky, D. University of Washington Press. 192 pp. 1987.

Proceedings of the Air Pollution Control and Hazardous Work Management Meeting. New York, NY. June 21-26, 1987.

Following is chapter of significance:

Hallenbeck, WH. "Risk Assessment of Exposure to Airborne Radon", pp 2-14.

Proceedings of the International Conference on Occupational Radiation Safety in Mining. October 14-18, 1984, Toronto, Canada. Editor, Stocker, H. Canadian Nuclear Association, Toronto, Ontario, Canada.

Following are chapters of significance:

Subba, M.C., et al. "A Study of the Dose Conversion Factors for Inhalation Risk Assessment From Radon Daughters in Mine Atmospheres", pp. 131-133.

Dixon, D.W., et al. "A Review All Sources of Exposure to

Natural Radiation in UK Mines", pp. 241-247.

Steinhausler, F., et al. "Inherent dosimetric and Epidemiological Uncertainties Associated with Lung Cancer Risk Assessment for Mining Populations", pp. 327-333.

Muller, J., et al. "Study of Mortality of Ontario Miners", pp. 335-343.

Chamud, J., et al. "Lung Cancer Induction by Radon Daughters in Mining", pp 350-353.

Nair, RC., et al. "Mortality Experience Among Workers in the Uranium Industry", pp 354-364.

Morrison, H.I., et al. "Lung Cancer Mortality and Radiation Exposure Among the Newfoundland Fluorspar Miners", pp. 365-368.

Stranden E. "Thoron Daughter to Radon Daughter Ratios in Mines", pp 604-606.

Chambers, D.B., et al. "Potential Co-Carcinogens in Uranium Mine Environment", pp 615-622.

Samet, J.M., et al. "Studies of Uranium Miners in New Mexico", pp 623-626.

Myers, D.K., et al. "Impact of Occupational Hazards on the Life Expectancy of Uranium Miners," pp.627-634.

Steinhausler, F. "The Radon Dilemma", pp 637-641.

Radon: A Homeowner's Guide to Detection and Control. Editor, Cohen, B. Consumer Reports Books. 224 pp. 1987.

Radon: Index of Modern Information. Neiderhaus, LB. ABBE Publishers Association of Washington, 150 pp. 1988.

Radon and Its Decay Products: Occurrence, Properties and Health Effects. Editor, Hopke, P.K. ACS Symposium, Series No. 331, American Chemical Society. 609 pp. 1987.

Following are chapters of significance:

James, A.C. "A Reconsideration of Cells at Risk and Other Key Factors in Radon Daughter Dosimetry", pp 400-418.

Harley, N H., et al. "Updating Radon Daughter Bronchial Dosimetry", pp 419-429.

Steinhausler, F. "The validity of Risk Assessments for Lung Cancer Induced by Radon Daughters", pp. 430-443.

Martel, E.A. "Critique of Current Dosimetry Models for Radon Progeny Exposure", pp. 444-461.

Cohen, B.S. "Deposition of Ultrafine Particles in the Human Tracheobronchial Tree", pp. 475-486.

Reubel, B., et al. "Biophysical Effects of Radon Exposure on Human Lung Cells", pp. 502-512.

Radon and Its Decay Products in Indoor Air. Editors, Nazaroff W.W. and Nero A.V., Jr., Environmental Science and Technology Ser. New York, John Wiley and Sons, 518 pp. 1988.

Following are chapters of significance:

Steinhausler, F. "Epidemiology Evidence of Radon-Induced Health Risks"

James, A.C. "Lung Dosimetry"

Phillips, C.R., et al. "The Nature and Determination of the Unattached Fraction of Radon and Thoron Progeny".

Radon in the Home: Reducing the Risk. Editor, Scherer, D.J. Reymont. 32 pp. 1987.

Radon Reduction Methods: A Homeowner's Guide. US EPA, US GPO. (OPA-86-005) 24 pp. 1986.

191st American Chemical Society National Meeting, New York, NY. April 13-18, 1986

Following are papers of significance:

Lowder, W.M. "Future Directions in USA Radon Research"

Kothari, B.K.; Kunz C.; Lilley, W. "Correlation Between Indoor Radon and Soil Gas Availability"

Martell, E.A. "Critique of Current Lung Dosimetry Models for Radon Progeny Exposure"

Porstendorfer, J.; Reineking, A.; Becker, K.H. "Free Fractions, Attachment Rates and Plate-Out Rates of Radon Daughters in Homes"

Sextro, R.G.; Moed, B.A.; Nazaroff, W.W.; Revzen, K.L.; Nero, A.V. "Investigations of Soil as a Source of Indoor Radon"

Swedjemarl, G.A.; Buren, A.; Majones, L. "A Comparison of Radon Levels in Swedish Homes in the 1980's and 30 Years Ago"

Cliff, K.D.; Wrixon, A.D.; Green, B.M.R.; Miles, J.C.H. "Radon-222 and Its Decay Product Concentrations in UK Dwellings"

Cliff, K.D.; Wrixon, A.D.; Miles, J.C.H.; Lomas, P.R.; Warren, P.R. "Remedial Measures in a House With High Radon Levels"

Stranden, E. "Radon in Norwegian Dwellings. A Pilot Study"

192nd American Chemical Society National Meeting, Anaheim, CA.
September 7-12, 1986

Following are papers of significance:

Harper, J.P.; Nagda, N.L.; Purcell, G.G. "Building Pressurization Control as an Indoor Pollution Mitigation Strategy in Residential Dwellings"

Hawthorne, A.R.; Dudney, C.S.; Cohen, M.A.; Spengler, J.D. "Multipollutant Indoor Air Quality Study of 300 Homes in Kingston-Harriman Tennessee USA Study Design"

Ford, J.S.; Johnson, G.L.; Jackson, M.D.; Messner, M.J. "Quality Assurance Criteria for Indoor Air Data Measurements"

194th American Chemical Society National Meeting, New Orleans, LA
August 30 September 4, 1987

Following is paper of significance:

Mose, D.G.; Mushrush, G.W. "Regional Levels of Indoor Radon in Virginia and Maryland USA"

II. HEALTH EFFECTS

A. EPIDEMIOLOGY

SAMPLE SIZE AND POWER FOR CASE-CONTROL STUDIES WHEN EXPOSURES ARE CONTINUOUS

LUBIN J H; GAIL M H; ERSHOW A G

BIostatISTICS BRANCH, NATL. CANCER INST., 7910 WOODMONT AVE., LANDOW BUILD., ROOM 3C09, BETHESDA, MD. 20205, USA.

STAT MED 7 (3). 1988. 363-376. CODEN: SMEDD

Language: ENGLISH

Subfile: BA (Biological Abstracts)

In estimating the sample size for a case-control study, epidemiologic texts present formulae that require a binary exposure of interest. Frequently, however, important exposures are continuous and dichotomization may result in a 'not exposed' category that has little practical meaning. In addition, if risks vary monotonically with exposure, then dichotomization will obscure risk effects and require a greater number of subjects to detect differences in the exposure distributions among cases and controls. Starting from the usual score statistic to detect differences in exposure, this paper develops sample size formulae for case-control studies with arbitrary exposure distributions; this includes both continuous and dichotomous exposure measurements as special cases. The score statistic is appropriate for general differentiable models for the relative odds, and, in particular, for the two forms commonly used in prospective disease occurrence models: (1) the odds of disease increase linearly with exposure; or (2) the odds increase exponentially with exposure. Under these two models we illustrate calculation of sample sizes for a hypothetical case-control study of lung cancer among non-smokers who are exposed to radon decay products at home. (BIO)

Sample size and power for case-control studies when exposures are continuous.

Lubin JH; Gail MH; Ershow AG

Biostatistics Branch, National Cancer Institute, Bethesda, Maryland 20205.

Stat Med (ENGLAND) Mar 1988, 7 (3) p363-76, ISSN 0277-6715

Journal Code: SIM

Languages: ENGLISH

In estimating the sample size for a case-control study, epidemiologic texts present formulae that require a binary exposure of interest. Frequently, however, important exposures are continuous and dichotomization may result in a 'not exposed' category that has little practical meaning. In addition, if risks vary monotonically with exposure, then dichotomization will obscure risk effects and require a greater number of subjects to detect differences in the exposure distributions among cases and controls. Starting from the usual score statistic to detect differences in exposure, this paper develops sample size formulae for case-control studies with arbitrary exposure distributions; this includes both continuous and dichotomous exposure measurements as special cases. The score statistic is appropriate for general differentiable models for the relative odds, and, in particular, for the two forms commonly used in prospective disease occurrence models: (1) the odds of disease increase linearly with exposure; or (2) the odds increase exponentially with exposure. Under these two models we illustrate calculation of sample sizes for a hypothetical case-control study of lung cancer among non-smokers who are exposed to radon decay products at home. (BIO)

HEALTH EFFECTS AND SOURCES OF INDOOR AIR POLLUTION PART I

SAMET J M; MARBURY M C; SPENGLER J D

DEP. MEDICINE, UNIV. NEW MEXICO, ALBUQUERQUE, NM 87131.

AM REV RESPIR DIS 136 (6). 1987. 1486-1508. CODEN: ARDSB

Language: ENGLISH

Subfile: BARRM (Biological Abstracts/RRM)

Since the early 1970's, the health effects of indoor air pollution have been investigated with increasing intensity. Consequently, a large body of literature is now available on diverse aspects of indoor air pollution: sources, concentrations, health effects, engineering, and policy. This review begins with a review of the principal pollutants found in indoor environments and their sources. Subsequently, exposure to indoor air pollutants and health effects are considered, with an emphasis on those indoor air quality problems of greatest concern at present: passive exposure to tobacco smoke, nitrogen dioxide from gas-fueled cooking stoves, formaldehyde exposure, radon daughter exposure, and the diverse health problems encountered by workers in newer, sealed office buildings. The review concludes by briefly addressing assessment of indoor air quality, control technology, research needs, and clinical implications. (BIO)(AUTH)

HEALTH EFFECTS AND SOURCES OF INDOOR AIR POLLUTION PART II
SAMET J M; MARBURY M C; SPENGLER J D
DEP. MED., UNIV. NEW MEXICO, ALBUQUERQUE, N.M. 87131.
AM REV RESPIR DIS 137 (1). 1988. 221-242. CODEN: ARDSB
Language: ENGLISH
Subfile: BARRM (Biological Abstracts/RRM)

See abstract above (BIO)

RADIATION IN DWELLINGS AND CANCER IN CHILDREN
STJERNFELDT M; SAMUELSSON L; LUDVIGSSON J
DEP. PEDIATRICS, UNIV. HOSP., LINKOPING, SWEDEN.
PEDIATR HEMATOL ONCOL 4 (1). 1987. 55-62. CODEN: PHONE
Language: ENGLISH
Subfile: BA (Biological Abstracts)

Indoor radiation, especially radon exposure, has been in focus in the public domain during the past several years. The growing concern among parents of children with cancer possibly having high radiation levels in their homes led us to study the levels of gamma- and alpha-radiation levels in the homes of a group of children in the county of Ostergotland. The indoor concentration of alpha-emitting radon daughters was measured by a high-voltage method. The gamma activity was measured with a standard detector scintillation meter. The yearly average for radon-daughter concentration in both cases (57 Bq/m³) and controls (61 Bq/m³) corresponds fairly well with the national average of 53 Bq/m³. The yearly average for gamma radiation (cases 0.37 mGy, controls 0.36 mGy) is much lower than the permissible upper level in dwellings (2.5 mGy/year). The values seem to be of the same order as the subtracted cosmic radiation, which is 0.24-0.26 mGy. No appreciable difference could thus be found between cases and controls either from gamma radiation or radon-daughter exposure. We cannot from our study rule out the possibility of an effect of low-level radiation in susceptible individuals, but it seems clear that children who get cancer do not live in more radioactive homes than other children. (BIO)

RADIOLOGICAL RISK AVERTED WHEN RADIATION WORKERS RECEIVE LOWER DOSES AT WORK THAN AT HOME
LEVINE S; STROM D J
DEP. RADIATION HEALTH, GRADUATE SCH. PUBLIC HEALTH, UNIV. PITTSBURGH, PITTSBURGH, PA. 15261.
THIRTY-SECOND ANNUAL MEETING OF THE HEALTH PHYSICS SOCIETY, SALT LAKE CITY, UTAH, USA, JULY 5-9, 1987. HEALTH PHYS 52 (SUPPL. 1). 1987.
S5. CODEN: HLTPA
Language: ENGLISH

Document Type: CONFERENCE PAPER
Subfile: BARRM (Biological Abstracts/RRM)

Radiation workers are protected by NRC and OSHA regulations which keep doses to a minimum through ALARA practices. In contrast, there are no regulations for natural radiation sources in the home, and until recently, little measurement and/or concern regarding them. This paper addresses the possible radiological risk averted by radiation workers not staying at home. (BIO) (AUTH)

A case-control study of lung cancer relative to domestic radon exposure.

Lees RE; Steele R; Roberts JH
Department of Community Health and Epidemiology,
Queen's University, Kingston, Ontario, Canada.
Int J Epidemiol (ENGLAND) Mar 1987, 16 (1) p7-12, ISSN
0300-5771
Journal Code: GR6
Languages: ENGLISH

Public concern was expressed regarding the possibility of adverse health effects with the disposal of radioactive waste in Port Hope, Ontario. A case-control study was carried out to estimate the relative importance of domestic radon gas exposure in the causation of lung cancer in the town over a ten-year period. Twenty-seven cases met the entry criteria. Statistical analyses of results did not provide conclusive results that linked an increased risk of lung cancer and elevated domestic alpha radiation levels, when all factors were considered. However, a very strong association was demonstrated between cigarette smoking and lung cancer. (MED)

LUNG CANCER IN MALES AND TYPE OF DWELLING AN EPIDEMIOLOGIC PILOT STUDY

DAMBER L A; LARSSON L-G
CENTER ONCOLOGY, UNIV. HOSP., S-901 85 UMEA, SWEDEN.
ACTA ONCOL (STOCKH) 26 (3). 1987. 211-216. CODEN: ACTOE
Language: ENGLISH
Subfile: BA (Biological Abstracts)

Data from a large case-control study of male lung cancer in northern Sweden were used for a pilot study concerning possible association between type of dwelling (indoor radon) and lung cancer. The study illustrated the possibilities of retrospective assessment of building type and confounding factors of importance as smoking and occupation and can therefore have methodologic value for further investigations. The study suggested that,

within the region, increased indoor radon due to building material was not an important cause of lung cancer. Leakage of radon from the ground could, however, not be considered in the present study and the used radon measure was very crude (years in nonwooden houses). (BIO)

Indoor exposure to radon from the ground and bronchial cancer in women.

Svensson C; Eklund G; Pershagen G

Department of Cancer Epidemiology, Radiumhemmet, Karolinska Institute, Stockholm, Sweden.

Int Arch Occup Environ Health (GERMANY, WEST) 1987, 59 (2) p123-31, ISSN 0340-0131 Journal Code: GPN

Languages: ENGLISH

A case-referent study on the possible association between radon emanating from the ground and bronchial cancer was carried out on 292 female lung cancer cases and 584 matched population referents. Both groups had lived for at least 30 years in the city of Stockholm, Sweden. The cases were diagnosed during 1972 to 1980 with oat-cell and other types of anaplastic pulmonary carcinomas. A sample of about 10% of the dwellings where cases and referents had lived was selected for measurements of radon and radon daughters. There was a relative risk of 2.2 ($P = 0.01$) for lung cancer associated with living in dwellings close to the ground in areas with an increased risk of radon emanation. Smoking habits did not appear to be a major confounding factor for this association, although a detailed evaluation was not possible. The measurements indicated increased radon daughter concentrations in ground level dwellings within radon risk areas where lung cancer cases had lived, suggesting that this exposure was of etiologic importance. (MED)

Effect on Peripheral Blood Chromosomes

Pohl-Ruling, J., 50 (SUPPL. 1). 1986.

S58. CODEN: HLTPA

Language: ENGLISH

Document Type: CONFERENCE PAPER

Subfile: BARRM (Biological Abstracts/RRM)

A pilot study of the risks associated with exposure to indoor radon decay products has been conducted in 40 homes in New Mexico. The emphasis in the investigation has been on resolving the many methodological issues associated with developing good estimates of life-long exposures and competing risk factors for members of the general public. Presented are results of the study, including a report on the identification

of a region of high indoor radon concentrations in the State.
(BIO) (AUTH)

**GASTRIC CANCER IN NEW MEXICO COUNTIES WITH SIGNIFICANT
DEPOSITS OF URANIUM**

WILKINSON GREGG S.

LANL,

ARCHIVES ENV HEALTH, NOV-DEC 85, V40, N6, P307(6)

RESEARCH ARTICLE SEVERAL COUNTIES IN NORTHERN NEW MEXICO
DISPLAY HIGH RATES OF MORTALITY FROM GASTRIC CANCER. SIGNIFICANT
DIFFERENCES IN SEX-SPECIFIC, AGE-ADJUSTED, AVERAGE ANNUAL
STOMACH CANCER MORTALITY RATES AMONG WHITES FROM 1970-79 WERE
FOUND BETWEEN COUNTIES WITH SIGNIFICANT DEPOSITS OF URANIUM
COMPARED WITH THOSE WITHOUT SIGNIFICANT DEPOSITS. FURTHER
RESEARCH NEEDS TO CONSIDER INDIVIDUAL CHARACTERISTICS AND
COMPETING RISK FACTORS FOR INDIVIDUALS WITH GASTRIC CANCER IN
THESE COUNTIES. A WORKING HYPOTHESIS IS THAT RESIDENTS OF
COUNTIES WITH U DEPOSITS ARE EXPOSED TO HIGHER THAN AVERAGE
LEVELS OF RADIONUCLIDES OR TO TRACE ELEMENTS WHICH ARE COMMONLY
ASSOCIATED WITH SUCH DEPOSITS. (ENV)

**Domestic and Personal Determinants of the Contamination of
Individuals by Household Radon Daughters**

20. annual conference on trace substances in
environmental health, Columbia, MO, USA, 2 Jun 1986.

NTIS Prices: PC A02/MF A01

Stebbins, J.H.; Kardatzke, D.R.; Toohey, R.E.; Essling,
M.E.; Pagnamenta, A.

Argonne National Lab., IL. Biological and Medical Research
Div.

Corp. Source Codes: 001960006; 9502123

Sponsor: Department of Energy, Washington, DC.

Report No.: CONF-860626-2

1986 17p

Languages: English Document Type: Conference proceeding

NTIS Prices: PC A02/MF A01 Journal Announcement:

GRAI8705; NSA1100

Country of Publication: United States

Contract No.: W-31-109-ENG-38

Radon daughters were counted by gamma spectroscopy from 180
adult residents of eastern Pennsylvania during the winter of
1983-84. Body radon daughter contamination is an index of
relative individual respiratory exposures to radon daughters.
These can be related to household radon levels, and to personal
risk factors such as sex and tobacco smoking. Over 75% of this

Pennsylvania population appeared to have environmentally enhanced radon daughter contamination; 59% had counting rates greater than 2 s.d. above background. House radon levels were the major determinants of radon daughters contamination in the 112 subjects for which both sets of measurements were available ($p < .001$). Both sex ($< .02$) and cigarette smoking ($p < .005$) were found to significantly modify that relationship, after nonlinear adjustment for travel times. Using a logarithmic model, for a given radon level body contamination by radon daughters in females was 2-3.5x higher than in males. Nonsmokers had 2-4x higher levels of contamination than smokers. For female nonsmokers relative to male smokers (which in general corresponds to the population of major concern relative to the population from which risk estimates have been derived), the excesses multiply. These results are for total contamination, both internal and external. (ERA citation 11:052212) (NTIS)

Radon in Norwegian dwellings and the feasibility of epidemiological studies.

Stranden E

Radiat Environ Biophys 1986, 25 (1) p37-42, ISSN 0301-634X

Journal Code: QML

Languages: ENGLISH

The results of a pilot study on radon in Norwegian dwellings are presented together with a discussion on the feasibility of an epidemiological study on the correlation between lung cancer and radon progeny exposure in dwellings. There are large variations in the mean radon concentration in Norwegian municipalities, and the population average indoor radon concentration is high (80-100 Bq m⁻³). The large variations and high absolute values, together with excellent lung cancer and smoking habit data, make it feasible to conduct epidemiological studies based on representative exposure data in the Norwegian population. (MED)

Indoor radon daughter concentrations and passive smoking

Bergman, H.; Edling, C.; Axelson, O.; Berglund, B.; Berglund, U.; Lindvall, T.; Spengler, J.; Sundell, J. (eds.)
Dep. Occup. Med., University Hosp., Linköping, Sweden

3. International Conference on Indoor Air Quality and Climate Stockholm (Sweden) 1984

ENVIRON. INT VOL. 12, NO. 1-4, pp. 17-19, Publ.Yr: 1986
SUMMARY LANGUAGE - ENGLISH

Languages: ENGLISH

Journal Announcement: V19N2

Radon daughter exposure is a well-known cause of lung cancer in miners. Since radon daughters are known to attach to aerosol particles, it was also of interest to study to what extent radon daughters in indoor air might attach to cigarette smoke. Experiments were undertaken, which showed that moderate concentrations of radon daughters indoors could increase considerably and even more than double in the presence of cigarette smoke. The radon daughter levels obtained together with cigarette smoke may imply a risk of lung cancer for active and passive smokers. (POL)

**INDOOR RADON DAUGHTER CONCENTRATIONS AND PASSIVE SMOKING
(RADON, PASSIVE SMOKING, PARTICULATES & HOUSING
EPIDEMIOLOGY)**

BERGMAN HANS; EDLING CHRISTER; AXELSON OLAV

UNIV HOSPITAL, SWEDEN,

WHO/ET AL 3RD INTL INDOOR AIR QUALITY & CLIMATE CONF,
STOCKHOLM, AUG 20-24, 84, V2, P79(6)

CONF PAPER RADON DAUGHTERS ARE KNOWN TO ATTACH TO AEROSOL PARTICLES. THE EXTEND TO WHICH RADON DAUGHTERS IN INDOOR AIR MIGHT ATTACH TO CIGARETTE SMOKE WAS RESEARCHED. EXPERIMENTS SHOWED THAT MODERATE CONCENTRATIONS OF RADON DAUGHTERS INDOORS COULD MORE THAN DOUBLE IN THE PRESENCE OF CIGARETTE SMOKE. THE RADON DAUGHTER LEVELS OBTAINED WITH SMOKE MAY IMPLY A SUBSTANTIAL RISK OF LUNG CANCER FOR BOTH ACTIVE AND PASSIVE SMOKERS. (4 GRAPHS, 14 REFERENCES) (ENV)

**INDOOR HEAVY METAL EXPOSURE OF THE POPULATION AROUND A
SECONDARY LEAD SMELTER (RADON, PASSIVE SMOKING,
PARTICULATES & HOUSING EPIDEMIOLOGY)**

SEIFERT BERND ; DREWS MARIANNE; AURAND KARL

INST FOR WATER SOIL & AIR HYGIENE, W GERMANY,

WHO/ET AL 3RD INTL INDOOR AIR QUALITY & CLIMATE CONF,
STOCKHOLM, AUG

20-24, 84, V2, P177(6)

CONF PAPER HOUSE DUST COLLECTED WITH A PASSIVE SAMPLER WAS USED FOR A RAPID SCREENING OF THE HEAVY METAL CONTENT OF DUST DEPOSITED IN HOUSES LOCATED NEAR A SOURCE. ANALYZING DUST SAMPLES FOR LEAD AND CADMIUM ALLOWED PINPOINTING OF HIGHLY POLLUTED SPOTS IN AN AREA SURROUNDING A SECONDARY LEAD SMELTER IN WEST GERMANY. THE HIGHEST PB AND CD DEPOSITS WERE OBSERVED IN HOMES LOCATED IN THE IMMEDIATE VICINITY OF THE SMELTER. (1 GRAPH, 10 REFERENCES) (ENV)

EXPOSURE TO RADON IN DWELLINGS AND LUNG CANCER: A PILOT STUDY (RADON, PASSIVE SMOKING, PARTICULATES & HOUSING EPIDEMIOLOGY)

PERSHAGEN GORAN; DAMBER LENA; FALK ROLF

NATL INST OF ENV MEDICINE, SWEDEN,

WHO/ET AL 3RD INTL INDOOR AIR QUALITY & CLIMATE CONF, STOCKHOLM, AUG 20-24, 84, V2, P73(6)

CONF PAPER A CASE CONTROL TECHNIQUE WAS USED TO EXAMINE THE RELATION BETWEEN ESTIMATED LIFETIME EXPOSURE TO RADON IN SWEDISH DWELLINGS AND LUNG CANCER. FIFTY-THREE CASES OF LUNG CANCER AND 53 CONTROLS WERE STUDIED. EXPOSURE ESTIMATES WERE BASED ON DATA REGARDING HOUSE CHARACTERISTICS OF RELEVANCE FOR INDOOR RADON LEVELS. A HIGHER EXPOSURE TO RADON WAS INDICATED FOR THE LUNG CANCER CASES THAN FOR THE CONTROLS AMONG SMOKERS BUT NOT AMONG NON-SMOKERS. A POSITIVE INTERACTION BETWEEN RADON AND SMOKING MAY EXPLAIN THESE RESULTS. (9 REFERENCES, 3 TABLES)
(ENV)

PLEURAL CHANGES CONSISTENT WITH ASBESTOS EXPOSURE FOUND ON SCREENING RADIOGRAPHS ARE NOT PREDICTIVE OF LUNG CANCER (RADON, PASSIVE SMOKING, PARTICULATES & HOUSING EPIDEMIOLOGY)

TOCKMAN MELVYN S.; WHEELER PAUL; LEVIN MORTON; FROST JOHN K.; GREEN KENDALL; BALL WILMOT

JOHNS HOPKINS MEDICAL INST, MD,

WHO/ET AL 3RD INTL INDOOR AIR QUALITY & CLIMATE CONF, STOCKHOLM, AUG 20-24, 84, V2, P229(6)

CONF PAPER HIGH-RISK MALE CIGARETTE SMOKERS WERE RECRUITED IN A STUDY OF LUNG CANCER SCREENING. INITIAL CHEST X-RAYS WERE READ FOR CASE AND CONTROL SUBJECTS. PRE-CANCER RADIOGRAPHS OF LUNG CANCER CASES SHOWED SIGNIFICANTLY GREATER FREQUENCIES OF PARENCHYMAL ABNORMALITIES, SMALL LINEAR OPACITIES, AND DISCOID ATELECTASIS. IN CONTRAST, THERE WAS NO CASE-CONTROL DIFFERENCE IN PLEURAL ABNORMALITIES. THE DATA ARE INTERPRETED AS SHOWING THAT INTERSTITIAL PARENCHYMAL CHANGES ARE PREDICTIVE OF LUNG CANCER, WHILE PLEURAL CHANGES ARE NOT. (9 REFERENCES, 1 TABLE)
(ENV)

MUTAGENIC ACTIVITY OF INDOOR AIRBORNE PARTICLES COMPARED TO OUTDOORS (RADON, PASSIVE SMOKING, PARTICULATES & HOUSING EPIDEMIOLOGY)

VAN HOUDT J.J. ; BOLEIJ J.S.

AGRICULTURAL UNIV, NETHERLANDS,

WHO/ET AL 3RD INTL INDOOR AIR QUALITY & CLIMATE CONF, STOCKHOLM, AUG 20-24, 84, V2, P169(8)

CONF PAPER THE MUTAGENIC ACTIVITY OF DIFFERENT INDOOR PARTICULATE SAMPLES WAS STUDIED IN RELATION TO OUTDOOR SAMPLES. PARTICLES WERE COLLECTED SIMULTANEOUSLY IN KITCHENS, LIVING ROOMS, AND OUTDOORS. METHANOL EXTRACTS WERE TESTED IN THE SALMONELLA/MICROSOME ASSAY. THE MUTAGENIC ACTIVITY OF INDOOR AS WELL AS OUTDOOR SAMPLES WAS GENERALLY INCREASED IN THE PRESENCE OF A METABOLIZING SYSTEM. INDOOR SAMPLES BEAR A HIGHER INDIRECT MUTAGENIC ACTIVITY, ESPECIALLY IN SMOKERS' HOMES. (3 GRAPHS, 10 REFERENCES, 2 TABLES) (ENV)

MAN-MADE MINERAL FIBRES (MMMF) IN INDOOR CLIMATE (RADON, PASSIVE SMOKING, PARTICULATES & HOUSING EPIDEMIOLOGY),
RINDEL ANNE
NATL BOARD OF HEALTH, DENMARK,
WHO/ET AL 3RD INTL INDOOR AIR QUALITY & CLIMATE CONF,
STOCKHOLM, AUG 20-24, 84, V2, P221(4)

CONF PAPER HEALTH AND AIR POLLUTION HAZARDS ASSOCIATED WITH THE INSTALLATION OF PRODUCTS DERIVED FROM MAN-MADE MINERAL FIBERS (MMMF) IN BUILDINGS ARE CONSIDERED. FEW INVESTIGATIONS OF THE SIGNIFICANCE OF MMMF FOR THE SICK BUILDING SYNDROME HAVE BEEN PERFORMED. A RECENT STUDY IN DENMARK EXAMINED A HIGH FREQUENCY OF HEADACHE AND EYE IRRITATION COMPLAINTS IN INSTITUTIONS WITH CEILINGS COMPRISED OF MMMF-PLATES. GUIDELINES FOR MEASURING MMMF AND FORMULATING APPROPRIATE REGULATIONS ARE SUMMARIZED. (5 REFERENCES) (ENV)

II. HEALTH EFFECTS

B. RISK ESTIMATES

RADON IN HOMES - DETERMINING RISKS AND PREVENTING EXPOSURES (ENGLISH)

DOEGE TC; HENDEE WR

AMER MED ASSOC, SCI & TECHNOL GRP, 535 N DEARBORN
ST/CHICAGO//IL/60610; UNIV ILLINOIS, SCH PUBL
HLTH/URBANA//IL/61801; NORTHWESTERN UNIV, SCH
MED/CHICAGO//IL/60611

SEMINARS IN NUCLEAR MEDICINE , V18, N1, P10-15, 1988

Knowledge about the effects of radon disintegration products and their levels in the nation's homes indicates that in a small proportion of homes these radioactive substances are increasing the inhabitants' risks of lung cancer. Testing for the problem and reducing its magnitude are the homeowner's responsibility. While practical methods for testing are known, they may not be easily available in all regions. (SCI) (AUTH)

Origin and health risks of indoor radon.

Hendee WR; Doege TC

Group on Science and Technology, American Medical Association, Chicago, IL 60610.

Semin Nucl Med (UNITED STATES) Jan 1988, 18 (1) p3-9, ISSN 0001-2998

Journal Code: UNY

Languages: ENGLISH

Radon has always been a component of ground and air and it has been present in increased concentrations from the moment humans first sought shelter inside dwellings. Recent improvements in the energy efficiency of dwellings have led to increased concentrations of radon and to increased risks of lung cancer. To quantify the magnitude of this risk, well-designed epidemiological studies, including surveys of representative dwellings, are needed, and several are being implemented. In the meantime, the EPA and other agencies have offered guidance on monitoring procedures and remedial measures appropriate for the problem on indoor radon. Recent disclosures of relatively high concentrations of radon and radon decay products in homes in several parts of the country have increased public concern about the problem. More information and education are needed about the health risks of radon, the desirability of implementing

monitoring procedures for radon, and about remediation measures when detected levels are above average. Educational resources are needed in communities to address local issues when they arise. (26 Refs.) (MED)

The validity of risk assessments for lung cancer induced by radon daughters

Steinhaeusler, F.; Hopke, P.K. (ed.)

Div. Biophys., Univ. Salzburg, A-5020 Salzburg, Austria

191. Meeting of the American Chemical Society New York, NY (USA) 13-18 Apr 1986

RADON AND ITS DECAY PRODUCTS. OCCURRENCE, PROPERTIES AND HEALTH EFFECTS

pp. 430-443, Publ.Yr: 1987

AMERICAN CHEMICAL SOCIETY, WASHINGTON, DC (USA)

SUMMARY LANGUAGE - ENGLISH; ACS. 331.

Languages: ENGLISH

Available input data for the risk assessment from low level radon daughter (Rn-d) exposure are mostly either of low quality, partially contradicting or simply "guesstimates". Therefore at present only the upper limit of this risk can be estimated. Results of epidemiological studies amongst miners are associated with large uncertainties with regard to the assessment of past radiation exposure, lung cancer diagnostic and/or classification and synergistic effects due to smoking and dust exposure. An alternative approach uses dosimetric modelling for Rn-d inhalation to obtain Rn-D exposure-dose conversion factors. Large uncertainty is caused by individual variability due the influence of life style, physical and biological parameters. It is concluded that for "normal" indoor Rn-D exposure the resulting risk is negligible compared to other risks "accepted" by society. (POL)

Risk Assessment of Exposure to Waterborne and Airborne Radon-222 in Illinois (Final rept.)

Sponsored by Illinois Dept. of Energy and Natural Resources, Springfield.

Energy and Environmental Affairs Div.

NTIS Prices: PC A05/MF A01

Hallenbeck, W. H.

Hallenbeck (William H.), La Grange, IL.

Corp. Source Codes: 090920000

Sponsor: Illinois Dept. of Energy and Natural Resources, Springfield.

Energy and Environmental Affairs Div.

Report No.: IL/ENR/RE/AQ-87/21

Dec 87 80p

Languages: English

NTIS Prices: PC A05/MF A01 Journal Announcement: GRAI8810

Country of Publication: United States

The study analyzed epidemiological and experimental animal studies in order to develop exposure-response relationships for radon-induced cancer. These relationships were used to estimate lifetime risks and annual excess cases based on the available waterborne and airborne data for Illinois. Exceedances of the USEPA action level of 4pCi/l occurred in 13% of 303 first floor measurements and 43% of 1094 basement measurements. For waterborne radon, the highest lifetime risk of cancer mortality associated with an Illinois groundwater-based drinking water system was estimated to be 4×10^4 . The number of excess cases of fatal cancer generated per year in Illinois was estimated to be about six. For airborne radon, a tentative value of 0.9 pCi/l (for first floors), derived from the limited existing data, was used to estimate the average lifetime lung cancer mortality risk and the number of excess cases of fatal lung cancer generated per year. The average lifetime lung cancer mortality risk was estimated to be 0.0048, and the annual number of excess cases of fatal lung cancer was estimated to be 784. Due to the nature of the underlying exposure-response relationships for radon-induced cancer, the values presented most likely represent upper-bound estimates. (NTIS)

ANNALS OF THE ICRP INTERNATIONAL COMMISSION ON RADIOLOGICAL PROTECTION VOL. 17. NO. 1. LUNG CANCER RISK FROM INDOOR EXPOSURES TO RADON DAUGHTERS

SMITH H

ICRP, CLIFTON AVE., SUTTON, SURREY SM2 5PU, ENGL.

SMITH, H. (ED.). ANNALS OF THE ICRP (INTERNATIONAL COMMISSION ON RADIOLOGICAL PROTECTION), VOL. 17. NO. 1. LUNG CANCER RISK FROM INDOOR EXPOSURES TO RADON DAUGHTERS. VII+60P. PERGAMON PRESS: OXFORD, ENGLAND, UK; NEW YORK, NEW YORK, USA. ILLUS. PAPER. ISBN 0-08-035597-X.

1987. VII+60. CODEN: ANICD

Language: ENGLISH

Document Type: BOOK

Subfile: BARRM (Biological Abstracts/RRM)

This volume of the series presents six sections that deliver information on sources, levels, lung exposure, and general findings, evaluation methods, and the risk of radiation-induced lung cancer. Abundant graphs, tables, equations, references and a appendix supplement the text. (BIO)

Contribution of radon and radon daughters to respiratory cancer.

Harley N; Samet JM; Cross FT; Hess T; Muller J; Thomas D
Department of Environmental Medicine, New York University
Medical Center, NY 10016.

Environ Health Perspect (UNITED STATES) Dec 1986, 70
p17-21, ISSN 0091-6765 Journal Code: EIO
Languages: ENGLISH

This article reviews studies on the contribution of radon and radon daughters to respiratory cancer and proposes recommendations for further research, particularly a national radon survey. The steady-state outdoor radon concentration averages 200 pCi/m³, and indoor levels are about 4 times higher. The primary source of radon in homes is the underlying soil; entry depends on multiple variables and reduced ventilation for energy conservation increases indoor radon levels. Occupational exposures are expressed in units of radon daughter potential energy concentration or working level (WL). Cumulative exposure is the product of the working level and the time exposed. The unit for cumulative exposure is the working level month (WLM). The occupational standard for radon exposure is 4 WLM/year, and 2 WLM/year has been suggested as a guideline for remedial action in homes. Epidemiologic studies show that miners with cumulative radon daughter exposures somewhat below 100 WLM have excess lung cancer mortality. Some 3% to 8% of miners studied have developed lung cancer attributable to radon daughters. All of the underground mining studies show an increased risk of lung cancer with radon daughter exposure. All cell types of lung cancer increased with radon exposure. If radon and smoking act in a multiplicative manner, then the risk for smokers could be 10 times that for nonsmokers. The potential risk of lung cancer appears to be between 1 and 2 per 10,000/WLM, which yields a significant number of lung cancers as some 220 million persons in the United States are exposed on average to 10 to 20 WLM/lifetime. (MED)

TESTS OF THE LINEAR NO-THRESHOLD DOSE-RESPONSE RELATIONSHIP FOR HIGH-LET RADIATION

COHEN B L

DEP. PHYSICS, UNIV. PITTSBURGH, PITTSBURGH, PA. 15260.

CONFERENCE ON RADIATION HORMESIS, OAKLAND, CALIFORNIA,
AUGUST 14-16, 1985. HEALTH PHYS 52 (5). 1987. 629-636.

CODEN: HLTPA

Language: ENGLISH

Subfile: BARRM (Biological Abstracts/RRM)

It is pointed out that induction of lung cancer by exposure to Rn daughters, applied at high doses to miners and at low doses

to exposures in homes, provides a very stringent and sensitive test of the linear, no-threshold dose-response relationship for high-LET radiation, because the relationship predicts that a substantial fraction of lung cancer among non-smokers is due to average Rn levels. Therefore, it predicts an easily observable elevation of lung cancer rates in areas where Rn levels are many times greater than the average, especially before cigarette smoking began to have important effects on lung cancer statistics. (BIO) (AUTH)

Radiation doses from radon in buildings.

Swedjemark GA

National Institute of Radiation Protection, Environmental Laboratory, Stockholm, Sweden.

Med Oncol Tumor Pharmacother (ENGLAND) 1987, 4 (3-4) p139-50, ISSN 0736-0118 Journal Code: LSP

Languages: ENGLISH

Not until about 1970 was it possible to estimate the magnitude of the correlation between additional lung cancer frequency and radon daughter exposure in miners. In addition, it has been realised that high levels of radon daughters in homes may be found in all countries and therefore the interest in radon in buildings has rapidly increased during the last 10 years. Radon gas enters the house from underground, from building materials and in some cases from tap water. Indoor radon daughter concentrations vary between countries and regions. The absorbed dose in the basal cells of the bronchial epithelium based on an average of the population in Canada, U.S.A. and West Germany can be estimated to be about 1 mGy a⁻¹ (average radon daughter concentration about 25 Bq m⁻³) for Great Britain about half of that value and for the Nordic countries about double this value. 300-3000 lung cancer cases (most probable 1100) may occur in the future in the Swedish population of 8.4 million from radon daughter exposure indoors today. This estimation is made by the National Institute of Radiation Protection. A lower estimate of 100-1000 lung cancer cases is made by the Swedish Cancer Committee. Efforts to decrease the exposure from radon daughters indoors have been made in some countries by establishing limits or recommendations for the radon or radon daughter concentration indoors. Measuring methods for finding houses with high radon daughter concentrations and effective building techniques in order to decrease the radon daughter concentrations in both existing and for planned buildings are available. (42 Refs.) (MED)

**AN ESTIMATE OF THE LUNG-CANCER RISK FROM RADON AND ITS
DECAY PRODUCTS IN ALPINE DWELLINGS (ENGLISH)
BURKART W**

EIR, ABT 81/CH-5303 WURENLINGEN//SWITZERLAND/
INTERNATIONAL JOURNAL OF RADIATION BIOLOGY , V49, N5,
P868-869, 1986

In large areas of the Swiss Alps, the high radium content of rocks and soil may produce considerable indoor levels of radon in dwellings with low air exchange rates. A sample of 32 conventional homes in South-eastern Switzerland was taken. Energy conservation efforts such as weatherstripping were shown to increase radon levels and doses further. (SCI)(HQL)

Estimated Risk from Exposure to Radon Decay Products in US Homes Workshop on exposure modeling and monitoring, Cambridge, MA, USA, 30 Sep 1985.

NTIS Prices: PC A02/MF A01

Nero, A. V.

Lawrence Berkeley Lab., CA. Applied Science Div.

Corp. Source Codes: 086929008; 9505804

Sponsor: Department of Energy, Washington, DC.

Report No.: LBL-21642; CONF-8509332-1

May 86 19p

Languages: English Document Type: Conference proceeding

NTIS Prices: PC A02/MF A01 Journal Announcement:

GRAI8709; NSA1200

Country of Publication: United States

Contract No.: AC03-76SF00098

Recent analyses now permit direct estimation of the risks of lung cancer from radon decay products in US homes. Analysis of data from indoor monitoring in single-family homes yields a tentative frequency distribution of annual-average $\text{sup } 222 \text{ Rn}$ concentrations averaging 55 Bq m^{-3} and having 2% of homes exceeding 300 Bq m^{-3} . Application of the results of occupational epidemiological studies, either directly or using recent advances in lung dosimetry, to indoor exposures suggests that the average indoor concentration entails a lifetime risk of lung cancer of 0.3% or about 10% of the total risk of lung cancer. The risk to individuals occupying the homes with 300 Bq m^{-3} or more for their lifetimes is estimated to exceed 2%, with risks from the homes with thousands of Bq m^{-3} correspondingly higher, even exceeding the total risk of premature death due to cigarette smoking. The potential for such average and high-level risks in ordinary homes forces development of a new perspective on environmental exposures. (ERA citation 12:001994) (NTIS)

Energy-related risk in the U.S.A. in the year 2020

Inhaber, H.; King, S.

Risk Concepts Inc., P.O. Box 1231, Oak Ridge, TN 37831, USA
ANN. NUCL. ENERGY VOL. 13, NO. 4, pp. 173-184, Publ.Yr:
1986

SUMMARY LANGUAGE - ENGLISH

Languages: ENGLISH

The present risk to health of energy systems has been the subject of much debate in recent years. This paper extrapolates some present results on energy-related risk to the year 2020. It finds that if today's trends continue, the largest sources of risk will be due to the changeover from large to small cars, radon buildup in better-sealed buildings and the entire coal (and synthetic fuel) cycle. Other sources of risk, such as the larger proportion of nuclear and solar energy three or four decades from now, are about an order of magnitude lower than the aforementioned three. Because of the many uncertainties in the calculations, the results should be viewed as primarily qualitative, although derived quantitatively. However, they can be used as a guide by policymakers and research planners to produce the greatest risk reduction per unit effort. (POL)

POTENTIAL HEALTH EFFECTS OF INDOOR RADON EXPOSURE

RADFORD EDWARD P.

UNIV OF PITTSBURGH,

ENV HEALTH PERSPECTIVES, OCT 85, V62, P281(7)

JOURNAL ARTICLE ALPHA RADIATION FROM INHALED
SHORT-LIVED DAUGHTERS OF RADON READILY IRRITATES HUMAN BRONCHEAL
EPITHELIUM. IN HOMES, RADON LEVELS ARE HIGHLY VARIABLE, SHOWING
APPROXIMATE LOG-NORMAL DISTRIBUTIONS. FACTORS AFFECTING INDOOR
CONCENTRATIONS INCLUDE TYPE OF BEDROCK UNDER DWELLINGS, HOUSE
FOUNDATION CHARACTERISTICS, RADON DISSOLVED IN ARTESIAN WATER,
AND VENTILATION IN LIVING SPACES. FROM APPLICATION OF RISK
ASSESSMENTS IN MINERS TO HOME CONDITIONS, IT APPEARS THAT ABOUT
25% OR MORE OF LUNG CANCERS AMONG NONSMOKERS OVER THE AGE OF 60,
AND ABOUT 5% IN SMOKERS, MAY BE ATTRIBUTABLE TO EXPOSURE TO
RADON DAUGHTERS IN THE HOME. (ENV)

II. HEALTH EFFECTS

C. DOSIMETRY

A Reconsideration of Cells at Risk and Other Key Factors in Radon Daughter Dosimetry

James, A.C.

Radon and Its Decay Products, P.K. Hopke, Editor;
Washington, D.C., American Chemical Society, pages 400-418,
41 references 1987

A model for assessing dose to lung from radon (10043922) daughter exposure was formulated which was consistent with the available data on bronchial dimensions, airway deposition and clearance of radon daughters. When dose was averaged over the whole thickness of bronchial epithelium, the calculated mean bronchial dose was about 60 percent greater for the unattached fraction of alpha energy and about 30 percent greater for radon daughters attached to aerosol particles than when only the dose to basal cells was considered. Based on recent experimental data, the conversion factor for absorbed dose per unit exposure was estimated to be 130 milligray (mGy) for unattached radon daughters and 8mGy for the aerosol fraction. Under typical exposure conditions in the home, the estimated conversion factor to effective dose equivalent was approximately 15 millisieverts. Breathing rate and age were shown to be minor factors in determining dose per unit exposure. Lung dose rate was found to be proportional to the radon gas concentration over a wide range of conditions, which facilitated interpretation of monitoring data. The author identifies the need for further research to determine whether radon daughter aerosol particles grow significantly in size at physiological humidity and to assess nasal deposition of unattached daughters. (OSH)

LUNG CANCER AFTER IRRADIATION THE RADON PROBLEM

JACOBI W

INST. STRAHLENSCHUTZ GSF, D-8042 MUENCHEN-NEUHERBERG.

NATURWISSENSCHAFTEN 73 (11). 1986. 661-668. CODEN:
NATWA

Language: GERMAN

Subfile: BA (Biological Abstracts)

The estimation and limitation of lung cancer risk from inhaled ^{222}Rn -daughters in mines and in the home is one of the

most important problems in radiation protection. The results of epidemiological studies are summarized. The radiation-induced increase in the age-specific lung cancer rate can be interpreted in terms of a proportional hazard model. On the basis of this model, the relative fraction of total lung cancer frequency which might be initiated by the radon-daughter exposure in homes is estimated. (BIO)

Computerised Model for the Calculation of the Activity to Dose Conversion Factor for Radon Daughter Inhalation in Dwellings

U.S. Sales Only.

NTIS Prices: PC A03/MF A01

Muraleedharan, T.S.; Ramachandran, T.V.; Subba Ramu, M.C.
Bhabha Atomic Research Centre, Bombay (India).

Corp. Source Codes: 004104000; 0807000

Report No.: BARC-1317

1986 30p

Languages: English

NTIS Prices: PC A03/MF A01

Journal Announcement:

GRAI8724; NSA1200

Country of Publication: India

Occupants of dwellings are exposed to high concentrations of airborne radon and its daughters and hence it is important to assess the dose received by them. This report describes the various parameters that are used to calculate the dose to the lung. The calculations are carried out by a simple computer model with the help of which one can get the activity to dose conversion factor in terms of either rad or grey per working level month. Typical calculations have been carried out to show that the conversion factor can vary by a factor of 5 depending on some typical input parameters. 12 references, 4 figures. (ERA citation 12:040108) (NTIS)

Updating radon daughter bronchial dosimetry

Harley, N.H.; Cohen, B.S.; Hopke, P.K. (ed.)

Inst. Environ. Med., New York Univ. Med. Cent., New York, NY
10016, USA

191. Meeting of the American Chemical Society New
York, NY (USA)

13-18 Apr 1986

**RADON AND ITS DECAY PRODUCTS. OCCURRENCE, PROPERTIES AND
HEALTH EFFECTS**

pp. 419-429, Publ.Yr: 1987

AMERICAN CHEMICAL SOCIETY, WASHINGTON, DC (USA)

SUMMARY LANGUAGE - ENGLISH; ACS. 331.
Languages: ENGLISH

The lung cancer risk from radon daughter exposure is known only for occupationally exposed males. In order to determine the risk in environmental situations it is necessary to determine whether the bronchial alpha dose, which confers the risk, is similar to that in mines. Particle size is a major factor which determines the alpha dose conversion factor for radon daughters (mGy/WLM). Data on indoor environments are emerging and indicate that a variety of specific conditions exist. For example, a dose factor four times that for a nominal occupational or environmental exposure exists if kerosene heater particles dominate the indoor aerosol and four times smaller if a hygroscopic particle dominates. (POL)

III. EXPOSURE

A. HOUSE CONSTRUCTION

Variation of radon levels in U.S. homes with various forms.

Cohen BL; Gromicko N

JAPCA (UNITED STATES) Feb 1988, 38 (2) p129-34, ISSN
0894-0630

Journal Code: JCA

Languages: ENGLISH

A program combining 70,000 purchased and 3,500 random selection-no charge measurements with extensive questionnaires is described. (MED)

Radon in homes. Council on Scientific Affairs.

JAMA (UNITED STATES) Aug 7 1987, 258 (5) p668-72, ISSN
0098-7484

Journal Code: KFR

Languages: ENGLISH

Radon 222 and its radioactive decay products can enter buildings and, through inhalation, expose the inhabitants' pulmonary tissues to ionizing radiation. Studies of radon levels in the United States indicate that variations of 100-fold or greater exist among private dwellings. In one region, 55% of homes had levels exceeding 4 pCi/L (0.15 Bq/L), which is the guidance level recommended by the US Environmental Protection Agency. Ventilation and tightness of construction are important determinants of radon levels. In some instances, fans or heat exchangers can reduce excessive concentrations, but in others more elaborate remedial measures may be required. Physicians may obtain information about radon through Environmental Protection Agency regional offices and state radiation control programs. The risk of radiogenic cancer is believed to increase with exposure to ionizing radiation. According to some estimates, concentrations of radon decay products in US homes could be responsible for several thousand cases of lung cancer per year. Studies of radon levels in representative buildings and guidelines are needed to ensure safe, effective, and cost-effective countermeasures. Architects, contractors, designers, building code administrators, health physicists, and biomedical investigators can help with solutions. (MED)

Indoor ventilation rates for 222Rn.

Terilli TB; Harley NH

New York University Medical Center, NY 10016.

Health Phys (UNITED STATES) Jun 1987, 52 (6) p801-3,

ISSN 0017-9078 Journal Code: G2H

Contract/Grant No.: ES-00260; CA-13343

Languages: ENGLISH

For the past 3 years, indoor and outdoor 222Rn concentrations have been measured at a single-family dwelling in northern New Jersey. In the spring of 1985, a small experimental room was built as an extension to the cellar. Findings are discussed. (MED)

The Role of Building Construction and Ventilation in Indoor Air Pollution. Review of a Recurring Problem

McCunney, R. J.

New York State Journal of Medicine, Vol. 87, No. 4, pages 203-209, 77

references April 1987 CODEN: NYSJAM

The role of building construction and ventilation in indoor air pollution is discussed. A number of adverse health effects can be attributed to the indoor environment. New materials, energy efficiency measures, and inadequate ventilation have all been associated with conditions ranging from fatal pulmonary disease to vague symptoms such as headache and fatigue. The most notable infection resulting from indoor air pollution is that caused by Legionella-pneumophila (Legionnaire's disease and Pontiac fever). Person to person spread does not appear to occur. The only proven route of transmission is through contaminated aerosols originating in air handling systems. Hypersensitivity pneumonitis and humidifier fever are other conditions associated with contaminated air systems. Epidemic psychogenic illness, also known as mass hysteria, refers to a constellation of symptoms that develops in people who are under some type of physical or emotional stress. Concern almost invariably focuses on an apparent toxic agent. Sources of indoor pollution such as radon (10043922), formaldehyde (50000), asbestos (1332214), tobacco, and indoor combustion are discussed. Procedures for investigating a suspected case of indoor pollution are reviewed. The number of requests to NIOSH for indoor air quality investigations has greatly increased since 1978, probably due to a heightened awareness of hazards and to improved energy efficiency. It is noted that the ideal approach for preventing adverse effects of indoor pollution is through proper ventilation. Inadequate ventilation, in the absence of other sources of contamination, can cause systemic health effects, especially fatigue. Preventive maintenance on air handling systems is considered essential. (OSH)

**Indoor Air Quality Environmental Information Handbook:
Building System Characteristics**

Paper copy only, copy does not permit microfiche production.
Original copy available until stock is exhausted.

NTIS Prices: PC A13

Mueller Associates, Inc., Baltimore, MD.

Corp. Source Codes: 100249000; 9502678

Sponsor: Argonne National Lab., IL.; Brookhaven National
Lab., Upton, NY.

Department of Energy, Washington, DC.

Report No.: DOE/EV/10450-H1

Jan 87 290p

Languages: English

NTIS Prices: PC A13

Journal Announcement: GRAI8801;

NSA1200

Country of Publication: United States

Contract No.: AC01-81EV10450; AC02-76CH00016

This manual, the third in a series, focuses on residential building system characteristics and their effects on indoor air quality. The manual addresses: residential indoor air pollutants by source, indoor concentrations, health effects, source control and mitigation techniques, standards and guidelines; building system characteristics of air exchange, pollutant source strength, residence volume, site characteristics, structural design, construction, and operation, infiltration and ventilation system, building occupancy; and monitoring methods. (ERA citation 12:039058) (NTIS)

Indoor ventilation rates for super(222)Rn

Terilli, T.B.; Harley, N.H.

New York Univ. Med. Cent., 550 First Ave., New York, NY
10016, USA

HEALTH PHYS VOL. 52, NO. 6, pp. 801-803, Publ.Yr: 1987

SUMMARY LANGUAGE - ENGLISH

Languages: ENGLISH

Journal Announcement: V19N3

For the past 3 y, indoor and outdoor super(222)Rn concentrations have been measured at a single-family dwelling in northern New Jersey. Continuous super(222)Rn monitors (Ch81) collect hourly data in the cellar and outdoors. In the spring of 1985, a small experimental room was built as an extension cellar. The original cellar walls were built with poured concrete. The experimental room has walls made of concrete blocks to provide a more porous entry and to augment the response time of super(222)Rn to different meteorological conditions. The experimental room also has a larger surface-to-volume ratio and thinner walls than the original cellar. (POL)

Residential Indoor Air Pollutants

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NTIS Prices: PC A06/MF A01

Wilfert, G. L.; Young, J. K.; Buck, J. W.

Battelle Pacific Northwest Labs., Richland, WA.

Corp. Source Codes: 048335000; 9512268

Sponsor: Department of Energy, Washington, DC.

Report No.: DOE/BP/18690-3

Nov 86 124p

Languages: English

NTIS Prices: PC A06/MF A01

Journal Announcement:

GRAI8719; NSA1200

Country of Publication: United States

Contract No.: AC06-76RL01830

A growing concern about housing is the type, amount and health effects of residential indoor air pollution. In recent years, considerable research has been conducted in an effort to understand the airborne pollutants present in residential indoor air, their sources, their concentration levels, their risks to health, and what can be done to eliminate or mitigate pollution levels. This report focuses on the first three of these: pollutants, sources, and concentration levels. Health risks of key pollutants and mitigation strategies to control pollutant levels are the topics of separate reports. The report reflects current information available through the fall of 1985. (ERA citation 12:023454) (NTIS)

Constancy of Air Tightness in Buildings

In Finnish.

U.S. Sales Only. Portions of this document are illegible in microfiche products.

NTIS Prices: PC A08/MF A01

Metiaainen, P.; Saarimaa, J.; Saarnio, P.; Salomaa, H.; Tulla, K.

Valtion Teknillinen Tutkimuskeskus, Espoo (Finland).

Corp. Source Codes: 067526000; 6658300

Report No.: VTT-TUTK-422

Sep 86 170p

Languages: Finnish

NTIS Prices: PC A08/MF A01

Journal Announcement:

GRAI8812; NSA1300

Country of Publication: Finland

In order to reduce consumption of energy, more air tight buildings have been built. There were many doubts, that too air tight construction can cause some harm to indoor climate and structures. It was also unclear whether the building would remain air tight with time. In the study, pressure measurements have

been carried out to discover whether the air tightness of mainly detached houses changes with time. The study consists of 34 new buildings and 9 old improved buildings. The air tightness of the building envelope decreased significantly in energy two buildings during the two first years. The change occurred mainly in timber framed buildings. In many cases it was very difficult to detect any specified causes to reduced air tightness. In timber framed buildings drying of wood is one notable reason. It causes small cracks all over the building envelope and reduces thus the air tightness evenly. The study of the inconveniences caused by too air tight constructions was carried out by sending inquiries to the holders of real estate. Some buildings were then thoroughly inspected and measured. The study showed that too air tight as well as too leaky constructions cause much harm. Draught and bad smell of indoor air seemed to be quite common in flats. The window pane became misty in several buildings, whereas moisture defects inside the constructions were rare. The radon content was measured in several buildings, and very low concentrations were found. The problems of indoor climate were significantly connected with poor ventilation. The main problem was the insufficient use of mechanical ventilation devices and the incompatibility between the ventilation system and air tightness, in other words, the air change rate was out of control. (ERA citation 13:014896) (NTIS)

Influence of Source Type and Air Exchange on Variations of Indoor Radon Concentration

U.S. Sales Only.

NTIS Prices: PC A03/MF A01

Arvela, H. ; Wingvist, K.

Finnish Centre for Radiation and Nuclear Safety, Helsinki.

Corp. Source Codes: 083143000; 9820910

Report No.: STUK-A-51

Apr 86 33p

Languages: English

NTIS Prices: PC A03/MF A01

Journal Announcement:

GRAI8718; NSA1200

Country of Publication: Finland

The model relates radon concentration to source strength and its variations, air exchange rate and meteorological factors. Two types of sources have been studied. The pressure difference dependent source is made up of radon transported with soil pore air and driven by pressure difference due to the stack effect. The constant source is made up of radon transported by diffusion from building materials or from soil. The air exchange rate depends exponentially on indoor-outdoor temperature difference and linearly on wind speed. These two inputs have been summed in quadrature. In a house with a constant source radon concentration decreases when the air exchange rate increases due

to the increasing temperature difference, whereas the pressure difference dependent source causes an increasing concentration. This is due to the fact that the effect of the source strength increase is stronger than the decreasing effect of air exchange on concentration. The winter-summer concentration ratio depends on the combination of the two types of source. A pure pressure dependent source leads to the winter-summer ratio of 2-3.5 (winter -5 deg C, summer +15 deg C, wind speed 3 m/s). A strong contribution of a constant source is needed to cause a summer concentration higher than the winter concentration. The model is in agreement with the winter-summer concentration ratios measured. This ratio increases with the increasing winter concentration. The measured ratio was near 1.0 for houses with winter concentration of 200 Bq m⁻³ or less and near 2.0 with concentration of 1000 Bq m⁻³. In a house with a constant source, the diurnal maximum occurs in the afternoon, while in houses with a pressure difference dependent source the time of maximum is early in the morning. (ERA citation 12:023465) (NTIS)

Model for the Calculation of the Radiation Dose from Natural Radionuclides in the Netherlands

In Dutch.

U.S. Sales Only.

NTIS Prices: PC A05/MF A01

Ackers, J. G.

Ministerie van Volkshuisvesting, Ruimtelijke Ordening en Milieubeheer, The Hague (Netherlands). Directie Stralenbescherming.

Corp. Source Codes: 087985003; 4188735

Report No.: VROM-DSB-86-19; VROM-60201/3-86

Feb 86 87p

Languages: Dutch

NTIS Prices: PC A05/MF A01 Journal Announcement: GRAI8805

Country of Publication: Netherlands

A model has been developed to calculate the radiation dose incurred from natural radioactivity indoors and outdoors, expressed in effective dose equivalence/year. The model is applied on a three rooms dwelling characterized by interconnecting air flows and on a dwelling with crawlspace. In this model the distinct parameters are variable in order to allow the investigation of the relative influence. The calculated effective dose equivalent for an adult in the dwelling was calculated to be about 1.7 mSv/year, composed of 15% from cosmic radiation, 35% from terrestrial radioactivity, 20% from radioactivity in the body and 30% from natural radionuclides in building materials. The calculations show an enhancement of about a factor of two in radon concentration in air in a room which is ventilated by air from an adjacent room. It is also

shown that the attachment rate of radon products to aerosols and the plate-out effect are relatively important parameters influencing the magnitude of the dose rate. (Auth.). 37 refs.; 12 figs.; 42 tabs. (Atomindex citation 18:079206) (NTIS)

Building Assessment Techniques for Indoor Air Quality Evaluations

Bearg, D. W., and W. A. Turner

Indoor Air Quality in Cold Climates: Hazards and Abatement Measures, D. S. Walkinshaw, Editor; Pittsburgh, PA, Air Pollution Control Association, pages 276-283, 4 references 1986

Methods used to evaluate the quality of indoor air were reviewed, with emphasis on techniques to determine effective ventilation rates and indoor air movement pathways. Sources of air contamination in a building and methods for their identification were also examined. Specific topics reviewed included the assessment of actual building ventilation rates, determination of air movement pathways and ventilation efficiency, assessment of building contaminants, sources within the building (particles, combustion gases, ozone (10028156), biological sources, organic chemicals, and fibers), sources from outside the building (radon (10043922), parking lots, cooling towers, and localized exhaust), and sources related to the building mechanical system (location of air intakes, humidity control, location of supply and exhaust registers, parameters for localized exhausts, capture efficiency, negative pressurization, and discharge parameters). Examples of air contamination and source identification included a five story academic arts and sciences building, a multistory health care facility, and a two story office building. The authors conclude that while potential sources of indoor and outdoor contamination can be evaluated by observation, the actual evaluation of building ventilation requires measurement of ventilation rates and determination of air movement pathways, and more specific measures may be required for determination of contaminant levels and sources. (OSH)

Energy Efficient House Research Project

Portions of this document are illegible in microfiche products. Original copy available until stock is exhausted. NTIS Prices: PC A10/MF A01

Robinson, D. A. ; Nelson, G. D. ; Hutchinson, M.

Minnesota Dept. of Energy and Economic Development, St. Paul. Energy Div.

Corp. Source Codes: 079314001; 9517499

Sponsor: Department of Energy, Washington, DC.

Report No.: ORNL/SUB-83-47980/1

Sep 86 206p

Languages: English

NTIS Prices: PC A10/MF A01 Journal Announcement: GRAI8707;
NSA1100

Country of Publication: United States

Contract No.: AC05-84OR2140

The basis for this project was a set of energy efficient houses built in 1980 by the Energy Efficient Housing Demonstration Program of the Minnesota Housing Finance Agency. Under this programs, 144 detached and attached housing units were constructed throughout the State of Minnesota by 23 different builders. The research project utilized a simple data collection method involving homeowners in the field and utility data reports to establish a performance data base for the houses in the study. Data have been provided for addition to the BECA-A (new residential) data base on file at Lawrence Berkeley Laboratory, establishing a comprehensive data base for further analyses. The 112 houses for which there were good quality energy data performed very well, but analysis of these data showed few significant correlations between energy performance and design features. Detailed field investigation of 25 houses revealed many commonly practiced housing design and construction methods that degrade the energy performance of solar and other features of potentially energy efficient houses. Indoor air quality was investigated in 12 energy efficient houses and in an equal number of control houses. Air quality in the energy efficient houses was found to be as good as in houses of conventional construction. Radon mitigation using subfloor ventilation was investigated and found to be successful in reducing the concentration of this indoor air contaminate. Attempts to seal out radon in two control houses were not successful. (ERA citation 11:051073) (NTIS)

Ventilation- and Infiltration Measurements in a Dwelling in
View of the Problems with Radon

In Dutch.

U.S. Sales Only.

NTIS Prices: PC A05/MF A01

Gids, W. F. ; Phaff, J. C.

Ministerie van Volkshuisvesting, Ruimtelijke Ordening en
Milieubeheer, The Hague (Netherlands). Directie
Stralenbescherming.

Corp. Source Codes: 087985003; 4188735

Report No.: VROM-DSB-86-22; VROM-60522/6-86

Jun 86 87p

Languages: Dutch

NTIS Prices: PC A05/MF A01 Journal Announcement: GRAI8805

Country of Publication: Netherlands

This report describes the results of continuous ventilation measurements, with N/sub 2/O as tracer gas, of infiltration streams in seven spaces in a dwelling. The results are compared with ventilation model calculations; good agreement was obtained. (Auth.). 24 figs.; 1 table. (Atomindex citation 18:079246) (NTIS)

RADON AND LUNG-CANCER - INCREMENTAL RISKS ASSOCIATED WITH RESIDENTIAL WEATHERIZATION (ENGLISH)

BRAMBLEY MR; GORFIEN M

WASHINGTON UNIV, DEPT ENGN & POLICY/ST LOUIS//MO/63130
ENERGY, V11, N6, P589-605, 1986

Energy conservation measures for residences that decrease air-exchange rates between the indoors and outdoors are shown, in the absence of substantial pressure-driven sources of radon, to increase substantially the concentrations of short-lived radionuclides in indoor air that are produced by the decay of naturally occurring radon. The associated incremental risk of lung cancer, although small compared to the risk attributable to tobacco smoking, is probably large enough to concern a substantial fraction of the population. (SCI)(AUTH)

POLLUTION BEGINS AT HOME

MATTHEWS ROBERT

NEW SCIENTIST, DEC 5, 85, V108, N1485, P34(4)

JOURNAL ARTICLE INSULATED AND WEATHERPROOFED HOMES CONSERVE ENERGY WHILE TRAPPING ATMOSPHERIC POLLUTANTS. REDUCED VENTILATION AND THE USE OF FORMALDEHYDE INSULATION ARE THE CULPRITS OF INCREASED INDOOR LEVELS OF FORMALDEHYDE AND CONDENSATION. GAS APPLIANCES PRODUCE SEVERAL POTENTIALLY HARMFUL WASTE GASES, SUCH AS NITROGEN DIOXIDE. CIGARETTE SMOKING IS THE MOST OBVIOUS SOURCE OF POLLUTION FROM COMBUSTION. RADON CAN SEEP OUT OF SOIL AND MASONRY INTO BUILDINGS, WHERE IT CAN ACCUMULATE TO LEVELS AT LEAST 10 TIMES HIGHER THAN THOSE OUTSIDE IN THE OPEN AIR. SCRUBBERS AND OTHER DEVICES FOR PURIFYING INDOOR AIR ARE DISCUSSED, BUT INCREASING VENTILATION APPEARS TO BE THE BEST APPROACH. (ENV)

INDOOR AIR QUALITY, INFILTRATION AND VENTILATION IN RESIDENTIAL BUILDINGS

NITSCHKE IAN A.; TRAYNOR GREGORY W.; WADACH JOHN B.; CLARKIN MICHAEL E.; CLARKE WAYNE A.

W. S. FLEMING & ASSOC, NY,

NEW YORK STATE ENERGY R&D AUTHORITY REPORT 85-10, MAR 85 (265)

STATE/LOCAL GOVT REPORT SIXTY HOUSES BUILT WITH DIFFERENT CONSTRUCTION PRACTICES IN UPSTATE NEW YORK WERE MONITORED FOR AIRTIGHTNESS AND RADON CONCENTRATIONS IN INDOOR AIR, HOUSEHOLD WATER, AND SOIL SURROUNDING THE HOUSE. THIRTY OF THE HOUSES WERE ALSO MONITORED FOR AIR EXCHANGE RATES, COMBUSTION POLLUTANTS, AND FORMALDEHYDE. UNVENTED KEROSENE HEATERS WERE RESPONSIBLE FOR HIGH INDOOR NITROGEN DIOXIDE LEVELS; SMOKERS AND SOME WOOD STOVES WERE SOURCES OF INDOOR RESPIRABLE PARTICULATES. NEW PANELLING AND HIGH HUMIDITY LEVELS WERE ASSOCIATED WITH HIGH FORMALDEHYDE LEVELS IN ONE HOUSE. THE MOST EFFECTIVE GENERAL CONTROL TECHNIQUE WAS THE IDENTIFICATION OF THE SOURCES OF POLLUTION AND THE REMOVAL AND/OR THE ISOLATION OF THE SOURCES FROM THE INDOOR ENVIRONMENT. (ENV)

EXPOSURE TO ENHANCED NATURAL RADIATION AND ITS REGULATORY IMPLICATIONS: PROCEEDINGS OF A SEMINAR HELD IN MAASTRICHT, THE NETHERLANDS, 25-27 MARCH 1985, SCIENCE OF THE TOTAL ENV, OCT 85, V45 (699)

CONF PROCEEDINGS PROCEEDINGS OF A EUROPEAN SEMINAR ENTITLED "'EXPOSURE TO ENHANCED NATURAL RADIATION AND ITS REGULATORY IMPLICATIONS'" ARE PRESENTED. THE USE OF NEW CONSTITUENTS IN BUILDING MATERIALS, REDUCTION OF VENTILATION IN HOUSES TO CONSERVE ENERGY, PRODUCTION AND USE OF PHOSPHATE FERTILIZERS, INDUSTRIAL ACTIVITIES INVOLVING RELEASE OF NATURALLY OCCURRING RADIONUCLIDES INTO THE ENVIRONMENT, AND REUSE OF LARGE AMOUNTS OF WASTE MATERIAL ARE EXAMPLES OF SITUATIONS WHICH MODIFY DISTRIBUTION OF NATURAL RADIOACTIVITY IN THE ENVIRONMENT. (ENV)

RADON TRANSPORT INTO A DETACHED ONE-STORY HOUSE WITH A BASEMENT
NAZAROFF W.W.; FEUSTEL H.; NERO A.V.; REVZAN K.L.; GRIMSRUD D.T.; ESSLING M.A.; TOOHEY R.E.
LBNL, ATMOSPHERIC ENV, 1985, V19, N1, P31(16) RESEARCH ARTICLE

RESULTS OF A FIVE-MONTH STUDY DURING WHICH RADON (RN 222) CONCENTRATION, AIR-EXCHANGE (VENTILATION) RATE, AND WEATHER AND RADON SOURCE PARAMETERS WERE CONTINUOUSLY MONITORED IN A HOUSE NEAR CHICAGO ARE DESCRIBED, PARTICULAR FOCUS ON RADON ENTRY RATE. RESULTS SUGGEST THAT THE BASEMENT SUMP PUMP AND PERIMETER DRAIN-TILE SYSTEM PLAYED AN IMPORTANT ROLE IN INFLUENCING RADON ENTRY RATE AND THAT PRESSURE-DRIVEN FLOW WAS MORE IMPORTANT THAN DIFFUSION AS A MECHANISM FOR RADON ENTRY. FIREPLACE OPERATION SUBSTANTIALLY INCREASED THE AIR-EXCHANGE RATE BUT HAD ONLY A SMALL EFFECT ON INDOOR RADON CONCENTRATION, PROVIDING CORROBORATIVE EVIDENCE FOR THE ROLE OF PRESSURE-DRIVEN FLOW. (2 DIAGRAMS, 6 GRAPHS, 30 REFERENCES, 5 TABLES) (ENV)

III. EXPOSURE

B. GEOLOGY

Predictive Model for Indoor Radon Occurrences -- A First Approximation

LeGrand, H. E.

IN: Radon, Radium and Other Radioactivity in Ground Water: Hydrogeologic Impact and Application to Indoor Airborne Contamination. Proceedings of the NWWA Conference, April 7-9, 1987, Somerset, New Jersey. 1987. p 477-487, 1 fig, 7 ref.,

Efforts to develop a model that can allow one to predict the degree of health risks from radon gas emanations in buildings must face intangible factors. Yet, a useful predictive model is needed because: (1) measurements of Rn in millions of buildings are not feasible; (2) variable concentrations of Rn may exist within space and time conditions in a room; and (3) questions of reliability of sampling and analytical procedures arise in many cases. A first approximation toward a predictive model is proposed that applies to the crystalline rock terrane of eastern North America, based on fundamental hydrogeologic factors rather than solely on 'hot-spot' uranium areas. The preliminary model proposed here represents an early approximation of some future improved model that could be more acceptable. This model is based on estimating values (on a 10-point numerical scale) of four factors, as follows: (1) Rock type -- uranium content; (2) Topographic slope and vertical emplacement of building; (3) Hydrogeologic setting and average water-table position; and (4) Water-table behavior and characteristics. The values are compiled and then adjusted more specifically to conditions of indoor construction and ventilation. The final total value is directed to a rating scale that indicates a relative degree of seriousness. Each rated situation is classified as: 'almost certain', 'very likely', 'questionable', 'not likely', or 'very unlikely'. (See also W88-04980) (Lantz-PTT) (WRA)

A COMPARISON OF RADON CONCENTRATIONS IN SOIL GAS WITH INDOOR RADON LEVELS IN THE SALT LAKE VALLEY UTAH USA

BOLLENBACHER M K; NIELSON K K; SMITH W J II; ROGERS V C
ROGERS ASSOCIATES ENG. CORP., P.O. BOX 330, SALT LAKE CITY,
UTAH 84110-0330.

THIRTY-SECOND ANNUAL MEETING OF THE HEALTH PHYSICS SOCIETY,
SALT LAKE CITY, UTAH, USA, JULY 5-9, 1987. HEALTH PHYS 52
(SUPPL. 1). 1987. S40. CODEN: HLTPA

Language: ENGLISH

Document Type: CONFERENCE PAPER
Subfile: BARRM (Biological Abstracts/RRM)

Radon concentrations in homes, and in soils near the homes were measured at 30 locations in the Salt Lake Valley. These measurements indicated that the indoor radon concentrations in the Salt Lake Valley follow a log normal distribution. Indoor radon levels in roughly 47 percent of the homes in the Salt Lake Valley exceeded the EPA's radon concentration guideline of 4 pCi/l. Soil gas radon concentrations around the homes have also been obtained and follow a log normal distribution. They will be compared to indoor radon levels. The influence of near surface geology, soil gas permeability, and major structural characteristics of the homes on indoor radon levels will be discussed. (BIO) (AUTH)

Association of lung cancer mortality with precambrian granite.

Archer VE

Rocky Mountain Center for Occupational and Environmental Health, Department of Family and Community Medicine, University of Utah School of Medicine, Salt Lake City.

Arch Environ Health (UNITED STATES) Mar-Apr 1987, 42 (2) p87-91,

ISSN 0003-9896 Journal Code: 6YO

Languages: ENGLISH

Sixteen counties in New York, Pennsylvania, and New Jersey that are associated with the Reading Prong granite deposits have significantly higher age-adjusted lung cancer rates among whites of both sexes (1950-1979) than do 17 nearby control counties. Elevated radon daughter concentrations have been found in homes near the Reading Prong granites. Fraction of populations living in cities with over 5,000 persons, industrial centers, cities with populations above 20,000, and median incomes did not differ significantly for three county groups (those which include the granite, fringe area, and control areas). Weaknesses were inadequate home measurements of radon and lack of smoking information. Findings are consistent with several other studies relating radon in homes to lung cancer. (MED)

RADON: REPORTS FROM THE STATES: NEW JERSEY: INVOLVING THE COMMERCIAL SECTOR; FLORIDA: WORKING WITH THE PHOSPHATE FACTOR

NICHOLLS GERALD P.; DEIESO DONALD A.; NASH J. D.

NEW JERSEY DEPT ENV PROTECTION,
ENVIRONMENT, MAR 87, V29, N2, P12(9)

JOURNAL ARTICLE ASSESSMENT OF THE INDOOR RADON PROBLEM
BY THE NEW JERSEY DEPT. OF ENV. PROTECTION INDICATED THAT 1.6

MILLION HOMES MIGHT HAVE TO BE INDIVIDUALLY SCREENED TO DETERMINE WHETHER THEY HAD UNACCEPTABLE RADON LEVELS. A FOUR COMPONENT PROGRAM WAS LAUNCHED TO IDENTIFY HOMES AT HIGH RISK, COLLECT EPIDEMIOLOGICAL DATA FROM RESIDENTS, TO CONFIRM RADON LEVELS IN HOMES PREVIOUSLY MONITORED BY COMMERCIAL TESTING CONCERNS, AND TO PROVIDE PUBLIC INFORMATION. REMEDIATION RESEARCH IS UNDERWAY BY THE STATE AGENCY IN COOPERATION WITH EPA. OFFICIALS IN FLORIDA ARE ALSO CONCERNED ABOUT THE RADON ISSUE, AS LARGE AREAS OF THE STATE ARE COMPOSED OF PHOSPHATE ROCK, A MAJOR SOURCE OF RADON PROGENY. NEW STATE REGULATIONS SPECIFY CONSTRUCTION STANDARDS AND PROVIDE FOR TESTING OF RADON IN NEW HOMES AND SCHOOLS BUILT ON RECLAIMED PHOSPHATE MINING LANDS. HOMES IN HIGH RISK AREAS ARE BEING TESTED TO DETERMINE WHERE THE RADON RULE SHOULD BE APPLIED. 2 <M>S, (2 PHOTOS) (ENV)

CORRELATION BETWEEN RADIUM-226 IN SOIL RADON-222 IN SOIL GAS AND RADON-222 INSIDE ADJACENT HOUSES

NASON R; COHEN B L

DEP. PHYS., UNIV. PITTSBURGH, PITTSBURGH, PA 15260.

HEALTH PHYS 52 (1). 1987. 73-78. CODEN: HLTPA

Language: ENGLISH

Subfile: BARRM (Biological Abstracts/RRM)

It is now widely agreed that the principal source of ^{222}Rn in houses is the soil gas in the soil surrounding it and it seems almost obvious that the source of ^{222}Rn in the soil gas is the ^{226}Ra in the soil. One would therefore expect a strong correlation between these quantities in making measurements on a wide variety of houses. It was therefore decided to study the correlations between these three quantities in a number of houses. (BIO) (AUTH)

UNDERSTANDING THE ORIGIN OF RADON INDOORS - BUILDING A PREDICTIVE CAPABILITY (ENGLISH)

SEXTRO RG

UNIV CALIF BERKELEY LAWRENCE BERKELEY LAB,BLDG VENTILAT & INDOOR AIR QUAL PROGRAM/BERKELEY//CA/94720

ATMOSPHERIC ENVIRONMENT, V21, N2, P431-438, 1987

Because a significant number of dwellings are expected to have indoor radon concentrations above guideline levels, a predictive capability is needed that would help identify geographical areas having the potential for high indoor concentrations. This paper reviews the preliminary work that has been done to identify important soil and building characteristics that influence the migration of radon and outlines the areas of further research necessary for development of a predictive method. (SCI) (AUTH)

RADON-222 CONCENTRATIONS IN HOMES BUILT ABOVE GRANITE FORMATIONS AND PHOSPHATE DEPOSITS IN NORTH CAROLINA USA

MABRY A M

DEP. ENVIRON. SCI. ENG., SCH. PUBLIC HEALTH, UNIV. N.C.,
CHAPEL HILL, N.C. 27514.

THIRTY-SECOND ANNUAL MEETING OF THE HEALTH PHYSICS SOCIETY,
SALT LAKE CITY, UTAH, USA, JULY 5-9, 1987. HEALTH PHYS 52
(SUPPL. 1). 1987. S2. CODEN: HLTPA

Language: ENGLISH

Document Type: CONFERENCE PAPER

Subfile: BARRM (Biological Abstracts/RRM)

Thirty homes in three regions of North Carolina were monitored for Rn-222 concentrations using Track Etch ^R time integrating detectors. Each home was monitored for one year in intervals of approximately three to six months. The results of measurements in homes above granite formations indicated that indoor radon concentrations in these areas were somewhat higher than the estimated U.S. average but most were less than the 4 pCi/l action guide recommended by the EPA. (BIO) (HQL)

Radon and Radium Emanations from Fractured Crystalline Rocks - A Conceptual Hydrogeological Model

LeGrand, H. E.

Ground Water GRWAAP, Vol. 25, No. 1, p 59-69,
January-February 1987. 6 fig, 25 ref.,
Journal Announcement: SWRA2006

Subsurface air is a refuge for radon gas escaping from rock and soil surfaces, as well as from subsurface water. The crystalline rocks of eastern United States contain granites and associated rocks that have moderate to low amounts of uranium source material; the amounts are sufficient for radon to emanate significantly from both the soil-saprolite zone and the part of the underlying fractured rock above the water table. The pressure increases in the air systems chiefly as infiltrated water moves downward and as the water table rises. The radon-laden air moves toward two types of low-pressure chambers. One type of chamber is a house on sloping topography niched into the soil-saprolite zone and perhaps into bedrock fractures. The other type is the unwatered fracture zone of a pumping cone of depression where overlying clays are less permeable. These two types of low-pressure chambers have characteristics of vacuum cleaners, sucking in radon-laden air. Conditions leading to high indoor radon concentrations are: (1) granites and associated rocks with normal or above normal amounts of uranium, (2) normal inter connecting fracture pattern, (3) a thin mantle of relatively impermeable clay soil, (4) repeated cycles of recharge and of fluctuating water table in the fracture zone or in the overlying regolith, (5) indentation of buildings into soil and rock materials, and (6) building construction allowing relatively easy inflow of air from the subsoil and rock. (WRA)

Preliminary Assessment of Factors Affecting Radon Levels in Idaho

Ogden, A.E.; Welling, W.B.; Funderburg, R.D.; Boschult, L.C. Tennessee Technological Univ., Cookeville. Water Resources Center.

IN: Radon, Radium and Other Radioactivity in Ground Water: Hydrogeologic Impact and Application to Indoor Airborne Contamination. Proceedings of the NWWA Conference, April 7-9, 1987, Somerset, New Jersey. 1987. p 83-96, 7 fig, 5 tab, 8 ref.

Journal Announcement: SWRA2106

Much of Idaho is underlain by granitic and related rocks associated with the Idaho Batholith. Since granitic-type rocks commonly have higher concentrations of radium which decays to radon, the Idaho Division of Environment obtained a grant from the Idaho Cancer Coordinating Committee to survey radon levels throughout the state. The results of the first phase of this state-wide survey are presented along with an examination of the possible factors affecting these levels in two Idaho counties. The results indicate that earth covered homes have the highest radon levels, but the presence or absence of a basement or crawl space does not appear to significantly affect radon levels. Also, there was no significant difference between homes that are weatherized versus those that are not. The type of heating in the homes and presence or absence of an air cleaning system also seem to have little influence on the radon levels. A more detailed look at radon levels in Ada and Kootenai counties suggests that levels are higher if the home is near a fault and also where the water tables is deeper. The greater the granitic composition of the alluvium and outwash on which homes are built, the greater the possibility of higher radon levels. (See also W88-04980) (Lantz-PTT) (WRA)

Understanding the Origin of Radon Indoors--Building a Predictive Capability

Sextro, R. G.

California Univ., Berkeley. Lawrence Berkeley Lab.

Atmospheric Environment ATENBP, Vol. 21, No. 2, p 431-438, February 1987. 4 fig, 31 ref. EPA/DOE Interagency Agreement DW89930801-01-0 and DOE Contract DE-AC03-76SF00098.

Journal Announcement: SWRA2011

The preliminary work that has been done to identify important soil and building characteristics that influence the migration of radon into buildings are reviewed. Soil is the major source of radon in houses with higher-than-average indoor concentrations. Identifying the estimated 1 to 2 million homes with indoor concentrations exceeding 300 Bq/cu m is a difficult task. Factors that are likely to affect the source strength of

radon from soil include the soil radium concentration, the emanating fraction, and soil type and moisture content. A geographically-based predictive method would, ideally, locate areas with the potential for having high indoor radon levels; such areas would then be investigated in more detail. The efficacy of such an approach would depend upon the availability and quality of data for the characterization of soils in terms of both radon availability and radon transport. Although exploration of existing data bases with wide geographic coverage has begun, further research is needed to investigate the validity of the approach and to define a suitable mathematical relationship among the important parameters. (Author's abstract) (WRA)

SURFICIAL GEOLOGY AND INDOOR RADON - STUDIES IN NEW-YORK STATE (ENGLISH)

KUNZ C; KOTHARI B; LILLEY W

NEW YORK STATE DEPT HLTH, WADSWORTH CTR LABS & RES/ALBANY//NY/12201; NEW YORK STATE DEPT LABOR, RADIOLOG HLTH UNIT/BROOKLYN//NY/11201

HEALTH PHYSICS , V52, S1, PS 70, 1987

Several areas in New York State have been studied to investigate correlations between the surficial soil-bedrock geology and indoor radon. The soils and surficial bedrock were measured for radium concentration, emanating fraction, soil-gas radon concentration and soil permeability for gas flow. In addition, the geology of the areas were characterized regarding soil and rock type, depth of soil to bedrock and water table depth. (SCI) (AUTH)

EXPERIMENTS ON POLLUTANT TRANSPORT FROM SOIL INTO RESIDENTIAL BASEMENTS BY PRESSURE-DRIVEN AIRFLOW

NAZAROFF W W; LEWIS S R; DOYLE S M; MOED B A; NERO A V

ENVIRON. ENG. SCI., CALIF. INST. TECHNOL., PASADENA, CALIF. 91125.

ENVIRON SCI TECHNOL 21 (5). 1987. 459-466. CODEN: ESTHA

Language: ENGLISH

Subfile: BA (Biological Abstracts)

At two residences in Portland, OR [USA], we have investigated (1) the coupling between residential basements and the air in nearby soil and (2) the influence of basement depressurization on the migration of air in soil. With the basements depressurized 25-50 Pa relative to outdoor air, underpressures as great as 20-40% of those in the basement were observed at sampling points in the soil. Sulfur hexafluoride was injected into the soil near the houses and its concentration

monitored in soil air and in the house over time, but with and without basement depressurization. Depressurization was seen to have substantial effect on the migration of the tracer within the soil. For basement depressurization of 25-50 Pa, effective transport velocities through the soil and into the houses were observed to exceed 1 m h⁻¹. Airborne ²²²Rn concentration was monitored in the basement of one house during the 6-day investigation and was seen to increase substantially on each of the seven occasions that the house was depressurized. The techniques employed are applicable to the study of problems of excessive radon entry into buildings and the migration of toxic vapors from waste dumps and landfills. (BIO)

GEOLOGICAL VARIATION OF RADON SOURCES AND INDOOR RADON CONCENTRATIONS ALONG THE SOUTHWESTERN EDGE OF THE CANADIAN SHIELD USA

STECK D J

PHYS. DEP., ST. JOHN'S UNIV., COLLEGEVILLE, MINN. 56321.

THIRTY-SECOND ANNUAL MEETING OF THE HEALTH PHYSICS SOCIETY, SALT LAKE CITY, UTAH, USA, JULY 5-9, 1987. HEALTH PHYS 52 (SUPPL. 1). 1987. S40. CODEN: HLTPA

Language: ENGLISH

Document Type: CONFERENCE PAPER

Subfile: BARRM (Biological Abstracts/RRM)

This work compares radon source strengths and indoor radon concentrations with surface geological features in a large, glacially-sculptured region lying along the southwestern edge of the Canadian shield. Over 200 houses, located in Minnesota and the northern parts of Wisconsin and Michigan, are being studied. The complete data set and correlations between indoor radon concentrations, source strengths, local geological features, and housing characteristics will be presented. (BIO)(AUTH)

Correlation between super(236)Ra in soil, super(222)Rn in soil gas, and super(222)Rn inside adjacent houses

Nason, R.; Cohen, B.L.

Dep. Phys., Univ. Pittsburgh, Pittsburgh, PA 15260, USA

HEALTH PHYS VOL. 52, NO. 1, pp. 73-77, Publ.Yr: 1987

Languages: ENGLISH

Journal Announcement: V18N6

Three surveys were made with the cooperation of physics department faculty members in various universities throughout the United States. These were: (A) Twenty-four houses in 16 states, with the soil gas measured during the winter of 1983-84. (B) Seventeen houses in 12 states (including six states not represented in A), with the soil gas measured during summer-fall of 1984. (C) Seven houses in the Pittsburgh area (no two close together), which were known to have high indoor super(222)Rn

levels from surveys done previously (Co85). In addition, measurements only on soil gas and super(226)Ra concentrations were made at four other locations in the area (they averaged 10% higher super(226)Ra and 80% higher super(222)Rn in soil gas than the Pittsburgh houses). (POL)

Indoor radon and its sources in the ground

Tanner, A. B.

U. S. Geol. Surv., USA

Open-File Report (United States Geological Survey. 1978)
1986 5p.

Report No.: OF 86-0222

Country of Publ.: United States

ISSN: 0196-1497

CODEN: XGROAG 6 REFS.

Subfile: B

Doc Type: SERIAL; REPORT Bibliographic Level: MONOGRAPHIC

Languages: English

Availability: U. S. Geol. Surv., Denver, CO, United States

This Open-File Report contains a fact sheet about radon.

(GEO) (HQL)

Geological factors that influence radon availability

Tanner, A. B.

U. S. Geol. Surv., Reston, VA, USA

Indoor radon

Anonymous

Air Pollution Control Association specialty conference,
Philadelphia, PA, United States, Feb. 1986

Publ: Air Pollut. Control Assoc.

1986 1-12p.

Country of Publ.: United States

15 REFS.

Subfile: B

Doc Type: BOOK; CONFERENCE PUBLICATION Bibliographic

Level: ANALYTIC

Languages: English

illus.

This paper discusses principles relevant to the production and movement of radon in the ground; methods of identifying areas likely to have indoor radon problems; geological correlations with indoor radon surveys that have been noted to date; and speculation on the radon potential of certain rock and soil types and land forms. (GEO) (HQL)

Indoor radon is a geologic hazard
Lilley, W. D.
U. S. Nucl. Reg. Comm., Washington, DC, USA
Geotimes 31: 4, 1986 5p.
Country of Publ.: United States
ISSN: 0016-8556
CODEN: GEOTAJ
Subfile: B
Doc Type: SERIAL Bibliographic Level: ANALYTIC
Languages: English
illus., 1 table

Naturally occurring radioactive radon gas, which exceeded safe mine standards by 40 times, was found recently in a house in Pennsylvania. The high levels of indoor radon such as those found in Pennsylvania recently were not expected. (GEO) (HQL)

III. EXPOSURE

C. SOURCE

INDOOR CONCENTRATIONS OF RADON-220 AND ITS DECAY PRODUCTS
KATASE A; MATSUMOTO Y; SAKAE T; ISHIBASHI K
DEP. NUCLEAR ENG., KYUSHU UNIV., FUKUOKA, 812 JPN.
HEALTH PHYS 54 (3). 1988. 283-286. CODEN: HLTPA
Language: ENGLISH
Subfile: BA (Biological Abstracts)

The distribution of ^{220}Rn atoms in a room was derived from the diffusion equation. The activity concentrations of ^{212}Pb and ^{212}Bi were obtained in relation to ^{220}Rn exhalation rate from a concrete wall. Near the surface of the concrete wall, the radiation exposure due to inhalation of ^{220}Rn decay products may be significant in some cases. (BIO)

RADIOLOGICAL ASSESSMENT OF THE UTILIZATION OF FLY ASH IN
CONCRETE FOR BUILDING CONSTRUCTION AND THE PARAMETERS
AFFECTING RADON-222 EMANATION FROM FLY ASH CONCRETE
HWANG J; ZIEMER P L; SCHOLER C F
SCH. HEALTH SCI. SCH. CIVIL ENG., PURDUE UNIV., WEST
LAFAYETTE, IN 47907, USA.
THIRTY-FIRST ANNUAL MEETING OF THE HEALTH PHYSICS SOCIETY,
PITTSBURGH, PA., USA, JUNE 29-JULY 3, 1986. HEALTH PHYS 50
(SUPPL. 1). 1986.
S11. CODEN: HLTPA
Language: ENGLISH
Document Type: CONFERENCE PAPER
Subfile: BARRM (Biological Abstracts/RRM)

The Rn^{222} area exhalation rates and the maximum area exhalation from concrete containing fly ash were measured. Fly ash originating from two different power plants was used to replace 30% of the cement in fabricating concrete test samples. For another set of test samples, three concentrations of Ra^{226} water solution were used with fly ash in fabricating concrete. A newly designed emanation chamber, which consists of two consecutive chambers with the cylindrical concrete specimen located between them, was used in this study. Air samples were assayed at various elapsed times by using the scintillation cell technique. (BIO) (AUTH)

NATURAL RADIOACTIVITY OF BUILDING MATERIALS

TAMEZ E; OLGUIN M T; SEGOVIA N; BULBULIAN S; ABASCAL F
INST. NAC. INVESTIGACIONES NUCLEARES, AGRICULTURA N. 21,
COL. ESCANDON, C.P. 11800, MEXICO D.F., MEX.

J RADIOANAL NUCL CHEM 103 (4). 1986. 231-240. CODEN:
JRNCD

Language: ENGLISH

Subfile: BA (Biological Abstracts)

Experiments were designed to measure trace uranium concentration and the rate of radon exhalation from masonry structural materials, both bare and surface finished and coated. LR115 cellulose nitrate track detectors were used to record the alpha emission from structural material surface. Fission track, neutron activation and fluorometric analysis methods were used to determine the uranium content. Most types of paints studied will reduce alpha contribution and radon emanation from building materials. (BIO)

Radionuclide content of and ^{222}Rn emanation from building materials made from phosphate industry waste products.

Paredes CH; Kessler WV; Landolt RR; Ziemer PL; Paustenbach DJ

School of Health Sciences, Purdue University, West Lafayette, IN 47907.

Health Phys (UNITED STATES) Jul 1987, 53 (1) p23-9, ISSN 0017-9078

Journal Code: G2H

Languages: ENGLISH

The radionuclide content and ^{222}Rn emanation coefficients of selected construction materials were determined. The materials were analyzed for ^{226}Ra , ^{228}Ra and ^{40}K by gamma-ray spectrometry. Mineral wool insulation, which is made from Tennessee phosphate slag, and commonly used insulation, which is made from blast furnace slag, had similar concentrations of these radionuclides. Concrete blocks made with phosphate slag had enhanced ^{226}Ra and ^{228}Ra contents when compared to ordinary concrete block. The mineral wool insulation materials which were examined had emanation coefficients that were a few (2-6) times 10^{-3} . All other materials had emanation coefficients that ranged from 6×10^{-4} to 4×10^{-2} . (MED)

Discussing possible standards of natural radioactivity in building materials.

Keller G; Folkerts KH; Muth H

Universitat des Saarlandes, Homburg/Saar, Federal Republic of Germany.

Radiat Environ Biophys (GERMANY, WEST) 1987, 26 (2) p143-50, ISSN

0301-634X Journal Code: QML
Languages: ENGLISH

This paper discusses different possibilities of deriving reference values for the natural radioactivity concentrations in building materials to estimate possible additional radiation exposure for the population. Based on comprehensive experimental and theoretical investigations the consequences of the resulting hypothetical reference activity concentrations in building materials, applying different dose limits, were examined. The calculation of the activity concentration standards was performed for standard conditions obtained by earlier studies on exhalation of Radon-222 and Radon-220 from building materials. (MED)

MEASUREMENT OF THE FREE EXHALATION RATE OF RADON-222 FROM SOLID SAMPLES VIA AN ACCUMULATION METHOD

QUINDOS L S; SOTO J; FERNANDEZ P L

DEP. MED. PHYS., FAC. MED., SANTANDER, SPAIN.

THIRTY-SECOND ANNUAL MEETING OF THE HEALTH PHYSICS SOCIETY, SALT LAKE CITY, UTAH, USA, JULY 5-9, 1987. HEALTH PHYS 52 (SUPPL. 1). 1987.

S41. CODEN: HLTPA

Language: ENGLISH

Document Type: CONFERENCE PAPER

Subfile: BARRM (Biological Abstracts/RRM)

Experimental values of the free exhalation rate for samples from different places of Spain including typical Spanish building materials were measured. Also, equations showing the increase of radon concentration in time inside the container have been tested for several sizes of samples in order to explain the experimental results obtained. (BIO) (AUTH)

Characterization of Indoor Sources of Air Contaminants: Report on a Technical Conference

Sponsored by Environmental Protection Agency, Research Triangle Park, NC.

Air and Energy Engineering Research Lab.

NTIS Prices: PC A04/MF A01

Leaderer, B. P.

John B. Pierce Foundation Lab., New Haven, CT.

Corp. Source Codes: 064032000

Sponsor: Environmental Protection Agency, Research Triangle Park, NC. Air and Energy Engineering Research Lab.

Report No.: EPA/600/9-87/014

Jul 87 67p

Languages: English Document Type: Conference proceeding

NTIS Prices: PC A04/MF A01 Journal Announcement: GRAI8721

Country of Publication: United States

Contract No.: EPA-R-812489

The report describes a technical conference, 'Characterization of Contaminant Emissions from Indoor Sources,' held in Chapel Hill, NC, May 13-15, 1985, to assess the status of methodological issues in the laboratory and field evaluation of air contaminants from indoor sources. A total of 29 invited papers were presented in five technical sessions during the 3-day conference. A sixth session was a panel discussion summarizing the conference findings, led by the conference chairman and the five session chairmen. The papers presented at the conference and the session summaries, written by the session chairmen, have been published in Atmospheric Environment, Vol. 21, No. 2, February 1987. The report contains a description of the purpose of the conference, a conference program, abstracts of the papers presented, a list of attendees, and a conference review. (NTIS)

APPORTIONMENT OF SOURCES OF INDOOR RADON

HARLEY N H; TERILLI T B

N.Y. UNIV. MED. CENT., DEP. ENVIRON. MED., 550 FIRST AVE., NEW YORK, N.Y. 10016, USA.

THIRTY-FIRST ANNUAL MEETING OF THE HEALTH PHYSICS SOCIETY, PITTSBURGH, PA., USA, JUNE 29-JULY 3, 1986. HEALTH PHYS 50 (SUPPL. 1). 1986.

S60 CODEN: HLTPA

Language: ENGLISH

Document Type: CONFERENCE PAPER

Subfile: BARRM (Biological Abstracts/RRM)

Various factors other than the radium content of underlying soil influence the indoor concentration of radon in dwellings. These include the properties of the soil and the dwelling. Hourly data have been obtained over three years in single family dwellings and it is possible by analysis of radon excursions from the baseline data to apportion the source of radon to the various pressure driven and diffusional processes. (BIO) (AUTH)

EMANATION OF RADON BY BUILDING-MATERIALS (ENGLISH)

MEDORA R; TREFLER M

UNIV MIAMI/MIAMI//FL/33101

MEDICAL PHYSICS , V13, N4, P608-608, 1986

"Of all radioactive isotopes released by the nuclear industry, the one expected to cause the most harm to human health is not 1-131.... Far more important than all of these combined is radon-222." In many parts of the world, levels of airborne radon enhanced by the advent of energy conservation methods have been receiving considerable attention. In Florida, the prospective use of waste byproducts of the phosphate industry for building material has caused similar concern due to this material's elevated radium content. This paper investigates the effects of environmental parameters on this emanation. (SCI) (AUTH)

DISCUSSING POSSIBLE STANDARDS OF NATURAL RADIOACTIVITY IN BUILDING MATERIALS

KELLER G; FOLKERTS K H; MUTH H

FACHRICHTUNG 3.6 BIOPHYSIK UND PHYSIKALISCHE GRUNDLAGEN DER MEDIZIN, UNIVERSITAET DES SAARLANDES, D-6650 HOMBURG/SAAR, W. GERMANY.

RADIAT ENVIRON BIOPHYS 26 (2). 1987. 143-150. CODEN: REBPA

Language: ENGLISH

Subfile: BA (Biological Abstracts)

This paper discusses different possibilities of deriving reference values for the natural radioactivity concentrations in building materials to estimate possible additional radiation exposure for the population. Based on comprehensive experimental and theoretical investigations the consequences of the resulting hypothetical reference activity concentrations in building materials, applying different dose limits, were examined. The calculations of the activity concentration standards was performed for standard conditions obtained by earlier studies on exhalation of Radon-22 and Radon-220 from building materials. (BIO)

EXTERNAL GAMMA-RAY DOSE RATES FROM RADON-222 PROGENY INDOORS

MILLER K M; GEORGE A C

ENVIRONMENTAL MEASUREMENTS LAB., U.S. DEP. ENERGY, NEW YORK, N.Y. 10014.

HEALTH PHYS 54 (2). 1988. 203-206. CODEN: HLTPA

Language: ENGLISH

Subfile: BARRM (Biological Abstracts/RRM)

In terms of radiation exposure to humans, the assumed critical pathway for ²²²Rn in the indoor environment is internal, resulting from the dose delivered to the lung from inhaled alpha-emitting ²²²Rn progeny. Basic calculations and measurements are addressed. The results are presented here in a form that allows the rough estimation of the dose rate in air per unit concentration of ²²²Rn progeny for typical houses. Effective dose equivalents for the internal versus the external pathways are compared. (BIO) (HQL)

Radon Daughters and Work at Display Devices. Results from a Prestudy In Swedish.

U.S. Sales Only.

NTIS Prices: PC A02/MF A01

Falk, R. ; Nyblom, L.

Statens Straalskyddsinstitut, Stockholm (Sweden).

Corp. Source Codes: 100859000; 9860158

Report No.: SSI-86-02

4 Feb 86 15p

Languages: Swedish

NTIS Prices: PC A02/MF A01

Journal Announcement:

GRAI8707; NSA1100

Country of Publication: Sweden

It has been shown that ions and electrically charged particles in the air can be transported in the electrostatic field between a face and a display device to either the face or the screen. Radon daughters can occur as ions, or sitting on charged particles. This prestudy shows that radon daughters were manifold concentrated on the face of a doll placed in front of a display device, or in a electrostatic field of the kind typical for displaying devices. The radiation dose, in the skin from the radon daughters in an ordinary office environment plus the addition caused by work at a display device, is not strong enough to cause skin damages alone. 7 refs. (ERA citation 11:054853) (NTIS)

III. EXPOSURE

D. PHYSICAL PROPERTY

Surface radioactivity resulting from the deposition of
super(222)Rn daughter products

Lively, R.S.; Ney, E.P.

Minnesota Geol. Surv., 2642 University Ave., St. Paul, MN
55114, USA

HEALTH PHYS VOL. 52, NO. 4, pp. 411-415, Publ.Yr: 1987

SUMMARY LANGUAGE - ENGLISH

Languages: ENGLISH

Journal Announcement: V18N5

Studies of indoor radiation environments typically involve measurements of super(222)Rn, airborne super(222)Rn decay products, and the degree of radioactive equilibrium. This paper describes the relationship between the super(222)Rn in air, and the level of surface radioactivity that results from the build-up and decay of the daughter isotope, super(210)Pb. Samples of super(222)Rn were collected from Mystery Cave, which is located in southeastern Minnesota and from the basement of a house in Minneapolis, MN. Lead-210 was measured on surfaces within the cave, on a rock removed from the cave, and on basement window. Surface alpha activities were measured on the rock sample and on the window. Radon-222 concentrations in the cave air ranged from 3 to 13 kBq m super(-3). In the basement, super(222)Rn levels were between 0.2 and 0.4 kBq m super(-3). (POL)

EFFECT OF RADON ON SOME ELECTRICAL PROPERTIES OF INDOOR
AIR (RADON AND ITS DECAY PRODUCTS)

WILKENING MARVIN

NEW MEXICO INST OF MINING & TECHNOLOGY,

ACS SYM SERIES 331, 1987, P252(12)

ASSN REPORT RADON ISOTOPES ARE IMPORTANT TO THE STUDY
OF THE INDOOR ENVIRONMENT FOR THEIR EFFECTS ON THE ELECTRICAL
NATURE OF INDOOR AIR AS WELL AS FOR THEIR CONTRIBUTION TO THE
INTERNAL DOSE. IONS OF INTEREST ARE THOSE FORMED AFTER THE DECAY
OF RADON OR A DAUGHTER ATOM. THESE HAVE A MASS AND ELECTRICAL
MOBILITY COMPARABLE TO ORDINARY ATMOSPHERIC SMALL IONS. AN
IONIZATION RATE OF 25 MILLION ION PAIRS/CU M/SECOND CAN BE
EXPECTED FOR TYPICAL INDOOR RADON LEVELS. THE RESULTING POSITIVE
IONS IN INDOOR AIR OUTNUMBER THE RADON DAUGHTER POSITIVE IONS BY
A FACTOR OF 1 MILLION. MEASUREMENTS IN A ROOM WHERE THE RADON
CONCENTRATION AVERAGED 23 BQ/CU M YIELDED A POTENTIAL ALPHA
ENERGY CONCENTRATION (PAEC) OF 0.003 WORKING LEVEL UNITS. THE

PAEC DUE TO THE POSITIVELY CHARGED DAUGHTER IONS WAS ONLY ABOUT 3% OF THAT DUE TO THE ATTACHED DAUGHTERS. (1 GRAPH, 34 REFERENCES, 1 TABLE) (ENV)

Physical Processes Affecting Levels of Radon, Thoron, and Their Decay Products in an Indoor Environment. Final Technical Report

NTIS Prices: PC A02/MF A01

Wilkening, M.; Schery, S.D.

New Mexico Inst. of Mining and Technology, Socorro. Dept. of Physics.

Corp. Source Codes: 012640011; 9513999

Sponsor: Department of Energy, Washington, DC.

Report No.: DOE/ER-60216

Feb 86 8p

Languages: English

NTIS Prices: PC A02/MF A01

Journal Announcement:

GRAI8614; NSA1100

Country of Publication: United States

Contract No.: AS04-84ER60216

The objective was to understand the physical processes affecting radon, thoron, and their daughter products in the indoor environment. Specific areas of research were: (1) the importance of thoron and thoron daughters as contributors to indoor radiation dose; (2) transport modeling for radon and thoron; (3) radon and thoron daughter ion-aerosol interactions; (4) indoor-outdoor radon levels and their relation to air exchange processes; and (5) publication and synthesis of research from earlier investigations. (ERA citation 11:020921) (NTIS)

Free fractions, attachment rates, and plate-out rates of radon daughters in houses

Porstendoerfer, J.; Reineking, A.; Becker, K.H.; Hopke, P.K. (ed.)

Isotopenlab. Biol. und. Med., Georg-August-Univ., Burckhardtweg 2, D-3400 Goettingen, FRG

191. Meeting of the American Chemical Society New York, NY (USA) 13-18 Apr 1986

RADON AND ITS DECAY PRODUCTS. OCCURRENCE, PROPERTIES AND HEALTH EFFECTS

pp. 285-300, Publ.Yr: 1987

AMERICAN CHEMICAL SOCIETY, WASHINGTON, DC (USA)

SUMMARY LANGUAGE - ENGLISH

Languages: ENGLISH

The paper summarizes the experimental data on the equilibrium factor, F , the free fraction, $f_{sub(p)}$, the attachment rate to the room air aerosol, $X_{@u-}$, the recoil factor, $r_{sub(1)}$, and the plateout rates of the free, $q_{super(f)}$,

and the attached, radon daughters, determined in eight rooms of different houses. In each room several measurements were carried out at different times, with different aerosol sources (cigarette smoke, stove heating etc.) and under low ($v < 0.3 \text{ h}^{-1}$) and moderate ($0.3 < v < 1 \text{ h}^{-1}$) ventilations. (POL)

Comparison of Working Level Ratios in Houses Occupied by Smokers and Non-Smokers

NTIS Prices: PC A03/MF A01

Lyon, R.J. ; Au, F.; Hans, J.M.

Office of Radiation Programs-Las Vegas Facility, NV.

Corp. Source Codes: 073120000

Report No.: EPA/520/6-86/006

Apr 86 27p

Languages: English

NTIS Prices: PC A03/MF A01 Journal Announcement: GRAI8615

Country of Publication: United States

The equilibrium ratios of measured radon concentrations and working levels in sixty-eight homes in Butte, Montana, were cataloged according to smokers and non-smokers in each home. The ratios were statistically evaluated to determine if there were differences in the average of the ratios depending on the number of smokers in the homes. The equilibrium ratio was higher in homes with smokers compared to homes with no smokers. This ratio was independent of the number of people smoking within the home. (NTIS)

THE BEHAVIOR OF RADON DAUGHTERS IN THE DOMESTIC ENVIRONMENT: EFFECT ON THE EFFECTIVE DOSE EQUIVALENT (RADON AND ITS DECAY PRODUCTS),

VANMARCKE H.; JANSSENS A.; RAES F.; POFFIJN A.; BERKVEN P.; VAN DINGENEN R.

STATE UNIV OF GENT, BELGIUM,

ACS SYM SERIES 331, 1987, P301(23)

ASSN REPORT SIMULTANEOUS MEASUREMENTS WERE MADE IN FOUR DWELLING ROOMS OF THE RADON DAUGHTER CONCENTRATIONS, VENTILATION RATES, AND SIZE DISTRIBUTION OF THE INACTIVE AEROSOL. MEASURED RADON DAUGHTER LEVELS WERE FITTED BY A ROOM MODEL TO OPTIMIZE UNATTACHED DAUGHTER DEPOSITION RATES. THE MEAN VALUE WAS 18/HOUR IN THE TWO BEDROOMS AND LIVING ROOM AND 8/HOUR IN THE CELLAR. THE UNATTACHED FRACTION WAS CALCULATED TO 0.05-0.15 WITHOUT AEROSOL SOURCES IN THE ROOM AND 0.05 IN THE PRESENCE OF AEROSOL SOURCES. THE EFFECTIVE DOSE EQUIVALENT WAS MORE RELATED TO THE RADON CONCENTRATION THAN TO THE EQUILIBRIUM EQUIVALENT RADON CONCENTRATION. (11 GRAPHS, 34 REFERENCES, 5 TABLES) (ENV)

Atmospheric Chemistry of Po-218: Technical Report for the Period March 1, 1987 to August 31, 1987

Portions of this document are illegible in microfiche products.

NTIS Prices: PC A03/MF A01

Hopke, P. K.

Illinois Univ. at Urbana-Champaign. Inst. for Environmental Studies.

Corp. Source Codes: 034597086; 9507244

Sponsor: Department of Energy, Washington, DC.

Report No.: DOE/ER/60546-2

1987 27p

Languages: English

NTIS Prices: PC A03/MF A01

Journal Announcement:

GRAI8804; NSA1200

Country of Publication: United States

Contract No.: FG02-87ER60546

The chemical and physical properties of sup 218 Po immediately following its formation from sup 222 Rn decay are important in determining its behavior in indoor atmospheres and plays a major part in determining its potential health effects. In 88% of the decays, a singly charged, positive ion of sup 218 Po is obtained at the end of its recoil path. The modes of neutralization, small ion recombination, electron transfer, and electron scavenging are reviewed. In typical indoor air, the ion will be rapidly neutralized by transfer of electrons from lower ionization potential gases such as NO sub 2. The neutral molecule can then become incorporated in ultrafine particles formed by the radiolytic processes in the recoil path. The evidence for these particles is presented. (ERA citation 12:048380) (NTIS)

SOME MEASUREMENTS OF THE EQUILIBRIUM FACTOR FOR RADON-222 DAUGHTERS IN HOUSES

TOOHEY R E; ESSLING M A; RUNDO J; HENGDE W

BIOLOGICAL MED. RES. DIV., ARGONNE NATL. LAB., ARGONNE, ILL. 60439.

HEALTH PHYS 53 (1). 1987. 89-92. CODEN: HLTPA

Language: ENGLISH

Subfile: BARRM (Biological Abstracts/RRM)

Because the radiation dose to the lung from environmental 222Rn is due almost entirely to the inhalation of the short-lived daughter products, measurements of 222Rn levels alone are not sufficient to determine the dose. In order to predict the equilibrium factor, or the value of F, one must measure 222Rn concentrations and working levels in houses under a variety of conditions, while simultaneously monitoring parameters, such as aerosol concentration and ventilation rate, which may be expected to affect the value of F. (BIO) (HQL)

A model for size distributions of radon decay products in realistic environments

Raes, F.; Janssens, A.; Vanmarcke, H.; Hopke, P.K. (ed.)
Nucl. Phys. Lab., State Univ. Gent, Proeftunist. 86, B-9000
Gent, Belgium

191. Meeting of the American Chemical Society New
York, NY (USA) 13-18 Apr 1986

**RADON AND ITS DECAY PRODUCTS. OCCURRENCE, PROPERTIES AND
HEALTH EFFECTS** pp. 324-339, Publ.Yr: 1987

AMERICAN CHEMICAL SOCIETY, WASHINGTON, DC (USA)

SUMMARY LANGUAGE - ENGLISH; ACS. 331.

Languages: ENGLISH

A model has been developed to calculate the size distribution of the short lived decay products of radon in the indoor environment. In addition to the classical processes like attachment, plate out and ventilation, clustering of condensable species around the radioactive ions, and the neutralization of these ions by recombination and charge transfer are also taken into account. Some examples are presented showing that the latter processes may affect considerably the appearance and amount of the so called unattached fraction, as well as the equilibrium factor. (POL)

THE EFFECTS OF MOISTURE ON OTHER AIR POLLUTANTS

KNIGHTS RICHARD

BLUE SKY TESTING LAB, WA,

WASHINGTON ENERGY/OREGON STATE UNIV INDOOR AIR CONF,
BELLEVUE, WA, NOV 15-16, 84, P71(5)

CONF PAPER THE EFFECTS OF HUMIDITY ON INDOOR AIR
POLLUTANTS ARE EXAMINED. THE BASIC EFFECT OF WATER IN
UREA-FORMALDEHYDE IS THAT IT BREAKS THE BOND BETWEEN THE UREA
AND THE FORMALDEHYDE AND GIVES OFF FORMALDEHYDE GAS. AMBIENT
WATER MOLECULES CLUSTER AROUND RADON PARTICLES; HUMAN LUNGS CAN
THEN TRAP MORE OF THESE LARGER, HEAVIER MASS PARTICLES. THE
INTERACTIONS OF HUMIDITY AND AEROSOL PARTICLES, MINERALS FROM
CONCRETE, OZONE, AND MICROBES ARE ALSO EXPLAINED. (ENV)

DAILY EVOLUTION OF THE INDOOR AEROSOL SIZE DISTRIBUTION,

QUINDOS L.S.; WILKENING M.; SOTO J.; FERNANDEZ P.L.

LOVELACE INHALATION TOXICOLOGY RESEARCH INST, NM,

AMER ASSN AEROSOL RESEARCH/ET AL 2ND INTL AEROSOL CONF,
W BERLIN, SEP 22-26, 86, P33(4)

CONF PAPER THE EVOLUTION OF A RADON PARTICLE WAS
MEASURED HOURLY IN LABORATORY CONDITIONS OVER A ONE-WEEK PERIOD.
A TYPICAL EVOLUTION IS SEEN WITH MAXIMUM VALUES IN THE MORNING
AND A DAILY AVERAGE OF 0.9 PCI/L. AN INVERSE RELATIONSHIP

BETWEEN THE NUMBER OF PARTICLES AND THE MEAN DIAMETER WAS DETECTED DURING THE DAY FOR NATURAL VENTILATION WITH A SMALL INCREASE OF THE NUMBER CONCENTRATION DURING MORNING HOURS. WHEN SMOKE WAS INTRODUCED INDOORS, BOTH THE PARTICLE NUMBER AND THE MEAN DIAMETER INCREASED RAPIDLY. (4 GRAPHS, 3 REFERENCES)
(ENV)

Aerosol Formation Caused by Electrostatic Precipitator

Keskinen, J., K. Janka, M. Lehtimäki, G. Graeffe, and V. Kulmala

Journal of Aerosol Science, Vol. 17, No. 3, pages 647-649, 5 references

June 1986 CODEN: JALSB7

The factors influencing the formation of aerosol particles by an electrostatic precipitator were studied in order to investigate the effect of the ozone produced on radon decay products. An electrical aerosol analyzer and a modified electrical aerosol detector were used to monitor aerosol particles in a test chamber in which an indoor environment could be simulated. Measurements were made first in particle free chamber air and then after several hours of being connected to the electrostatic precipitator. The corona current was found to have an approximately linear effect on the ozone production. The air flow rate used was much higher than would be found in home or office use of the precipitator and this limited the growth of particles. Disconnecting the precipitator resulted in an increase in the relative number of larger particles, and this growth of particles was related to the relative humidity within the test chamber. The insertion of a charcoal filter into the precipitator behind the collecting plates resulted in a decrease in the production of condensation nuclei. The authors conclude that use of an electrostatic precipitator can result in condensation nuclei formation, which may in some cases influence behavior of radon decay products; the use of a charcoal filter and correct adjustment of corona current can reduce this condensation nuclei formation. (OSH)

A MODEL FOR SIZE DISTRIBUTIONS OF RADON DECAY PRODUCTS IN REALISTIC ENVIRONMENTS (RADON AND ITS DECAY PRODUCTS)

RAES F.; JANSSENS A.; VANMARCKE H.

STATE UNIV OF GENT, BELGIUM,

ACS SYM SERIES 331, 1987, P324(16)

ASSN REPORT THE SIZE DISTRIBUTIONS OF THE SHORT-LIVED DECAY PRODUCTS OF RADON IN THE INDOOR ENVIRONMENT ARE COMPUTED WITH A NEWLY DEVELOPED MODEL. ALONG WITH THE CLASSICAL PROCESSES OF ATTACHMENT, PLATE-OUT, AND VENTILATION, CLUSTERING OF CONDENSABLE SPECIES AROUND THE RADIOACTIVE IONS, AND THE NEUTRALIZATION OF THESE IONS BY RECOMBINATION AND CHARGE TRANSFER

ARE ALSO CONSIDERED. EXAMPLES DEMONSTRATE THAT THESE PROCESSES MAY CONSIDERABLY AFFECT THE APPEARANCE AND AMOUNT OF THE UNATTACHED FRACTION, AS WELL AS THE EQUILIBRIUM FACTOR. (5 GRAPHS, 12 REFERENCES, 4 TABLES) (ENV)

III. EXPOSURE

E. RADON IN WATER

RADIUM AND RADON IN WATER SUPPLIES FROM THE TEXAS GULF COASTAL AQUIFER USA

CECH I; LEMMA M; KREITLER C W; PRICHARD H M

THE UNIV. TEX. HEALTH SCI. CENT. AT HOUSTON, SCH. PUBLIC HEALTH, P.O. BOX 20186, HOUSTON, TEX. 77225, USA.

WATER RES 22 (1). 1988. 109-122. CODEN: WATRA

Language: ENGLISH

Subfile: BA (Biological Abstracts)

A sampling of the domestic water for two isotopes of the uranium (U)-238 series, radium (Ra)-226 and radon (Rn)-222, was conducted in parts of the Texas Gulf Coast (in and around Greater Houston and Harris County) to better understand the distribution patterns of these radioisotopes in residential and commercial water supplies. Samples were obtained from consumer's taps, as well as at well heads to evaluate variation due to location and depth of water sources. Analyses were conducted at the University of Texas, School of Public Health (UTSPH) in Houston. Computer mapping and statistical analyses were used to depict patterns of Ra and Rn distribution. The concentrations varied depending on water source. No measurable Ra or Rn were found in surface water supplies, whereas up to 23 pCi l-1 of Ra and 3300 pCi l-1 of Rn were observed in some of the wells in northwest and southwest Harris County. The Rn concentration were observed to increase with depth, but for Ra peak concentrations were found between 180 and 320 m below the surface (at depths roughly corresponding to the top of the Evangeline aquifer). High concentrations of Ra and Rn were associated with wells developed on the flanks of piercement-type salt domes, along faults, and near streams. This study documents high Ra in Tertiary clastic coastal aquifers and suggests that it may be external sources, e.g. salt domes, uranium, or leaky faults, and not the bulk mineralogy of the aquifer which cause elevated concentrations. This is an important consideration when decisions are made about sites for drilling water wells. (BIO)

HUMAN EXPOSURE TO VOLATILE ORGANIC COMPOUNDS IN HOUSEHOLD TAP WATER: THE INDOOR INHALATION PATHWAY

MCKONE THOMAS E.

LLNL,

ENV SCIENCE & TECHNOLOGY, DEC 87, V21, N12, P1194(8)

JOURNAL ARTICLE HUMAN EXPOSURE TO VOLATILE ORGANIC COMPOUNDS CAN RESULT FROM MASS TRANSFER FROM TAP WATER TO INDOOR AIR. A THREE-COMPARTMENT MODEL IS USED TO SIMULATE THE 24-HOUR CONCENTRATION PROFILE WITHIN THE SHOWER, BATHROOM, AND REMAINING HOUSEHOLD VOLUMES OF A RESIDENCE. MASS TRANSFERS FROM WATER TO AIR ARE DERIVED FROM MEASURED DATA FOR RADON AND ADJUSTED TO ACCOUNT FOR THE DIFFERENCE IN MASS-TRANSFER PROPERTIES FOR VOLATILE ORGANIC SUBSTANCES. A PRELIMINARY DATABASE FOR HOUSEHOLD PARAMETERS IS USED TO COMPUTE A RANGE OF CONCENTRATIONS AND HUMAN EXPOSURES IN U.S. HOMES. THE MODEL ESTIMATES EXPOSURE FACTORS FOR CHLOROFORM, ETHYLENE DIBROMIDE, DIBROMOCHLOROPROPANE, METHYLCHLOROFORM, PERCHLOROETHYLENE, TRICHLOROETHYLENE, AND CARBON TETRACHLORIDE. PATHWAY DOSE FACTORS OF 0.008-0.04 MG/KG/DAY PER MG/L FOR CHLOROFORM ARE DETERMINED. (1 DIAGRAM, 2 GRAPHS, 21 REFERENCES, 8 TABLES) (ENV)

Extreme Levels of 222-Rn and U in a Private Water Supply

Lowry, J. D.; Hoxie, D. C.; Moreau, E.

Maine Univ., Orono. Dept. of Civil Engineering.

IN: Radon, Radium and Other Radioactivity in Ground Water: Hydrogeologic Impact and Application to Indoor Airborne Contamination. Proceedings of the NWWA Conference, April 7-9, 1987, Somerset, New Jersey. 1987.

p 363-375, 7 fig, 1 tab, 24 ref. EPA Grant No. R8108290.,

Journal Announcement: SWRA2106

There are legitimate health concerns associated with internal organ cancers for waterborne 222-Rn and with U toxicity at the extreme levels existing in water supplies. In addition, the elevated indoor air 222-Rn levels that result from waterborne 222-Rn via water use are a significant health concern in terms of lung cancer. Information is presented that updates previous studies about a private water supply in Leeds, Maine, particularly the ramifications on treatment alternatives associated with the presence of both 222-Rn and U in a water supply. It is demonstrated that it is possible to effectively reduce elevated 222-Rn levels in indoor air through the removal of 222-Rn from the water supply. In situations where there are other significant contributors of 222-Rn, water treatment will only reduce the airborne 222-Rn in proportion to its contribution to the water supply. Based upon the results of this study, the following conclusions are made: (1) A water supply, with an extremely high 222-Rn level averaging 41,590 bq/l (1,124,000 pCi/l) was found to be contributing nearly 100% of the elevated 222-Rn measured in the indoor air; (2) A properly designed water treatment system is capable of bringing airborne 222-Rn levels down to normal background levels; (3) The granulated activated carbon (GAC) adsorption/decay steady state 222-Rn removal efficiency has ranged between 99.99% and 97.5%; (4) GAC has a significant capacity to adsorb U and removals in this application were nearly 100% for 100 to 200 days (1200 to 2400 bed volumes);

(5) A saturation of the GAC with adsorbed U appeared to slightly reduce the efficiency of steady state 222-Rn removal, but does not appear to present a significant problem; and (6) A strong positive correlation between 222-Rn and gross alpha (U) was found for the influent concentrations. (See also W88-04980) (Lantz-PTT) (WRA)

Development of Regulations for Radionuclides in Drinking Water

Cothorn, C.R.

Environmental Protection Agency, Washington, DC. Office of Drinking Water.

IN: Radon, Radium and Other Radioactivity in Ground Water: Hydrogeologic Impact and Application to Indoor Airborne Contamination. Proceedings of the NWWA Conference, April 7-9, 1987, Somerset, New Jersey. 1987. p 1-11, 4 tab.

Journal Announcement: SWRA2106

The Office of Drinking Water in the U.S. EPA is currently reexamining existing regulations for radionuclides in drinking water and is considering the possibility of adding maximum contaminant levels (MCLs) for uranium and radon. Background analyses to support this activity include evaluations of occurrence, exposure, health effects, monitoring analytical methodology and treatment techniques. The occurrence of radium-226, radium-228, natural radium, and radon in drinking water supplies is discussed, along with possible sources of the contamination and risk estimates. (See also (WRA))

Age-dependent lung doses from ingested 222Rn in drinking water.

Crawford-Brown DJ

Department of Environmental Sciences and Engineering, School of Public Health, University of North Carolina, Chapel Hill 27514.

Health Phys (UNITED STATES) Feb 1987, 52 (2) p149-56, ISSN 0017-9078

Journal Code: G2H

Languages: ENGLISH

The U.S. Environmental Protection Agency currently is considering regulatory standards limiting the concentration of 222Rn in public drinking water supplies. As part of this effort, a criteria document has been prepared detailing the health risks expected to occur from the presence of 222Rn in water used in homes. The present report examines the dose equivalent delivered to lung tissue following direct ingestion of 222Rn in water. Irradiation from both in-situ decay of 222Rn in lung tissue and the decay of 222Rn in lung air passages following exhalation are examined and results presented for ages from neonate through

adult. These results indicate that the risk of lung cancer from inhalation of airborne progeny following emanation of ^{222}Rn from water into home air is significantly greater than the risk from both irradiation pathways considered in ingestion at all ages.
(MED)

A Bayesian analysis or scientific judgment of uncertainties in estimating risk due to super(222)Rn in U.S. public drinking water supplies

Crawford-Brown, D.J.; Cothorn, C.R.

Dep. Environ. Sci. and Eng., Sch. Public Health, Univ. North Carolina, Chapel Hill, NC 27514, USA

HEALTH PHYS VOL. 53, NO. 1, pp. 11-21, Publ.Yr: 1987

SUMMARY LANGUAGE - ENGLISH

Languages: ENGLISH

Journal Announcement: V19N1

The elements which contribute to the range of values or uncertainties for the lifetime risk and dose equivalent due to super(222)Rn in U.S. public drinking water supplies are estimated and discussed here. From imperfect scientific knowledge, reasonable upper and lower bounds are placed on these estimates through the use of a semiquantitative Bayesian approach to uncertainty analysis. The factors considered are: occurrence of super(222)Rn in drinking water, indoor air super(222)Rn concentrations as a function of drinking water concentration, equilibrium state of the progeny, fraction of daughter products attached to aerosol particles, anatomical and dosimetric variables, epidemiological studies and choice of latency period, plateau period and effects of age. For Rn in U.S. public drinking water supplies, it is estimated that the estimate for the lifetime lung cancer risk factor is 5×10^{-9} excess cases of lung cancer per becquerel of Rn per m³ of water, with an estimated range between 2×10^{-9} and 2×10^{-8} excess cases per becquerel of Rn per m³ of water. The best estimate of the lifetime population risk due to super(222)Rn in U.S. public drinking water supplies is estimated to be 6,000 excess lung cancers, with a reasonable range of 1,000 to 30,000. (POL)

POTABLE WATER AS A SOURCE OF AIRBORNE RADON-222 IN USA DWELLINGS A REVIEW AND ASSESSMENT

NAZAROFF W W; DOYLE S M; NERO A V; SEXTRO R G

ENVIRON. ENG. SCI., CALIF. INST. TECHNOL., PASADENA, CALIF. 91125.

HEALTH PHYS 52 (3). 1987. 281-296. CODEN: HLTPA

Language: ENGLISH

Subfile: BA (Biological Abstracts)

Using a long-term-average, single-cell model and available

data for U.S. housing, the concentration of ^{222}Rn in indoor air due to the use of potable water is assessed. The ratio of the airborne ^{222}Rn concentration to the concentration in water is represented by a lognormal distribution with geometric mean and geometric standard deviation of 0.65 .times. 10^{-4} and 2.88, respectively, in fair agreement with the previously reported results of direct measurements of the ratio in 13 houses. By combining this result with data on ^{222}Rn concentrations in U.S. water supplies, potable water is estimated to contribute an average of 24, 1.3, and 0.1 Bq m^{-3} to the airborne ^{222}Rn concentration in residences served by private wells, public ground water, and surface water supplies, respectively. (POL)

**RADON FROM DRINKING-WATER - EVALUATION OF WATER-BORNE
TRANSFER INTO HOUSE AIR (ENGLISH)**

HESS CT; VIETTI MA; MAGE DT

UNIV MAINE, DEPT PHYS & ASTRON/ORONO//ME/04469

ENVIRONMENTAL GEOCHEMISTRY AND HEALTH , V9, N3-4, P68-73,
1987

To determine the transfer of ^{222}Rn from domestic water onto air, nine houses were measured for ^{222}Rn , house volume, water use and air exchange by SF_6 and radon. Measurements were done in Maine during April and May 1986 when sealed up for the winter. Radon in water concentration ranged from 35,000 to 1,250,000 pCi/l. Air peaks of ^{222}Rn ranged from 13 to 200 pCi/l due to a water use burst experiment. Use of water filters was also examined by repeats with filters on and off. Water ranged from 200 to 1922 litres/day. House volumes ranged from 380 to 999 m^3 . Air exchange rates measured by SF_6 was twice as large as air exchange rate measured by ^{222}Rn . (SCI) (AUTH)

THE TRANSFER OF RADON FROM DOMESTIC WATER TO INDOOR AIR

PRICHARD H M

UNIV. TEX., SCH. PUBLIC HEALTH, P.O. BOX 20186, HOUSTON,
TEX. 77225.

AM WATER WORKS ASSOC J 79 (4). 1987. 159-161. CODEN:
JAWWA

Language: ENGLISH

Subfile: BA (Biological Abstracts)

Theoretical and experimental literature dealing with the release of radon from water to air is reviewed and synthesized. Primary emphasis is placed on releases from domestic water supplies to indoor air within the context of a general indoor radon problem. The widely used assumption of 1 pCi/L increment in indoor air per 10,000 pCi/L in the water supply is valid, but regional and individual variations are important. (BIO)

RADON IN HOUSES DUE TO RADON IN POTABLE WATER (RADON AND ITS DECAY PRODUCTS)

HESS C.T.; KORSAN J.K. ; EINLOTH C.J.

UNIV OF MAINE,

ACS SYM SERIES 331, 1987, P30(12)

ASSN REPORT ATMOSPHERIC RADON LEVELS IN 10 HOUSES WERE MEASURED AS A FUNCTION OF WATER USE AND METEOROLOGICAL PARAMETERS SUCH AS BAROMETRIC PRESSURE, WIND VELOCITY, AND TEMPERATURE. SEASONAL CALIBRATIONS AND DATA ANALYSES ARE REPORTED FOR SELECTED DWELLINGS. AVERAGE RADON CONCENTRATIONS IN AIR WERE IN THE 0.8-77 PCI/L RANGE; WATER USE AVERAGED 70-240 GPD. AVERAGE POTENTIAL ALPHA ENERGY CONCENTRATIONS IN THESE HOUSES WERE 0.01-2.6 WORKING LEVELS. THE RADON LEVEL ASSOCIATED WITH WATER USE WAS IN THE 0-36% RANGE OF THE HOUSE RADON FROM SOIL AND WATER COMBINED. THE RADON LEVEL CHANGE DUE TO USE OF A WATER SUPPLY FILTER SHOWED A 60% REDUCTION IN INDOOR RADON. (1 DIAGRAM, 4 GRAPHS, 11 REFERENCES, 4 TABLES) (ENV)

POINT-OF-ENTRY REMOVAL OF RADON FROM DRINKING WATER

LOWRY J D; BRUTSAERT W F; MCENERNEY T; MOLK C

UNIV. MAINE, ORONO, MAINE 04469.

AM WATER WORKS ASSOC J 79 (4). 1987. 162-169. CODEN: JAWWA

Language: ENGLISH

Subfile: BA (Biological Abstracts)

Two processes were investigated in the laboratory to determine their efficiency for removing radon from household water supplied. Granular activated carbon (GAC) adsorption was found to be extremely effective as a result of an adsorption-decay steady state that is established quickly and continues for years. Because bed replacement is not a factor for practical purposes, GAC is the most cost-effective process for radon removal. The GAC bed, however, adsorbs radon progeny as the radon decays, and it becomes a source of gamma radiation. This problem is believed to be manageable for the vast majority of potential applications. Diffused bubble aeration was found to be as effective as GAC, with removals of greater than 99 percent being practical. Although more costly than GAC, aeration does not have the problem of gamma activity buildup. (BIO)

Radium-226 and Radon-222 in Domestic Water of Houston-Harris County, Texas

Cech, I.; Lemma, M.; Prichard, H. M.; Kreidler, C. W.

Texas Univ. Health Science Center at San Antonio.

IN: Radon, Radium and Other Radioactivity in Ground Water: Hydrogeologic Impact and Application to Indoor Airborne Contamination. Proceedings of the NWWA Conference, April

7-9, 1987, Somerset, New Jersey. 1987.
p 377-402, 12 fig, 3 tab, 41 ref.,
Journal Announcement: SWRA2106

Anomalous concentrations of 226-Ra and 222-Rn are shown to exist in the Greater Houston-Harris County area (Texas Gulf Coast). The findings summarized in this paper present an encouraging picture for predicting depths and locations in the Gulf Coast where elevated Ra and Rn concentrations may be encountered. Two to four key variables accounted for the statistically significant variation (from 38-74%) in concentrations observed under field conditions. The proximity of salt domes was a strong predictor of the presence of Ra and Rn in well water, particularly in combination with a certain range of pumping depths. The authors advise against developing domestic wells near salt domes, especially wells 180 m and deeper. (See also W88-04980) (Lantz-PTT) (WRA)

**Radon, Radium and Other Radioactivity in Ground Water:
Hydrogeologic Impact and Application to Indoor Airborne
Contamination**

National Water Well Association, Worthington, OH.
Proceedings of the NWWA Conference, April 7-9, 1987,
Somerset, New Jersey. Lewis Publishers, Chelsea, MI.
1987. 546 p. Edited by Barbara Graves.,
Journal Announcement: SWRA2106

The dangers associated with the inhalation of short-lived radon decay products have been well documented. The U.S. EPA estimates that radon contaminates one in eight U.S. homes and causes thousands of lung cancer deaths each year. The fact that groundwater is one of the many sources of radon contamination is cause for concern, considering the growing number of persons who rely on this resource. This concern prompted the Association of Ground Water Scientists and Engineers and the U.S. EPA to host this conference on radon, radium, and other radioactivity in groundwater in Somerset, New Jersey, on April 7-9, 1987. The conference sessions focused on the following topics: geologic and hydrogeologic controls influencing radon occurrence; monitoring radon, radium, and other radioactivity from geologic and hydrogeologic sources; mining impacts on the occurrence of radon, radium, and other radioactivity in groundwater; sampling and analysis of radon, radium, and other radioactivity in groundwater; radon and radium in water supply wells; predictive models for the occurrence of radon, radium, and other radioactivity; and remedial action for radon, radium, and other radioactivity. (See W88-04981 thru W88-05012) (Lantz-PTT) (WRA)

**RADON IN GROUND WATER RADON RADIUM AND OTHER RADIOACTIVITY
IN GROUND WATER HYDROGEOLOGY IMPACT AND APPLICATION TO**

**INDOOR AIRBORNE CONTAMINATION PROCEEDINGS OF THE NWWA
NATIONAL WATER WELL ASSOCIATION CONFERENCE SOMERSET NEW
JERSEY USA APRIL 7-9 1987**

GRAVES, B. (ED.). RADON IN GROUND WATER. RADON, RADIUM AND
OTHER RADIOACTIVITY IN GROUND WATER: HYDROGEOLOGIE IMPACT
AND APPLICATION TO INDOOR AIRBORNE CONTAMINATION;
PROCEEDINGS OF THE NWWA (NATIONAL WATER WELL ASSOCIATION)
CONFERENCE, SOMERSET, NEW JERSEY, USA, APRIL 7-9, 1987.
XIII+546P. LEWIS PUBLISHERS, INC.: CHELSEA, MICHIGAN, USA.
ILLUS. MAPS. ISBN 0-87371-117-3. 0 (0). 1987. XIII+546P.
CODEN: 27081

Language: ENGLISH

Document Type: BOOK; CONFERENCE PROCEEDINGS

Subfile: BARRM (Biological Abstracts/RRM)

The EPA estimates that radon contaminates one in eight U.S. homes and causes thousands of lung cancer deaths every year. The fact that ground water is one of the many sources of radon contamination is cause for concern as an increasing number of people rely on this resource. A result of this concern was the holding of the first conference on radon, radium, and other radioactivity in ground water, sponsored jointly by the Association of Ground Water Scientists and Engineers and the EPA. A wide spectrum of relevant topics were covered including geologic and hydrogeologic influence, monitoring, mining impacts, sampling and analysis, occurrence in water supply wells and remedial actions. (BIO) (HQL)

**Radon in Groundwater of the Long Valley Caldera, California
Conference on radon, radium, and other radioactivity in
ground water: hydrogeologic impact and application to
indoor airborne contamination, Somerset, NJ, USA, 7 Apr
1987.**

Portions of this document are illegible in microfiche products.

NTIS Prices: PC A03/MF A01

Flexser, S. ; Wollenberg, H. A. ; Smith, A. R.
Lawrence Berkeley Lab., CA.

Corp. Source Codes: 086929000; 9513034

Sponsor: Department of Energy, Washington, DC.

Report No.: LBL-23301; CONF-8704123-1

Apr 87 32p

Languages: English Document Type: Conference proceeding

NTIS Prices: PC A03/MF A01 Journal Announcement:

GRAI8723; NSA1200

Country of Publication: United States

Contract No.: AC03-76SF00098

In the Long Valley caldera, an area of recently (approx. 550 y) active volcanism and current seismic activity, sup 222 Rn concentrations in hot, warm, and cold spring waters have been measured since 1982. Rn contents of the waters correlate

inversely with temperature and specific conductance, with high concentrations (1500 to 2500 pCi/l) occurring in dilute cold springs on the margins of the caldera, and low concentrations (12 to 25 pCi/l) in hot to boiling springs. Rn correlates only slightly with the uranium contents of the wide range of rocks which host the hydrological system feeding the springs. These environmental effects on the radon record may mask responses to small or distant seismic, volcanic, or crustal deformation events. To date, anomalous changes in water-borne Rn have been observed in connection with at least one earthquake, which occurred close to the monitoring site. This continuing study points out that an understanding of the geological setting, its associated hydrological system, and environmental influences is necessary to properly evaluate concentrations and changes in groundwater radioactivity. (ERA citation 12:033752) (NTIS)

Natural Radioactivity in Some Groundwaters of the Canadian Shield

Lemire, A. E.; Gascoyne, M.

Atomic Energy of Canada Ltd., Pinawa (Manitoba).

IN: Radon, Radium and Other Radioactivity in Ground Water: Hydrogeologic Impact and Application to Indoor Airborne Contamination. Proceedings of the NWWA Conference, April 7-9, 1987, Somerset, New Jersey. 1987. p 97-110, 3 fig, 6tab, 14 ref.,

Journal Announcement: SWRA2106

High levels of uranium and radon were found in some individual wells in the Lac du Bonnet region of Manitoba. Considerable variation in concentration was observed between individual wells located within a small geographic area. The cause of the individual high concentrations is thought to be a combination of localized enrichment in overburden and granitic bedrock and of the high bicarbonate oxygenated groundwater of the region. A similar survey was carried out in the Atikokan region of northwestern Ontario. Uranium concentrations were low, but high radon levels were observed in some drill holes. At the Atikokan site, the presence of significant excess radon correlated with proximity to fault zones in the granitic bedrock. As a remedial measure, a uranium and radium removal system for individual household use was designed and tested and is now available commercially. (See also W88-04980) (Lantz-PTT) (WRA)

Connecticut Radon Study- Using Limited Water Sampling and a Statewide Ground-Based Gamma Survey to Help Guide an Indoor Air Testing Program. A Progress Report.

Thomas, M. A.

Connecticut Dept. of Environmental Protection, Hartford. Natural Resources Center.

IN: Radon, Radium and Other Radioactivity in Ground Water:

Hydrogeologic Impact and Application to Indoor Airborne Contamination. Proceedings of the NWWA Conference, April 7-9, 1987, Somerset, New Jersey. 1987.
p 347-362, 4 fig, 36 ref.,
Journal Announcement: SWRA2106

The Connecticut Geological Survey within the State Department of Environmental Protection (DEP) is working with the State Department of Health Services (DOHS) investigating the occurrence of radon in Connecticut. In 1985 and 1986, approximately 300 private and public water supply wells from 20 geological areas were tested for radon by the Toxic Hazards and Public Water Supply Sections of DOHS. Highest groundwater radon was 130,241 pCi/l from the Nonewaug Granite, a two-mica granite (range 10,720-130,240 pCi/l). Elevated radon was found in wells within several granitic gneisses: the Glastonbury Gneiss (3070-80,900 pCi/l from the Nonewaug Granite, a two-mica granite (range 10,720-130,240 pCi/l). Elevated radon was found in wells within several granitic gneisses: the Glastonbury Gneiss (3070-80,900 pCi/l), the Canterbury Gneiss (10,010-64,510 pCi/l), and the Hope Valley Alaskite Gneiss (4060-59,180 pCi/l). These Paleozoic and PreCambrian age rocks underlie about 5% of the state. Intermediate radon levels were found in water from PreCambrian and Paleozoic age stratified metamorphic rocks where radon levels > 10,000 pCi/l were widely scattered in these surveys. Relatively low groundwater radon values were found in central Connecticut Mesozoic age sedimentary rock wells (390-8490 pCi/l) and in Paleozoic age carbonate rock wells (200-4130 pCi/l). Preliminary results from the ground (automobile-borne) gamma radiation survey generally show a positive correlation with radon water analyses, enabling characterization of geological areas in Connecticut as radiation sources. DOHS is currently conducting 2,200 air tests in homes located in geologic areas selected from water analyses and the ground survey. All data is compiled on 1:24,000 maps to be included in multiple natural resource spatial analyses using an automated Geographic Information System. The analyses will explore relations between the distribution of radon levels and earth materials to better define the geologic areas and possible origins of radon in groundwater and in indoor air. (See also W88-04980) (Author's abstract) (WRA)

Fiscal Year 1985 Program Report (Vermont Water Resources Research Center)

Clausen, J. C.

Vermont Water Resources Research Center, Burlington.

Available from the National Technical Information Service, Springfield, VA 22161, as PB86-162343/AS. Price codes: A02 in paper copy, A01 in microfiche. Program Report G1048-01. November 1986. 18 p.

Contract No. 14-08-0001-G1048. Project No. USGS G1048-01.,
Journal Announcement: SWRA2104

The high priority water resource problems and issues of Vermont such as wastewater disposal and lake and wetland resources are discussed. Five research projects and two information transfer activities were funded by the Vermont Water Resources Research Center. Two research projects focused on wastewater treatment using attached microbes (periphyton) and investigations of the variability in sludge settling. Two projects addressed lake and wetland resources. One of these efforts established a Lake Champlain water quality data base and began examination of techniques for trend detection and the associated monitoring needs. The second project investigated public perceptions in the value of Vermont's wetlands. Another research project identified institutional devices for allocating wastewater capacity problems. The information transfer program co-sponsored a forest water quality and erosion control workshop and a groundwater workshop. Also, the use of a geographic information system was demonstrated on potential groundwater pollution sources, land suitable for wastewater application, analysis of hydrogeologic units for development of new groundwater supplies, and identification of potential radon contamination for one geologic formation. A pamphlet was prepared on household hazardous materials. (Clausen-U Vt) (WRA)

IV. SURVEYS

A. NATIONAL

NATIONAL SURVEY OF RADON IN DWELLINGS WITH PASSIVE DOSIMETER (ENGLISH)

KOBAYASHI S; IWASAKI T; UCHIYAMA M; KANKURA T; ICHIKAWA M;
SATO F; KANOUE M; AOYAMA T; TAKEDA A; SAWADA S; TSUCHYA T;
SAKAI H

ATL INST RADIOL SCI/CHIBA 260//JAPAN/; HOKKAIDO
UNIV/SAPPORO/HOKKAIDO

60/JAPAN/; KANAZAWA UNIV/KANAZAWA/ISHIKAWA 920/JAPAN/; SHIGA
NIV MED SCI/OTSU/SHIGA 52021/JAPAN/; RADIAT CTR/OSAKA/

/JAPAN/; HIROSHIMA UNIV/HIROSHIMA 730//JAPAN/; UNIV OCCUPAT
& ENVIRONM HLTH/KITAKYUSHU/FUKUOKA 807/JAPAN/; AIZU
WAKAMATSU HLTH CTR/AIZUWAKAMATSU//JAPAN/

JOURNAL OF RADIATION RESEARCH , V29, N1, P27-27, 1988

Exposure from inhaled ^{222}Rn and ^{220}Rn daughters contribute the largest fraction of natural radiation dose to general population and is associated with the possible lung cancer risk. Therefore, a national survey to assess the indoor radon exposure of the Japanese population is being carried out by NIRS with a support from the Science and Technology Agency. About 6,000 homes of high school teacher (Tokyo, Hikkaido and 16 prefectures in 1986 and 19 prefectures in 1987) are now being measured for a year using passive dosimeters (Makrofor, made in West Germany). This number corresponds to 0.016% of the total houses in Japan. The survey was carried out by post. Each householder completed a questionnaire on the type of dwelling and its characteristics. These data will be used in the assessment of the factors affecting indoor Rn exposure. (SCI) (AUTH)

Variation of radon levels in U.S. homes with various factors Cohen, B.L.; Gromicko, N.

Dep. Phys., Univ. Pittsburg, Pittsburgh, PA 15260, USA

J. AIR POLLUT. CONTROL ASSOC VOL. 38, NO. 2, pp. 129-134,
Publ.Yr: 1988

SUMMARY LANGUAGE - ENGLISH

Languages: ENGLISH

Journal Announcement: V19N3

A program combining 70,000 purchased and 3,500 random selection-no charge measurements with extensive questionnaires is

described. Methods for reducing biases in purchased measurements have been reasonably successful. Distributions are roughly lognormal with sigma sub(g) approximately equals 3.0 but with an excess of very high measurements. Winter and spring-fall measurements average about 60 percent and 40 percent, respectively, higher than summer measurements. Basements average 2.5 times higher radon levels than upper floors. Tightening of homes since 1974 has increased radon levels by less than 10 percent, but well-weatherized houses have similar to 40 percent higher levels than poorly weatherized houses. Open windows reduce levels by a factor of about 2.5. Low-cost newer houses have much lower levels than more expensive newer houses, but among older houses this is reversed. Low income families have substantially lower radon levels than average. There is little variation with education level. (POL)

EPA's radon study results

Dowd, R.M.

R.M. Dowd and Co., Washington, DC, USA

ENVIRON. SCI. TECHNOL VOL. 22, NO. 1, p. 28, Publ.Yr: 1988

Languages: ENGLISH

Journal Announcement: V19N3

Last winter, in cooperation with agencies in 10 states and two metropolitan area counties, EPA measured the indoor air radon concentrations of 14,000 houses, some chosen statistically at random and some by request of the homeowner. Passive measurement methodologies were used, such as exposing a charcoal canister to the air for a few days and allowing the air to migrate into the charcoal naturally. To reduce dilution of radon by the outside air, the protocol required that the house be shut up; therefore, the study was conducted during winter. The measuring device was placed in the lowest livable area (usually the basement) of each house to maximize potential concentration. (POL)

SURVEYS OF RADON LEVELS IN HOMES IN THE UNITED STATES: A TEST OF THE LINEAR-NO-THRESHOLD DOSE-RESPONSE RELATIONSHIP FOR RADIATION CARCINOGENESIS (RADON AND ITS DECAY PRODUCTS)
COHEN BERNARD L. UNIV OF PITTSBURGH,
ACS SYM SERIES 331, 1987, P462(13)

ASSN REPORT THE UNIV. OF PITTSBURGH RADON PROJECT FOR LARGE-SCALE MEASUREMENTS OF RADON CONCENTRATIONS IN HOMES SEEKS TO TEST THE LINEAR-NO-THRESHOLD RESPONSE RELATIONSHIP FOR RADIATION CARCINOGENESIS. AVERAGE RADON LEVELS ARE BEING DETERMINED IN THE 25 U.S. COUNTIES WITH HIGHEST AND LOWEST LUNG

CANCER RATES. THE THEORY PREDICTS THAT THE FORMER SHOULD HAVE ABOUT THREE TIMES HIGHER AVERAGE RADON LEVELS THAN THE LATTER, UNDER THE ASSUMPTION THAT ANY CORRELATION BETWEEN EXPOSURE TO RADON AND EXPOSURE TO OTHER CAUSES OF LUNG CANCER IS WEAK. THE VALIDITY OF THIS ASSUMPTION IS TESTED WITH DATA ON AVERAGE RADON LEVEL VS. REPLIES TO QUESTIONNAIRES. LITTLE CORRELATION IS FOUND BETWEEN RADON LEVELS IN HOMES AND SMOKING HABITS, EDUCATIONAL ATTAINMENT, OR ECONOMIC STATUS OF OCCUPANTS. (1 GRAPH, 4 REFERENCES, 4 TABLES) (ENV)

Radon Detection and Measurement. January 1970-August 1987
(Citations from the Engineering Index Database)
(Rept. for Jan 70-Aug 87)
Supersedes PB86-874740.
NTIS Prices: PC N01/MF N01
National Technical Information Service, Springfield, VA.
Corp. Source Codes: 055665000
Aug 87 76p
Languages: English Document Type: Bibliography
NTIS Prices: PC N01/MF N01 Journal Announcement: GRAI8720
Country of Publication: United States

This bibliography contains citations concerning the measurement of radon and radon daughter isotopes in various environments. Radon measurement in homes and buildings, mines, rainwater, groundwater, soils, in the Arctic and other atmospheres, and in exhaled air is discussed. Radon exhalation rates of building materials and mine tailings are noted. Analytic methods and equipment used to measure radon and radon isotopes are described. Radon detection as an earthquake prediction tool is briefly presented. (This updated bibliography contains 185 citations, 29 of which are new entries to the previous edition.) (NTIS)

Radon Monitoring Results from BPA'S Residential Weatherization Program
Paper copy only, copy does not permit microfiche production. Original copy available until stock is exhausted. NTIS Prices: PC A02
Bonneville Power Administration, Portland, OR.
Corp. Source Codes: 025155000; 0849300
Sponsor: Department of Energy, Washington, DC.
Report No.: DOE/BP-813
Mar 87 25p
Languages: English
NTIS Prices: PC A02 Journal Announcement: GRAI8719; NSA1200
Country of Publication: United States

The accumulated results of the Bonneville Power Administration regionwide Residential Weatherization Program radon monitoring data represent only those readings within the service areas of utilities who participate in the Residential Weatherization Program. Several areas in the Pacific Northwest are excluded in this evaluation. In addition, the amount of results received is heavily weighted by the high number of homes weatherized and monitored through large utility weatherization programs located in western Oregon and Washington. Due to these limitations, we do not recommend that any conclusions be made on a statewide or regionwide basis. We have provided this regional and statewide data for illustrative purposes only. This report provides a summary of all the data collected for the states of Oregon, Washington, Idaho, and Montana. Specific data is listed by US Geological Survey designated range and township locations. The specific data listed by range and township includes only those townships with a minimum of five radon readings. This has been done to protect the privacy of those residences participating in the program. The radon measurement results contained in this report were conducted by passive alpha-track radon detectors. The Residential Weatherization Program requires that the detectors be placed in residences for a minimum of three winter months, up to one year in length. Due to the variations in the length of measurements, we have added a section to this report which lists the average radon values for given exposure periods. (ERA citation 12:027409) (NTIS)

**COMPARISON OF PURCHASED MEASUREMENTS WITH MEASUREMENTS IN
RANDOMLY SELECTED HOUSES AS A SOURCE OF INFORMATION ON
RADON-222 LEVELS IN HOUSES**

COHEN B L; PONDY P

UNIV. PITTSBURGH, PITTSBURGH, PA. 15260.

HEALTH PHYS 53 (4). 1987. 409-416. CODEN: HLTPA

Language: ENGLISH

Subfile: BARRM (Biological Abstracts/RRM)

The most direct way to find valid evidence on the statistical distribution of ^{222}Rn concentrations in houses is to collect data on randomly selected houses. The problem here is that the sample is biased: measurements are more likely to be purchased by the rich than by the poor, by the educated than by the uneducated, and by those who have reason to believe that their house may have high levels of ^{222}Rn . (BIO)(HQL)

EPA REPORTS ON RADON IN HOUSING (ENGLISH)

COX JE

ASHRAE JOURNAL-AMERICAN SOCIETY OF HEATING REFRIGERATING
AND AIR-CONDITIONING ENGINEERS, V29, N10, P20-20, 1987

The results of a 10-state survey of radon levels in houses estimate that 8-12 percent exceed the accepted EPA action level.
(SCI) (AUTH)

EPA COMPILING DATA ON EXTENT OF INDOOR RADON HAZARD (ENGLISH)

EMBER L

CHEMICAL & ENGINEERING NEWS , V65, N33, P22-24, 1987

Surveys of gas concentration in homes in 17 states, data collected by states, and epidemiological studies will form a comprehensive database. (SCI) (AUTH)

THE INDOOR CONCENTRATION OF RADON AND ITS DAUGHTERS IN A MULTISTOREY BUILDING

KHAN A J; VARSHNEY A K; PRASAD R; TYAGI R K

PHYSICS SECT., Z.H. COLL. ENG. TECHNOL., ALIGARH MUSLIM
UNIV., ALIGARH, UP-202 001, INDIA.

NUCL TRACKS RADIAT MEAS 13 (1). 1987. 77-80.

CODEN: NTRMD

Language: ENGLISH

Subfile: BA (Biological Abstracts)

Long-term measurements of radon and its daughters in nineteen different rooms of a multistorey building in Aligarh having different types of environmental conditions have been performed. CR-39 solid state nuclear track detectors were used to measure the radon concentration. Variations of radon concentration due to height from ground level, ventilation conditions, convection air currents and materials placed inside were investigated. The highest value of radon has been found in the basement and the ground floor rooms which indicates the influence of subsoil emanation. No appreciable effect was observed with height above ground. Our study also reveals that ventilation conditions, convection air currents, housed materials such as books, papers, etc., affect the radon concentration.
(BIO)

MEASUREMENTS OF RADON LEVELS IN UNITED-STATES HOMES (ENGLISH)

COHEN BL; GROMICKO N

UNIV PITTSBURGH, DEPT PHYS/PITTSBURGH//PA/15260
HEALTH PHYSICS , V52, S1, PS 70, 1987

The data on radon measurements in U.S. homes collected by the University of Pittsburgh Radon Project will be reviewed. Mean radon levels will be given as a function of geographic area, month of year, age of house, house characteristics, socioeconomic status of the householders, etc. Studies of the effectiveness of 15-20 different types of charcoal for adsorbing radon will be presented. No one type is much superior to several others, but some are much inferior. (SCI) (HQL)

RADON DISTRIBUTION BY WEEK SEASON AND YEAR IN SINGLE FAMILY DWELLINGS

HARLEY N H; TERILLI T B

N.Y. UNIV. MED. CENT., 550 FIRST AVE., NEW YORK, N.Y. 10016.
THIRTY-SECOND ANNUAL MEETING OF THE HEALTH PHYSICS SOCIETY,
SALT LAKE CITY, UTAH, USA, JULY 5-9, 1987.

HEALTH PHYS 52 (SUPPL. 1). 1987. S72-S73. CODEN: HLTPA

Language: ENGLISH

Document Type: CONFERENCE PAPER

Subfile: BARRM (Biological Abstracts/RRM)

Hourly radon measurements have been made in the basement of a single family dwelling in northern NJ since 1982. This dwelling is wood frame, has a full poured concrete basement, is 70 years old and is typical of older construction. In 1985, a small experimental room was added onto the main basement with walls of thinner concrete block to better observe the radon surges which occur frequently with various weather phenomena. Radon levels in this home are about average (37 Bq/m³) for the U.S. In 1986, hourly measurements were initiated in a newer home in eastern PA which has radon concentrations about 5 times higher. (BIO) (AUTH)

NATIONWIDE DISTRIBUTION OF INDOOR RADON MEASUREMENTS A PRELIMINARY DATA BASE

ALTER H W; OSWALD R A

TERRADEX CORP., 460 N. WIGET LANE, WALNUT CREEK, CALIF. 94598.

JAPCA (J AIR POLLUT CONTROL ASSOC) 37 (3). 1987. 227-231.

CODEN: JIJME

Language: ENGLISH

Subfile: BA (Biological Abstracts)

A rapidly growing data base consisting of over 60,000 indoor radon concentrations measured with passive integrating Track Etch detectors is described. The data base is subdivided

by state and a variety of statistical parameters summarizing the contents of the data base are presented for each state. Certain states are better characterized than others in terms of having a variety of radon surveys done all over the state so that the statistical parameters given may be fairly representative of the state. The primary conclusions that can be drawn are that there are some homes with unacceptably high radon levels in nearly every state and that there exist regions where a significant fraction of homes have unacceptably high radon levels. (BIO)

Energy and Indoor Air Quality Measurements from Five Energy Conserving Manufactured Homes: Final Report, 1987

Microfiche only, copy does not permit paper copy reproduction. Original copy available until stock is exhausted.

NTIS Prices: MF A01

Lee, A.D.; Taylor, Z.T.; Parker, G.B.; Wilfert, G.L.; Callaway, J.W.

Battelle Pacific Northwest Labs., Richland, WA.

Corp. Source Codes: 048335000; 9512268

Sponsor: Department of Energy, Washington, DC.

Report No.: DOE/BP-803

Feb 87 106p

Languages: English

NTIS Prices: MF A01 Journal Announcement: GRAI8717; NSA1200

Country of Publication: United States

Contract No.: AC06-76RL01830

The objectives of this study are to (1) determine whether manufactured homes built to the Pacific Northwest Model Conservation Standards (MCS) perform according to the energy requirements of the standards, (2) determine air exchange rates in these homes, (3) determine whether indoor air pollutants exceed specified levels in these homes, and (4) provide information useful in future efforts to encourage the production of energy efficient manufactured homes in the Pacific Northwest. The study has been conducted by Pacific Northwest Laboratory (PNL) for the Office of Conservation, Bonneville Power Administration (BPA). The project constitutes one case study conducted in conjunction with the BPA-sponsored End-Use Load and Conservation Assessment Program. (ERA citation 12:022707) (NTIS)

Assessing exposure to radon in the United States: Perspective of the Environmental Protection Agency

Magno, P.J.; Guimond, R.J.; Hopke, P.K. (ed.)

Off. Radiat. Programs, US EPA, Washington, DC 20460, USA

191. Meeting of the American Chemical Society New York, NY

(USA) 13-18 Apr 1986

RADON AND ITS DECAY PRODUCTS. OCCURRENCE, PROPERTIES AND HEALTH EFFECTS pp. 63-69, Publ.Yr: 1987

AMERICAN CHEMICAL SOCIETY, WASHINGTON, DC (USA)

SUMMARY LANGUAGE - ENGLISH; ACS. 331.

Languages: ENGLISH

Exposure to radon and its decay products inside homes is now recognized as a significant public health problem. To better define the scope and magnitude of this problem, the Environmental Protection Agency (EPA) has developed a national radon exposure assessment program. This program consists of a national radon survey to determine the national frequency distribution of radon levels in residential structures, a States Assistance Program to identify high risk radon areas, and a Data Quality Program to assure reliable and consistent radon and radon decay product measurement results for both individual and governmental agencies. (POL)

Measurement of sup 222 Rn and Its Relationship to Environmental Variables: Factors Controlling Indoor Radon: Final Report for the Contract Period June 1, 1982 to August 31, 1986

NTIS Prices: PC A02/MF A01

Harley, N. H.

New York Univ., NY. School of Medicine.

Corp. Source Codes: 008702065; 4670000

Sponsor: Department of Energy, Washington, DC.

Report No.: DOE/EV/10374-6

1986 11p

Languages: English

NTIS Prices: PC A02/MF A01 Journal Announcement: GRAI8719; NSA1200

Country of Publication: United States

Contract No.: AC02-80EV10374

The report summarizes a project in which a new detector for measuring 'radon only' was designed and built. The units built were then used to measure hourly data indoors and outdoors in two locations to investigate the apportionment of the indoor radon source term. (ERA citation 12:025830) (NTIS)

Preliminary Radon Testing Results for the Residential Standards Demonstration Program. Program Results No. 3

Portions of this document are illegible in microfiche products. Original copy available until stock is exhausted.

NTIS Prices: PC A03/MF A01

Reiland, P. ; McKinstry, M. ; Thor, P.
Bonneville Power Administration, Portland, OR. Office of
Conservation.
Corp. Source Codes: 025155009; 9518455
Sponsor: Department of Energy, Washington, DC.
Report No.: DOE/BP-582
Jan 86 38p
Languages: English NTIS Prices: PC A03/MF A01 Journal
Announcement: GRAI8618; NSA1100
Country of Publication: United States

This paper reports measurements for heating season radon concentrations in indoor air for 289 homes in the Pacific Northwest. The homes are part of the Bonneville Power Administration (BPA) Residential Standards Demonstration Program, and include 143 dwellings constructed to the Model Conservation Standards proposed by the Northwest Power Planning Council (MCS homes) and 146 control dwellings built over the last several years to current building codes (control homes). These results indicate that the location of the dwelling was a more important determinant of indoor radon concentration than was use or non-use of the MCS. Previous studies have shown that radon levels in dwellings are only weakly correlated with air exchange rates, and that control of radon sources is a more practical and effective method of reducing indoor concentrations. (ERA citation 11:029905) (NTIS)

Studies of Radon in Buildings. Progress Report, July 1, 1981 - June 30, 1986
Cohen, B.L.
Univ. Pittsburgh, Pittsburgh, PA 152600, USA
Publ.Yr: 1986
NTIS, SPRINGFIELD, VA (USA)
SUMMARY LANGUAGE - ENGLISH; NTIS Order No: DE86015477/GAR.
Languages: ENGLISH
Journal Announcement: V18N5

Research reviewed includes scintillation cell development, radon levels in public and commercial buildings, development of diffusion barrier charcoal adsorption collectors, development of a low cost radon chamber, small scale radon surveys in Pittsburgh, Cumberland County, PA, and in the houses of national physics professors, development of methodology for large-scale surveys, radon carcinogenesis epidemiology, ventilation rate studies, studies of radon in soil, diffusion constants of radon through soils, test house studies, pressure differential studies, air cleaning studies, tests of the linear-no threshold theory, and large scale surveys. (NTIS)

A NATIONAL SURVEY OF RADON-222 IN USA HOMES AND CORRELATING FACTORS

COHEN B L

UNIV. PITTSBURGH, PITTSBURGH, PA 15260.

HEALTH PHYS 51 (2). 1986. 175-184. CODEN: HLTPA

Language: ENGLISH

Subfile: BA (Biological Abstracts)

A survey of ^{222}Rn levels in 453 houses of physics professors from 101 universities in 42 states (plus the District of Columbia) was carried out with 1-y exposures of nuclear track detectors, accompanied by an extensive questionnaire. The geometric mean concentration was 38 Bq/m^3 (1.03 pCi/l), the standard deviation was ****GRAPHIC****, and the arithmetic average was 54 Bq/m^3 (1.47 pCi/l). Correlations were studied with age of the house, environs, location of the detector in the house, number of floors in the house, what is beneath the house, integrity of the barrier between the house and the ground, wind conditions, draftiness, construction materials, ventilation, use of gas, and source of water. In general, these correlations were found to be much weaker than expected, indicating that geographical variations are the dominating effect. (BIO)

High-radon homes may be widespread.

Raloff, Janet

Science News v130 p325(1) Nov 22, 1986

According to a study at the Lawrence Berkeley Laboratory in Berkeley, CA, residents of an estimated 1 million homes with high indoor radon levels may be receiving radiation exposures that meet or exceed those received by the average uranium miner. (MI) (HQL)

Distribution of airborne radon-222 concentrations in U.S. homes.

Nero, A.V.; Schwehr, M.B.; Nazaroff, W.W.; Revzan, K.L.

Science v234 p992(6) Nov 21, 1986

Apparently large exposures of the general public to the radioactive decay products of radon-222 present in indoor air have led to asystematic appraisal of monitoring data from U.S. single-family homes; several ways of aggregating data were used that take into account differences in sample selection and season of measurements. (MI) (AUTH)

Residential Indoor Air Quality Field Studies

Georgia technical symposium on indoor air quality, Atlanta, GA, USA, 23 Sep 1986.

NTIS Prices: PC A02/MF A01

Hawthorne, A. R.

Oak Ridge National Lab., TN.

Corp. Source Codes: 021310000; 4832000

Sponsor: Department of Energy, Washington, DC.

Report No.: CONF-8609248-1

Sep 86 17p

Languages: English Document Type: Conference proceeding

NTIS Prices: PC A02/MF A01 Journal Announcement: GRAI8715; NSA1200

Country of Publication: United States

Contract No.: AC05-84OR21400

Our best estimate of population exposure to indoor air pollutants is provided by results of indoor air quality field studies. Field studies are conducted to answer a variety of objectives. Frequently, secondary objectives, compatible with the primary objective, are addressed in a cost-effective manner to allow a larger indoor air quality data base. Careful design of field studies is required. Factors that must be considered include participant selection, logistics, sampling frequency and duration, and questionnaire preparation. Selection of appropriate monitoring equipment is necessary to balance cost, ease of use, sensitivity, and selectivity. Passive samplers are frequently the preferred choice for large-scale field studies. As more results become available from various residential field studies, we will gain a better estimate of the quality of indoor air - both how it varies among homes and how it compares with ambient and occupational air quality. 8 refs. (ERA citation 12:019034) (NTIS)

A national survey of ^{222}Rn in U.S. homes and correlating factors.

Cohen BL

Health Phys Aug 1986, 51 (2) p175-83, ISSN 0017-9078

Journal Code: G2H

Languages: ENGLISH

A survey of ^{222}Rn levels in 453 houses of physics professors from 101 universities in 42 states (plus the District of Columbia) was carried out with 1-y exposures of nuclear track detectors, accompanied by an extensive questionnaire. The geometric mean concentration was 38 Bq/m³ (1.03 pCi/l), the standard deviation was times divided by 2.36, and the arithmetic average was 54 Bq/m³ (1.47 pCi/l). Correlations were studied with age of the house, environs, location of the detector in the house, number of floors in the house, what is beneath the house,

integrity of the barrier between the house and the ground, wind conditions, draftiness, construction materials, ventilation, use of gas, and source of water. In general, these correlations were found to be much weaker than expected, indicating that geographical variations are the dominating effect. (MED)

Interim Results of the Prompt alpha-Track Radon Detector Study

NTIS Prices: PC A03/MF A01

George, J. L. ; Langner, G. H.

Bendix Field Engineering Corp., Grand Junction, CO.

Corp. Source Codes: 056119000; 9502148

Sponsor: Department of Energy, Washington, DC.

Report No.: GJ/TMC-28

Jul 86 39p

Languages: English

NTIS Prices: PC A03/MF A01 Journal Announcement: GRAI8626; NSA1100

Country of Publication: United States

Contract No.: AC07-76GJ01664

The Technical Measurements Center is evaluating the reliability of using short-term exposures of alpha-track radon detectors to estimate annual average radon-daughter concentrations (RDC) in residences in the Grand Junction, Colorado, area. This Prompt Alpha-Track Study was initiated in the summer of 1985 and will be completed in the summer of 1986. Two sets of data are being collected, each consisting of two-, three-, four-, five-, and six-month-long exposures of alpha-track radon detectors. October 2 was selected as the midpoint of the Fall set of exposures and April 2 as the midpoint of the Spring set of exposures. These dates were selected after analyzing the RDC data collected by the Colorado Department of Health during the Grand Junction Remedial Action Program. This interim report on the Prompt Alpha-Track Study discusses the preliminary results of the Fall measurements. Terradex Type SF Track Etch detectors were exposed at 50 stations in 34 structures where previous annual average RDC and/or radon data have been collected. Two detectors were deployed at each station for each short-term exposure. Three additional annual detectors were deployed at each station concurrently with the six-month Fall detectors. The detectors were processed at a sensitivity level of 0.2 picocurie-month per liter. Preliminary results indicate that all of the short-term Fall measurements using October 2 as the midpoint of the exposure can reliably estimate the annual average indoor radon concentration in structures. The precision of both the short-term measurements and the methods is acceptable at 4 picocuries per liter (pCi/l). Results of a paired t-test indicate no difference in the measured radon concentration between a short-term measurement and an annual

measurement, at the 0.01 level of significance. These conclusions are provisional since only the Fall data have been analyzed. A final report will integrate the Fall, Spring, and annual data. (ERA citation 11:005404) (NTIS)

RADON ASSAYS IN CAMPUS AND RESIDENTIAL BUILDINGS

BRUCE A K; HUFF R D

BIOL. DEP., STATE UNIV. N.Y. BUFFALO, BUFFALO, N.Y. 14260, USA.

THIRTY-FIRST ANNUAL MEETING OF THE HEALTH PHYSICS SOCIETY, PITTSBURGH, PA., USA, JUNE 29-JULY 3, 1986. HEALTH PHYS 50 (SUPPL. 1). 1986. S35.

CODEN: HLTPA

Language: ENGLISH

Document Type: CONFERENCE PAPER

Subfile: BARRM (Biological Abstracts/RRM)

Radon analysis was performed in 10 campus buildings and in 3 residences. Samples were collected for 30 minutes at 40 lpm on glass fiber filters and counted at intervals for up to one hour using a 4-pi GM detector. Radon concentrations were calculated assuming product equilibrium. The use of steel mill slag from ore originating in Greenland as a fill during construction is suspected to be the source of the excess radon levels. A residence built of granite yielded 0.88 pCi/l whereas a frame house gave 0.20 pCi/l. (BIO)(HQL)

CONCERN OVER RADON IN HOMES TRIGGERS PLAN FOR NATIONAL SURVEY

CHEMICAL & ENGINEERING NEWS, APR 28, 86, V64, N17, P19(2)

JOURNAL ARTICLE THE POSSIBILITY OF WIDESPREAD HUMAN EXPOSURE TO RADON GAS IS A FOCUS OF ATTENTION BECAUSE OF REPORTS OF EXTREMELY HIGH RADON LEVELS IN HOMES. RADON IS A PROBLEM BECAUSE ITS RADIOACTIVE DECAY PRODUCTS ARE SHORT-LIVED NUCLIDES THAT CAN BECOME DEPOSITED IN THE LUNGS AND LEAD TO LUNG CANCER. THE EPA OFFICE OF RADIATION PROGRAMS IS PLANNING A NATIONAL SURVEY OF RESIDENCES TO DEFINE THE SCOPE AND MAGNITUDE OF RADON EXPOSURE. THE PRIMARY OBJECTIVE IS TO DETERMINE WHAT THE AVERAGE LEVELS OF RADON ARE IN HOMES ON A NATIONAL BASIS. A FREQUENCY DISTRIBUTION OF THESE LEVELS WILL BE DEVELOPED SO THE AGENCY CAN BETTER SELECT REMEDIAL MEASURES. (ENV)

Distribution of airborne radon-222 concentrations in U.S. homes

Nero, A.V.; Schwehr, M.B.; Nazaroff, W.W.; Revzan, K.L.

California Air Resour. Board, Sacramento, CA 95816, USA
SCIENCE (WASH. VOL. 234, NO. 4779, pp. 992-997, Publ.Yr:
1986
Languages: ENGLISH

Apparently large exposures of the general public to the radioactive decay products of radon-222 present in indoor air have led to systematical appraisal of monitoring data from U.S. single-family homes; several ways of aggregating data were used that take into account differences in sample selection and season of measurements. The resulting distribution of annual-average radon-222 concentrations can be characterized by an arithmetic mean of 1.5 picocurie per liter (55 becquerels per cubic meter) and a long tail with 1 to 3% of homes exceeding 8 picocuries per liter, or by a geometric mean of 0.9 picocurie per liter and a geometric standard deviation of about 2.8. Available dose-response data suggest that an average of 1.5 picocuries per liter contributes about 0.3% lifetime risk of lung cancer and that, in the million homes with the highest concentrations, long-term occupants suffer an added lifetime risk of at least 2%, reaching extraordinary values at the highest concentrations observed. (POL)

Measurements and Interpretation of Indoor Aerosol Radioactivity by a Microcomputer System

Raunemaa, T., M. Olin, M. Hannikainen, M. Kulmala, and A. Hautojarvi

Journal of Aerosol Science, Vol. 17, No. 3, pages 268-270, 4 references

June 1986 CODEN: JALSB7

A microcomputer system was used to measure radioactivity variations indoors, which were interpreted on the basis of particle concentration measurements and radon daughter attachment modelling. Levels of both polonium-218 (15422749) and polonium-214 (15735678), and of polonium-214 alone were monitored indoors over several days. The levels increased ten fold (from 5 Bequerels/cubic meter to 50 Bequerels/cubic meter) at night when ventilation was turned off. The activity ratio of polonium-218 to polonium-214 was 1:1.25. For night/day relative radioactivity, a theoretical factor of 2.5 to 5 was estimated, and the actual experimental values ranged from 5 to 8. During weekends, when ventilation was off, radioactivity levels correlated with relative humidity outdoors but were unrelated to outdoor temperature or atmospheric pressure. Introducing pump oil aerosol into the study volume increased the aerosol radioactivity by a factor of ten. Aerosol radioactivity was lowered by a small fresh air vent. The authors conclude that this system provides a reliable and low cost analytical method for continuous detection of radioactivity. (OSH)

IV. SURVEYS

A. NATIONAL

1 U.S. REGIONAL WEST

Radon Monitoring Results from BPA'S Residential Weatherization Program: Report No. 6

Portions of this document are illegible in microfiche products. Original copy available until stock is exhausted.

NTIS Prices: PC A03/MF A01

Bonneville Power Administration, Portland, OR.

Corp. Source Codes: 025155000; 9512400

Sponsor: Department of Energy, Washington, DC.

Report No.: DOE/BP-900

Oct 87 26p

Languages: English

NTIS Prices: PC A03/MF A01 Journal Announcement: GRAI8813; NSA1300

Country of Publication: United States

This report provides a summary of all the data collected for the States of Oregon, Washington, Idaho, and Montana. Specific data is listed by US Geological Survey designated range and township locations. The specific data listed by range and township includes only those townships with a minimum of five radon readings. The radon measurement results contained in this report were conducted by passive alpha-track detectors. The Residential Weatherization Program requires that the detectors be placed in residence for a minimum of 3 winter months, up to 1 year in length. Due to the variations in the length of measurements, we have added a section to this report which lists the average radon values for given exposure periods. 6 figs. (ERA citation 13:016161) (NTIS)

A SUMMARY OF KANSAS USA INDOOR RADON SCREENING RESULTS

GUINN L A

1902A KENTUCKY ST., LAWRENCE, KANS. 66044.

THIRTY-SECOND ANNUAL MEETING OF THE HEALTH PHYSICS SOCIETY, SALT LAKE CITY, UTAH, USA, JULY 5-9, 1987. HEALTH PHYS 52 (SUPPL. 1). 1987.

CODEN: HLTPA

Language: ENGLISH

Document Type: CONFERENCE PAPER

Subfile: BARRM (Biological Abstracts/RRM)

A summary of results for indoor radon done by the State of Kansas and private radon monitoring companies has been compiled. The results are compared to major population centers and the EPA's map of projected areas of high radon concentrations. Although not a statistically significant sampling, the results do indicate that Kansas has homes with indoor radon concentrations above the recommended guidelines, but not in the unusually high range. (BIO)(AUTH)

Seasonal variation of indoor Rn at a location in the southwestern United States [published erratum appears in Health Phys 1987 Aug;53(2):201]

Wilkening M; Wicke A

Health Phys Oct 1986, 51 (4) p427-36, ISSN 0017-9078

Journal Code: G2H

Languages: English

Radon-222 concentrations have been measured in 12 homes typical of a small town in the southwestern United States. Nine of the houses, in which both summer and winter data are available, have an annual mean of 63 ± 18 Bq m⁻³ (1.7 ± 0.5 pCi L⁻¹) and a range of 41 to 96 Bq m⁻³ (1.1 to 2.6 pCi L⁻¹). These results were obtained with passive Rn dosimeters using polycarbonate nuclear track detector foils. The overall results fall slightly above the middle of the range of values obtained in other studies in the United States. Winter levels clearly exceed summer by a factor of from two to three. This result is attributed primarily to wide use of evaporative air conditioners for daytime cooling in the summer together with the fact that doors and windows are left open frequently during evening and nighttime hours. Both practices enhance the exchange of outdoor air with indoor air contributing to a decrease in the indoor Rn levels during the summer season. Room-to-room differences were evident during the winter season only. Bedrooms and bathrooms were generally higher in Rn than kitchens and living rooms but by only about 25%. The two adobe houses in the group showed higher Rn concentrations during the winter season than did those of frame-stucco, concrete, or cinder block construction. Dose equivalent calculations yielded a mean figure of 0.29 WLM y⁻¹ for typical occupancy patterns in these New Mexico houses. (MED)

INDOOR AND SOIL RADON MEASUREMENTS IN THE ALBUQUERQUE NEW-MEXICO USA AREA

BROOKINS D G

DEP. GEOLOGY, UNIV. NEW MEXICO, ALBUQUERQUE, NM 87131.

HEALTH PHYS 51 (4). 1986. 529-533. CODEN: HLTPA

Language: ENGLISH

Subfile: BARRM (Biological Abstracts/RRM)

A study was undertaken in the winter of 1983-84 to gather data for Rn gas in soils and inside dwellings in the Albuquerque, NM, area. The study was restricted to 15 dwellings with one to two Rn determinations inside each dwelling and two soil Rn determinations per dwelling yard. (BIO) (AUTH)

IV. SURVEYS

A. NATIONAL

2 U.S. REGIONAL EAST

Niagara Falls Storage Site, Annual Site Environmental Report, Lewiston, New York, Calendar Year 1986: Surplus Facilities Management Program (SFMP)

Portions of this document are illegible in microfiche products. Original copy available until stock is exhausted.

NTIS Prices: PC A05/MF A01

Bechtel National, Inc., Oak Ridge, TN.

Corp. Source Codes: 076493000; 9514952

Sponsor: Department of Energy, Washington, DC.

Report No.: DOE/OR/20722-150

Jun 87 79p

Languages: English

NTIS Prices: PC A05/MF A01 Journal Announcement: GRAI8722; NSA1200

Country of Publication: United States

Contract No.: AC05-81OR20722

During 1986, the environmental monitoring program was continued at the Niagara Falls Storage Site (NFSS), a US Department of Energy (DOE) surplus facility located in Niagara County, New York, presently used for the interim storage of radioactive residues and contaminated soils and rubble. The monitoring program is being conducted by Bechtel National, Inc. The monitoring program at the NFSS measures radon gas concentrations in air; external gamma radiation levels; and uranium and radium concentrations in surface water, groundwater, and sediment. To verify that the site is in compliance with the DOE radiation protection standard and to assess its potential effect on public health, the radiation dose was calculated for the maximally exposed individual. Based on the conservative scenario described in the report, this individual would receive an annual external exposure approximately equivalent to 6% of the DOE radiation protection standard of 100 mrem/yr. By comparison, the incremental dose received from living in a brick house versus a wooden house is 10 mrem/yr above background. The cumulative dose to the population within an 80-km (50-mi) radius of the NFSS that would result from radioactive materials present at the site would be indistinguishable from the dose that the same population would receive from naturally occurring radioactive sources. Results of the 1986 monitoring show that the NFSS is in compliance with the DOE radiation protection standard. 14 refs., 11 figs., 14 tabs. (ERA citation 12:032532) (NTIS)

Monitoring Radon Reduction in Clinton, New Jersey Houses
Prepared in cooperation with Camroden Associates, Rome, NY.
NTIS Prices: PC A02/MF A01
Osborne, M.C.; Brennan, T.; Michaels, L.D.
Research Triangle Inst., Research Triangle Park, NC.
Corp. Source Codes: 045968000
Sponsor: Camroden Associates, Rome, NY.
Report No.: EPA/600/D-87/162
May 87 15p
Languages: English
NTIS Prices: PC A02/MF A01 Journal Announcement: GRAI8717
Country of Publication: United States
Contract No.: EPA-68-02-3992

The paper discusses EPA experience in monitoring radon reduction in Clinton, NJ, houses. Both the temperature-driven stack effect and typical household appliances (e.g., furnaces, whole-house fans, clothes dryers, and bathroom fans) were observed to reduce indoor pressure and potentially increase radon levels. Radon measurements obtained during cold weather, after residential heating systems were back in full operation, showed that the radon reduction techniques that were applied had been effective and that radon concentrations were significantly reduced. Although both grab sample and continuous monitor measurements were helpful in assessing radon entry sites and hour-to-hour fluctuations, respectively, only charcoal canister data collected under near-winter conditions could be used as a valid comparison with earlier March/April 1986 generated pre-radon reduction data. (NTIS)

GAMMA-RAY EXPOSURE LEVELS IN READING PRONG PENNSYLVANIA USA BASEMENTS BY HOUSE CHARACTERISTICS

ANAST G A; GOUN B D; GERUSKY T M; REILLY M A; STEBBINGS J H; DIGNAM J J

DIV. BIOLOGICAL MED. RES., ARGONNE NATL. LAB., ARGONNE, ILL. 60439.

THIRTY-SECOND ANNUAL MEETING OF THE HEALTH PHYSICS SOCIETY, SALT LAKE CITY, UTAH, USA, JULY 5-9, 1987. HEALTH PHYS 52 (SUPPL. 1). 1987.

S71-S72. CODEN: HLTPA

Language: ENGLISH

Document Type: CONFERENCE PAPER

Subfile: BARRM (Biological Abstracts/RRM)

Gamma-ray measurement (uR/h) in basements of 1654 Reading Prong residences were correlated with house characteristics to determine whether gamma-ray exposures can be significant confounders in studies of the carcinogenic effects of radon daughter exposure. (BIO) (AUTH)

INDOOR RADON LEVELS IN CUMBERLAND COUNTY PENNSYLVANIA USA
COHEN B L; NASON R
UNIV. PITTSBURGH, PITTSBURGH, PENNSYLVANIA 15260, USA.
ENVIRON INT 13 (3). 1987. 293-298. CODEN: ENVID
Language: ENGLISH
Subfile: BA (Biological Abstracts)

Measurements were made of radon levels in 165 randomly selected homes in Cumberland County, PA during Winter 1984-1985. The average and mean levels were found to be 9.1 ± 0.7 pCi/L and 6.3 ± 0.5 pCi/L, respectively, many times normally encountered levels. Average and mean radon levels are reported vs. various house characteristics. (BIO)(AUTH)

Measurements of radon concentrations in residential buildings in the eastern United States
George, A.C.; Hinchliffe, L.E.; Hopke, P.K. (ed.)
Environ. Meas. Lab., US DOE, New York, NY 10014, USA
191. Meeting of the American Chemical Society New York, NY (USA) 13-18 Apr 1986
RADON AND ITS DECAY PRODUCTS. OCCURRENCE, PROPERTIES AND HEALTH EFFECTS
pp. 42-62, Publ.Yr: 1987
AMERICAN CHEMICAL SOCIETY, WASHINGTON, DC (USA)
SUMMARY LANGUAGE - ENGLISH; ACS 331.
Languages: ENGLISH

As part of a program to develop and test radon survey techniques, passive activated carbon samplers were used to measure radon concentrations in 380 buildings in six states in the eastern United States. Measurements were made in the basement and living areas of each residential building, and in some work locations of several plant buildings during summer and winter. The activated carbon samplers performed well in these tests, and the logistics via U.S. mail were satisfactory. The lowest concentrations of radon were found in: Long Island, NY, Luzerne County, PA, and South Carolina. (POL)

Review of Radiological Surveys of the General Services Administration's Raritan Depot in Edison, New Jersey
Portions of this document are illegible in microfiche products. Original copy available until stock is exhausted.
NTIS Prices: PC A02/MF A01
Herzenberg, C. L. ; Winter, R. C.
Argonne National Lab., IL.
Corp. Source Codes: 001960000; 0448000

Sponsor: Department of Energy, Washington, DC.
Report No.: ANL/EES-TM-331
Oct 86 14p
Languages: English
NTIS Prices: PC A02/MF A01 Journal Announcement: GRAI8723;
NSA1200
Country of Publication: United States
Contract No.: W-31109-ENG-38

This report reviews two recent radiological surveys of the General Services Administration (GSA) Raritan Depot in Edison, New Jersey, that were conducted after somewhat elevated levels of radiation were detected within a depot building. The first survey indicated gamma radiation levels were higher than natural background levels in some buildings and identified the probable source of the radiation as gypsum-like building tiles that contained natural uranium-chain radionuclides at a level 20 times higher than other materials. Elevated levels of radon and radon decay products also were detected in some buildings. A follow-on survey was conducted to confirm the January measurements and to measure radiation levels at other locations: additional buildings at the depot, buildings on the Middlesex County College campus, and a possible outdoor disposal site. EPA measurements established that ceiling material is the primary source of the radiation. Radioisotope analysis of the ceiling tile material from buildings with elevated radiation levels showed the presence of radium-226 at levels of approximately 25 picocuries per gram (pCi/g); this material would thus have to be treated as hazardous waste, should it be removed. This report critiques the methodology and results of the two surveys and recommends further action. (ERA citation 12:033665) (NTIS)

Aerial Survey Efforts in the Search for Radon Contaminated Houses in the Reading Prong Area Near Boyertown, PA
American Nuclear Society annual meeting, Bethesda, MD, USA, 15 Sep 1986.
NTIS Prices: PC A02/MF A01
Hoover, R.A.; Mateik, D.E.
EG and G Energy Measurements, Inc., Suitland, MD.
Washington Aerial
Measurements Dept.
Corp. Source Codes: 088128001; 9521513
Sponsor: Department of Energy, Washington, DC.
Report No.: EGG-10282-1127; CONF-8609147-11
15 Sep 86 7p
Languages: English Document Type: Conference proceeding
NTIS Prices: PC A02/MF A01 Journal Announcement: GRAI8712;
NSA1200
Country of Publication: United States
Contract No.: AC08-83NV10282

At the request of the Commonwealth of Pennsylvania, the Department of Energy requested EG and G Energy Measurements to fly an aerial radiological survey over a portion of the Reading Prong near Boyertown, Pennsylvania. The survey goal was to help locate regions where buildings contained elevated levels of radon gas. A 250 km² area was surveyed. A number of sites were located. These sites correlated fairly well with known geologic faults in the area. 4 refs., 1 fig. (ERA citation 12:010112) (POL)

A COMPARISON OF RADON LEVELS IN CHICAGO AND PENNSYLVANIA HOUSES (ENGLISH)

TOOHEY RE; ESSLING MA; MARKUN F

ARGONNE NATL LAB, DIV BIOL & MED RES/ARGONNE//IL/60439
HEALTH PHYSICS, V50, S1, PS 59, 1986

Indoor levels of ²²²Rn have been measured in 144 single-family houses in the Chicago area and in 160 houses in eastern Pennsylvania, located in the vicinity of Bloomsburg (not on the Reading Prong). In Chicago, grab samples of air were collected in evacuated aerosol cans and then transferred to Lucas flasks for counting. The Pennsylvania radon levels were measured primarily with commercial "Track-Etch" detectors; a few grab samples were also taken. (SCI) (AUTH)

INDOOR RADON IN THE READING PRONG IN PENNSYLVANIA USA

ANON

THIRTY-FIRST ANNUAL MEETING OF THE HEALTH PHYSICS SOCIETY, PITTSBURGH, PA., USA, JUNE 29-JULY 3, 1986. HEALTH PHYS 50 (SUPPL. 1). 1986. S91.

CODEN: HLTPA

Language: ENGLISH

Document Type: CONFERENCE PAPER

Subfile: BARRM (Biological Abstracts/RRM)

Since late December 1984, the Pennsylvania Department of Environmental Resources, Bureau of Radiation Protection has been engaged in an intense effort to find those houses in the Reading Prong which present increased health risk due to indoor radon. The Reading Prong is a physiographic province underlying portions of Berks, Bucks, Lehigh and Northampton counties. (BIO) (AUTH)

IV. SURVEYS

A. NATIONAL

3 U.S. REGIONAL SOUTH

LEVELS OF RADON-222 AND ITS SHORT-LIVED PROGENY IN ALABAMA USA HOUSES

DUDNEY C S; HAWTHORNE A R; WALLACE R G; REED R P
HEALTH AND SAFETY RES. DIV., OAK RIDGE NATL. LAB., OAK
RIDGE, TENN. 37831.
HEALTH PHYS 54 (1). 1988. 89-92. CODEN: HLTPA
Language: ENGLISH
Subfile: BARRM (Biological Abstracts/RRM)

Preliminary results from an ongoing indoor air quality study of 70 houses in four southeastern states have revealed elevated indoor levels of Rn** and its short-lived progeny in some houses in Alabama. Reported here are Rn and Rn progeny results from summer and fall measurements made in 34 houses in Alabama. (BIO) (AUTH)

SURVEY OF RADON IN NORTH-CAROLINA HOMES (ENGLISH)

WATSON JE; ADAMS WC; FONG SW; NEWMAN HJ
UNIV N CAROLINA, DEPT ENVIRONM SCI & ENGN/CHAPEL
HILL//NC/27514; DEPT HUMAN RESOURCES, RADIAT PROTECT
SECT/RALEIGH//NC/27603
HEALTH PHYSICS , V52, S1, PS 70, 1987

A state-wide survey of radon in North Carolina homes was conducted using charcoal canisters to measure radon concentrations. Each charcoal canister consisted of a 10cm diameter tin canister, 2.9 cm deep, filled with 70 g of activated charcoal. A perforated brass screen and retainer ring hold the charcoal in place. For calibration, canisters were exposed to known radon concentrations at the U.S. Environmental Protection Agency's Eastern Environmental Radiation Facility. (SCI) (AUTH)

Indoor Air Quality in 300 Homes in Kingston/Harriman, Tennessee: Winter Phase Status Report

Portions of this document are illegible in microfiche products.

NTIS Prices: PC A07/MF A01

Hawthorne, A.R.; Uziel, M.; Vo-Dinh, T.; Cohen, M.A.;
Orebaugh, C.
Oak Ridge National Lab., TN.
Corp. Source Codes: 021310000; 4832000
Sponsor: Department of Energy, Washington, DC.
Report No.: ORNL/TM-10104
Oct 86 141p
Languages: English
NTIS Prices: PC A07/MF A01 Journal Announcement: GRAI8709;
NSA1200
Country of Publication: United States
Contract No.: AC05-84OR21400

This report summarizes the status of the 300-Home Kingston/Harriman Indoor Air Quality Study at the end of the winter phase of monitoring. Plans for the summer monitoring phase are also presented. The report is organized by the major pollutants monitored. Reporting focuses on study protocols and summaries of winter monitoring activities. A minimum of results are presented since, for many pollutants, laboratory analyses are not yet complete. (ERA citation 12:001640) (NTIS)

Indoor pollutants in 70 houses in the Tennessee Valley area:
Study design and measurement methods
Dudney, C.S.; Matthews, T.G.; Dreibelbis, W.G.; Hawthorne, A.R.; Thompson, C.V.
Oak Ridge Natl. Lab., Oak Ridge, TN, USA
Symposium on Measurement of Toxic Air Pollutants Raleigh, NC (USA) 27 Apr 1986
Publ.Yr: 1986
NTIS, SPRINGFIELD, VA (USA)
SUMMARY LANGUAGE - ENGLISH; DE86009506/GAR.
Languages: ENGLISH

Levels of nitrogen dioxide, formaldehyde, vapor-phase polynuclear aromatic hydrocarbon compounds, respirable particles, radon and other parameters related to indoor air quality are being measured with passive monitors in a year-long study of indoor air quality in 70 houses in the Tennessee Valley area. Criteria for house selection included presence of a lower level with cement floor and one or more block walls in contact with the soil and proximity to one of four cities in the region. By design, most of the houses in the study are in the same neighborhood as at least one other house in the study. Houses range in age from newly constructed to about forty years old, typically have more than 2000 square feet of finished floor space, and encompass a garage in the lower level in most cases. (POL)

Experimental Protocol and Preliminary Results of Air Infiltration Rate Measurements in Tennessee Valley Homes
Air Pollution Control Association annual meeting and exhibition, Minneapolis, MN, USA, 22 Jun 1986.

Portions of this document are illegible in microfiche products.

NTIS Prices: PC A02/MF A01

Hawthorne, A.R.; Dudney, C.S.; Matthews, T.G.; Monar, K.P.; Quillen, J.L.

Oak Ridge National Lab., TN.

Corp. Source Codes: 021310000; 4832000

Sponsor: Tennessee Univ., Knoxville.; Department of Energy, Washington, DC.

Report No.: CONF-860606-1

1986 12p

Languages: English Document Type: Conference proceeding

NTIS Prices: PC A02/MF A01 Journal Announcement: GRAI8619; NSA1100

Country of Publication: United States

Contract No.: AC05-84OR21400

The principal objective of this multipollutant indoor air quality study focuses on measurement of radon and radon progeny. Details of the radon monitoring component and the chemical pollutant monitoring aspects of the study and associated experimental methods have been recently described. Seventy houses throughout the Tennessee Valley area are included in the study. Six houses are in Oak Ridge, Tennessee; nine houses are in Chattanooga, Tennessee; five houses are in Rossville, Georgia (near Chattanooga); four houses are near Tupelo, Mississippi; eight houses are near Florence, Alabama; eight houses are in Huntsville, Alabama; and thirty houses are in the Birmingham, Alabama, area. Ten of the thirty houses in Birmingham are 'energy efficient' houses as defined by the local utility conservation program. With the exception of some of the energy efficient houses in Birmingham, all other houses have a basement level and a living space above this level. Some houses have this lower level as a conditioned living space; others do not. Only houses with basement levels were included in the main component of the study due to design objectives related to radon monitoring. Ten 'energy efficient' houses were added to the originally selected 60 houses to allow comparison between these homes and more typical houses in the study. (ERA citation 11:032709) (NTIS)

Radon and Radon Progeny in 70 Houses in the Tennessee Valley Area: Study Design and Measurement Methods

APCA specialty conference on indoor radon, Philadelphia, PA, USA, 24 Feb 1986.

Portions of this document are illegible in microfiche products.

NTIS Prices: PC A02/MF A01

Dudney, C.S.; Hawthorne, A.R.; Monar, K.P.; Quillen, J.L.; Clark, C.

Oak Ridge National Lab., TN.

Corp. Source Codes: 021310000; 4832000

Sponsor: Department of Energy, Washington, DC.

Report No.: CONF-860277-1

1986 10p

Languages: English Document Type: Conference proceeding

NTIS Prices: PC A02/MF A01 Journal Announcement: GRAI8617; NSA1100

Country of Publication: United States

Contract No.: AC05-84OR21400

Levels of radon and its short-lived airborne progeny are being measured in a year-long study of 70 houses in four states in the Tennessee Valley. Various methods were used to solicit volunteers with differing degrees of success. Criteria for selection of houses in the study included presence of a lower level with cement floor and one or more block walls in contact with the soil, absence of obvious indications of technologically enhanced sources of radium, and proximity to one of four cities (Knoxville, Chattanooga, Birmingham, or Florence). By design, most houses in the study are in the same neighborhood as at least one other house in the study. Houses range in age from newly constructed to about 40 years old. Most of the houses have more than 2000 square feet of finished floor space. The lower level encompasses a garage in most cases. More complete information pertaining to house characteristics will be gathered in the course of the study. 19 refs., 1 fig. (ERA citation 11:023909) (NTIS)

An indoor air quality study of 40 east Tennessee homes

Hawthorne, A.R.; Gammage, R.B.; Dudney, C.S.; Berglund, B.; Berglund, U.; Lindvall, T.; Spengler, J.; Sundell, J. (eds.)

Health and Saf. Res. Div., Oak Ridge Natl. Lab., Oak Ridge, TN, USA

3. International Conference on Indoor Air Quality and Climate Stockholm (Sweden) 1984

ENVIRON. INT VOL. 12, NO. 1-4, pp. 221-239, Publ.Yr: 1986

SUMMARY LANGUAGE - ENGLISH

Languages: ENGLISH

Journal Announcement: V19N2

Over a 1-yr period, measurements of indoor air pollutants (CO sub(x), NO sub(x), formaldehyde, volatile organics, particulate matter, and radon) were made in 40 homes in east

Tennessee. The houses were of various ages with different types of insulation and heating. Sixty percent of the houses exceeded 100 nL/L of formaldehyde on at least one occasion. Over the duration of the study, houses older than 5 yr averaged 40 nL/L of formaldehyde while houses less than 5 yr old averaged 80 nL/L. The highest concentration of formaldehyde was 400 nL/L, measured in a new home. The highest levels of formaldehyde were usually recorded during summer months. The concentration of various organics in indoor air was at least tenfold higher than in outdoor air. Carbon monoxide and nitrogen oxides were usually < 2 μ L/L and < 20 nL/L, respectively, except when gas stoves or kerosene space heaters were operating, or when a car was running in the garage. (ENV)

IV. SURVEYS

B. INTERNATIONAL

1 ASIA

Indoor concentrations of ^{220}Rn and its decay products.

Katase A; Matsumoto Y; Sakae T; Ishibashi K

Department of Nuclear Engineering, Kyushu University,
Fukuoka, Japan.

Health Phys (UNITED STATES) Mar 1988, 54 (3) p283-6, ISSN
0017-9078

Journal Code: G2H

Languages: ENGLISH

The distribution of ^{220}Rn atoms in a room was derived from the diffusion equation. The activity concentrations of ^{212}Pb and ^{212}Bi were obtained in relation to ^{220}Rn exhalation rate from a concrete wall. Near the surface of the concrete wall, the radiation exposure due to inhalation of ^{220}Rn decay products may be significant in some cases. (MED)

RADON CONCENTRATIONS IN JAPANESE HOUSES AND CORRELATING FACTORS (ENGLISH)

YONEHARA H; AOYAMA T; MIFUNE M; KATO H; SAKANOUÉ M

RADIAT EFFECTS RES FDN/HIROSHIMA 730//JAPAN/; SHIGA
UNIV MED

SCI/OTSU/SHIGA 52021/JAPAN/; OKAYAMA UNIV, MISASA BRANCH
HOSP/MISASA/TOTTORI 68202/JAPAN/; KANAZAWA
UNIV, LLRL/TATSUNOKUCHI/ISHIKAWA 92312/JAPAN/

JOURNAL OF RADIATION RESEARCH , V29, N1, P26-26, 1988

Correlations between the concentration and various factors were analyzed. The factors analyzed were regional differences, construction materials, purpose of the room, age of the house, ventilation in the room, use of air conditioners or heaters, number of floors etc. From the results of the studies, the factors related to regional differences and construction materials were found to have the obvious correlations. (SCI) (AUTH)

INDOOR RADON-222 MEASUREMENTS IN THE REGION OF BEIJING CHINA
REN T; LIN L; CHEN Z; LI G; CHEN A
LAB. IND. HYGIENE, MPH, 2 XINKANG ST., DESHENG MENWAI,
BEIJING, ROC.
HEALTH PHYS 53 (3). 1987. 219-226. CODEN: HLTPA
Language: ENGLISH
Subfile: BA (Biological Abstracts)

Passive integrating activated C detectors were used to study the regional distribution and temporal variation of ^{222}Rn in indoor air in dwellings in the Beijing region. Measurements were made in 537 dwellings, which were either detached houses or multi-family apartments. The city-wide study was completed in 1985. The distributions are approximately log-normal with 90% of the dwellings having ^{222}Rn levels less than 60 Bq m^{-3} . The weighted average ^{222}Rn concentration has been found to be 22.4 Bq m^{-3} . Averages for detached houses and multi-family dwellings are 25.9 and 15.2 Bq m^{-3} , respectively. Assuming an equilibrium factor of 0.5 and an occupancy factor of 0.8 , the average equilibrium equivalent concentration of ^{222}Rn progeny is 11.2 Bq m^{-3} and the annual average effective dose equivalent is 1.1 mSv . (BIO)

MEASUREMENT OF INDOOR RADON CONCENTRATIONS IN KUWAIT
MUSTAFA A A; VASISHT C M; SABOL J
DEP. RADIOLOGY, FAC. MED., KUWAIT UNIV., P.O. BOX 24923,
SAFAT, POST CODE 13110, KUWAIT.
ENVIRON INT 13 (4-5). 1987. 323-330. CODEN: ENVID
Language: ENGLISH
Subfile: BA (Biological Abstracts)

Values of indoor radon concentrations averaged over one year has been determined in 60 dwellings mainly located in the coastal part of Kuwait. All dwellings were monitored using the track-etch method. The monitors used were replaced every 3 months to detect seasonal variations. Mean values of 41 , 43.5 , 42.5 and 41.3 Bq/m^3 were measured during autumn, winter, spring, and summer, respectively. The highest concentration in the survey, 103 Bq/m^3 was repeatedly measured during winter and spring, indicating lower ventilation rates. Separate data distributions for different floor levels shows mean Rn concentrations of 54.4 , 48.4 , 44 , 41 and 31.3 Bq/m^3 in the basement and on the ground, first, second and third floors, respectively. The overall mean Rn concentration from the whole study was 41.3 Bq/m^3 , which is equivalent to 5.58 mWL . Assuming an equilibrium factor of 0.5 , and an occupancy factor of 0.8 , the average exposure to the short-lived daughters of radon-222 of a member of Kuwait population is 0.228 WLM/yr . This is equal to an effective dose equivalent of 2.28 mSv , which is very close to the effective dose equivalent from natural radiation amounting to 2

mSv/yr. It is expected that further reduction in indoor ventilation, for the purpose of energy saving, will cause an increase in population radiation doses. (BIO)

INDOOR AND OUTDOOR RADON-222 AND RADON-220 DAUGHTERS IN HONG KONG

TSO M-Y W; LI C-C

RADIOISOTOPE UNIT, UNIV. HONG KONG, POKFULAM RD., HONG KONG.
HEALTH PHYS 53 (2). 1987. 175-180. CODEN: HLTPA

Language: ENGLISH

Subfile: BARRM (Biological Abstracts/RRM)

In Hong Kong most people live and work in high-rise buildings, unlike other less densely populated places where relatively more people work and live in houses resting directly on the Earth's crust. However, because of its hot and humid weather, closed air conditioning is not uncommon now in Hong Kong. Under these unique conditions, it was of general interest to measure the indoor ^{222}Rn and ^{220}Rn levels. A small-scale survey was undertaken on the University of Hong Kong campus. (BIO) (AUTH)

INDOOR RADON DAUGHTER CONCENTRATION IN CHIBA AREA - RESULT OF PRELIMINARY WINTER SURVEY BY ACTIVE GRAB-SAMPLING MEASUREMENT (ENGLISH)

KOBAYASHI S; IWASAKI T; ICHIKAWA M; FUJIMOTO K

NATL INST RADIOL SCI/CHIBA 260//JAPAN/ JOURNAL OF RADIATION RESEARCH , V27, N1, P60-60, 1986

Indoor radon daughter concentration was measured in various types of houses and homes within Chiba area by means of grab-sampling active measurement according to the method of Thomas. A linear relationship was observed between equilibrium equivalent radon concentration and cumulative percentage of houses on log-normal pobit scale. (SCI) (AUTH)

RADON IN SAUDI HOUSES (ENGLISH)

ABUJARAD F; ALJARALLAH MI

UNIV PETR & MINERALS, DEPT PHYS/DHAHRAN 31261//SAUDI ARABIA/
RADIATION PROTECTION DOSIMETRY , V14, N3, P243-249, 1986

A total of 637 passive radon dosimeters (CR-39 nuclear track detectors in a closed chamber) were used in a survey in 400 houses in Saudi Arabia. This survey is the first in Saudi Arabia (a hot climate) and can usefully be compared with similar surveys in countries with cold climates. (SCI)

IV. SURVEYS

B. INTERNATIONAL

2 EUROPE

Indoor ^{222}Rn measurements in Sweden with the solid-state nuclear track detector technique.

Jonsson G

Department of Physics, University of Lund, Sweden.

Health Phys (UNITED STATES) Mar 1988, 54 (3) p271-81, ISSN 0017-9078

Journal Code: G2H

Languages: ENGLISH

Measurements of the indoor radon and radon daughter concentrations were performed in several thousand Swedish houses during the years 1979-1984 with the solid state nuclear track detector technique (SSNTD technique). The investigation focused on structures containing building materials of light-weight concrete with enhanced amounts of U. The detectors used nuclear track films exposed for 1 mo. The film basically measures total airborne alpha activity but may be calibrated in units of EER in an environment with known ^{222}Rn and daughter concentrations. (EER is here the equilibrium equivalent concentration of Rn with the equilibrium factor $F = 0.5$.) The investigation was performed in various municipalities in collaboration with the local public health and environmental authorities. The investigation included 6700 individual measurements in detached (single-family) houses as well as in apartment houses. A small percentage of the dwellings exhibited Rn daughter concentrations (EER) exceeding 400 Bq m^{-3} . It was found in detached houses that the concentrations were higher in the basement floor than in the entrance floor of a house. The Rn daughter values in the bedrooms were similar to values in any other room (mainly on the same floor) of the structure. The Rn daughter levels in apartment houses were lower than in single-family houses. The seasonal variations of the Rn daughter levels are presented and show that the levels in summertime are approximately equal to the levels in the winter. (MED)

**INDOOR RADON-222 MEASUREMENTS IN SWEDEN WITH THE SOLID-STATE
NUCLEAR TRACK DETECTOR TECHNIQUE**

JONSSON G

DEP. PHYSICS, UNIV. LUND, SOLVÉGATAN 14, S-223 62 LUND,
SWEDEN.

HEALTH PHYS 54 (3). 1988. 271-282. CODEN: HLTPA

Language: ENGLISH

Measurements of the indoor radon and radon daughter concentrations were performed in several thousand Swedish houses during the years 1979-1984 with the solid state nuclear track detector technique (SSNTD technique). The investigation focused on structures containing building materials of light-weight concrete with enhanced amounts of U. The detectors used nuclear track films exposed for 1 mo. The film basically measures total airborne .alpha. activity but may be calibrated in units of EER in an environment with known 222Rn and daughter concentrations. (EER is here the equilibrium equivalent concentration of Rn with the equilibrium factor $F = 0.5$). The investigation was performed in various municipalities in collaboration with the local public health and environmental authorities. The investigation included 6700 individual measurements in detached (single-family) houses as well as in apartment houses. A small percentage of the dwellings exhibited Rn daughter concentrations (EER) exceeding 400 Bq m⁻³. It was found in detached houses that the concentrations were higher in the basement floor than in the entrance floor of a house. The Rn daughter values in the bedrooms were similar to values in any other room (mainly on the same floor) of the structure. The Rn daughter levels in apartment houses were lower than in single-family houses. The seasonal variations of the Rn daughter levels are presented and show that the levels in summertime are approximately equal to the levels in the winter. (BIO)

**Radon on Mors Island. An Investigation of Virtual
Relationship Between Radon Concentration in Indoor Air and
the Local Geology in a Selected Area on Mors**

In Danish.

U.S. Sales Only.

NTIS Prices: PC A04/MF A01

Damkjaer, A.; Korsbech, U.

Technical Univ. of Denmark, Lyngby. Afdelingen for
Elektrofysik.

Corp. Source Codes: 014560023; 9800028

Report No.: NEI-DK-34

Mar 87 55p

Languages: Danish

NTIS Prices: PC A04/MF A01 Journal Announcement: GRAI8805;
NSA1200

Country of Publication: Denmark

The indoor ²²²Rn-concentration has been measured in 50 dwellings in a rural district on the Danish island Mors. In addition the radon-exhalation from the ground was measured in close vicinity of the houses. Also, samples of the surface soil has been analyzed for the radium and thorium content and for radon/emanation. The aim of the work has been to search for a possible correlation between the local geology and the indoor radon-concentration. Specifically a correlation was expected between the local deposits of a radium-rich paleocene clay and the indoor radon-concentration. As a result, no correlation has been found neither between the deposits of the radium-rich clay and the indoor radon-concentration, nor between any pair of the measured parameters. However, the southern part of the district shows a significant higher indoor radon-concentration compared to the northern part. This correlates with the limestone deposits which in the southern part of the district come close to the surface. Hence an indication has been found that the limestone deposits act as a transport channel for radon or as a source for enhanced radon-levels in the dwellings. (ERA citation 12:050239) (NTIS)

Radon-222 in Norwegian dwellings

Stranden, E.; Hopke, P.K. (ed.)

Natl. Inst. Radiat. Hyg., P.O. Box 55, N-1345 Oesteraas, Norway 191. Meeting of the American Chemical Society New York, NY (USA) 13-18 Apr 1986

RADON AND ITS DECAY PRODUCTS. OCCURRENCE, PROPERTIES AND HEALTH EFFECTS

pp. 70-83, Publ.Yr: 1987

AMERICAN CHEMICAL SOCIETY, WASHINGTON, DC (USA)

SUMMARY LANGUAGE - ENGLISH; ACS 331.

Languages: ENGLISH

Results of Rn-222 measurements in 1500 dwellings in 75 municipalities in Norway are reported. The study was conducted to assess geographical variations in Rn-222 concentrations and to assess the relative importance of the different sources. The population average indoor Rn-222 concentration is assessed to be 80-100 Bq super(-3). The equilibrium factor was studied in 58 dwellings and a factor of 0.5 was found to be representative for Norwegian dwellings. About 1% of Norwegian dwellings are expected to have Rn-222 concentrations exceeding 800 Bqm super(-3) (4000 Bqm super(-3) Rn-222 progeny). The highest values occur in alum shale and granite areas, and bedrock and subsoil are the dominating radon sources. In a pilot investigation, the radon exposure in dwellings was correlated against lung cancer incidence and smoking habits data from the Norwegian Cancer Registry. (POL)

Radon levels in Swedish homes: A comparison of the 1980s with the 1950s

Swedjemark, G.A.; Buren, A.; Mjoenes, L.; Hopke, P.K. (ed.)
Natl. Inst. Radiat. Prot., Box 60204, S-104 01 Stockholm, Sweden

191. Meeting of the American Chemical Society New York, NY (USA)

13-18 Apr 1986

RADON AND ITS DECAY PRODUCTS. OCCURRENCE, PROPERTIES AND HEALTH EFFECTS pp. 84-96, Publ.Yr: 1987

AMERICAN CHEMICAL SOCIETY, WASHINGTON, DC (USA)

SUMMARY LANGUAGE - ENGLISH

Languages: ENGLISH

In 1980-82 a study was carried out on Swedish homes built before 1976. The aim was to provide averages and distributions for the radon exposure of the Swedish population. Correlations with parameters such as building materials and building periods were also investigated. (POL)

Population doses in Ireland

McLaughlin, J.P.; Hopke, P.K. (ed.)

Phys. Dep., Univ. Coll. Dublin, Belfield, Dublin 4, Eire

191. Meeting of the American Chemical Society New York, NY (USA)

13-18 Apr 1986

RADON AND ITS DECAY PRODUCTS. OCCURRENCE, PROPERTIES AND HEALTH EFFECTS

pp. 113-123, Publ.Yr: 1987

AMERICAN CHEMICAL SOCIETY, WASHINGTON, DC (USA)

SUMMARY LANGUAGE - ENGLISH

Languages: ENGLISH

Indoor air radon concentrations measured in a randomly selected sample of 220 Irish houses have been found to range from about 20 Bq/m super(3) to as high as 1740 Bq/m super(3) with a median value of 61 Bq/m super(3). Using current dose estimation methods the estimated effective dose equivalents due to radon daughter inhalation in these houses are 1.6 mSv/year (median value) and 46 mSv/year (maximum value). Integrating alpha track based passive detectors, which yield both a measurement of the mean radon concentration and of the radon daughter equilibrium (F) in each house, are being used in this national survey. (POL)

Indoor radon measurements in Finland: A status report

Castren, O.; Maekelaenen, I.; Winqvist, K.; Voutilainen, A.; Hopke, P.K. (ed.)

Finnish Cent. Radiat. and Nucl. Saf., P.O. Box 268,

SF-00101 Helsinki, Finland

191. Meeting of the American Chemical Society New York, NY (USA) 13-18 Apr 1986

RADON AND ITS DECAY PRODUCTS. OCCURRENCE, PROPERTIES AND HEALTH EFFECTS

pp. 97-103, Publ.Yr: 1987

AMERICAN CHEMICAL SOCIETY, WASHINGTON, DC (USA)

SUMMARY LANGUAGE - ENGLISH; ACS 331.

Languages: ENGLISH

Large-scale surveys indicate that the mean indoor radon concentration in Finnish dwellings is about 90 Bq/m super(3). The percentages of concentrations exceeding 200, 400, 800 and 2,000 Bq/m super(3) are 11, 3.9, 1.4 and 0.5 per cent, respectively. An updated version of the geographical distribution is presented. Sampling and data processing methods as well as the reason for high concentrations are discussed. (POL)

Concentrations in dwellings in the United Kingdom

Cliff, K.D.; Wrixon, A.D.; Green, B.M.R.; Miles, J.C.H.; Hopke, P.K. (ed.)

Natl. Radiol. Prot. Board, Chilton, Didcot, Oxfordshire OX11 0RQ, UK

191. Meeting of the American Chemical Society New York, NY (USA) 13-18 Apr 1986

RADON AND ITS DECAY PRODUCTS. OCCURRENCE, PROPERTIES AND HEALTH EFFECTS

pp. 104-112, Publ.Yr: 1987

AMERICAN CHEMICAL SOCIETY, WASHINGTON, DC (USA)

SUMMARY LANGUAGE - ENGLISH; ACS. 331.

Languages: ENGLISH

A survey of the radon concentrations in a representative sample of more than 2000 dwellings in the UK has been completed and provisional results are now available. On average, concentrations are 29% lower in bedrooms than in living areas. The mean radon concentration weighted for room occupancy is 22 Bq m super(-3). Assuming an equilibrium factor of 0.35 and a mean occupancy of 75%, the mean annual exposure in UK homes is assessed as 0.08 Working Level Months (WLM) and the mean annual effective dose equivalent as 0.43 mSv. Special surveys have been made in small areas where geological conditions indicated high indoor radon concentrations. These suggest that there is a small number of dwellings in the UK in which the average radon concentration may exceed 1250 Bq m super(-3), corresponding to an annual dose of 25 mSv. (POL)

Measurements of Parameters for Determining the Radon Load in the Framework of the Dutch National Research Program SAWORA In Dutch.

U.S. Sales Only.

NTIS Prices: PC A05/MF A01

Groen, G.C.H.; Groot, T.J.H.; Nyqvist, R.G.; Keverling Buisman, A.S.; Stoute, J.R.D.

Ministerie van Volkshuisvesting, Ruimtelijke Ordening en Milieubeheer, The Hague (Netherlands). Directie Stralenbescherming.

Corp. Source Codes: 087985003; 4188735

Report No.: VROM-DSB-86-20; VROM-60519/6-86

Jun 86 88p

Languages: Dutch

NTIS Prices: PC A05/MF A01 Journal Announcement: GRAI8805

Country of Publication: Netherlands

This report describes a series of measurements related to the indoor exposure to daughters of radon and thoron. Important parameters are the Potential Alpha Energy Concentration (PAEC) and the Activity Median Aerodynamic Diameter (AMAD). The results for indoor atmosphere are presented leading to an order of magnitude estimate of the effective dose-equivalent rate of 500 μ Sv/y. The thoron daughter concentrations are relatively high with respect to those of radon daughters. (Auth.). 18 refs.; 24 figs.; 12 tabs. (Atomindex citation 18:076059) (NTIS)

Radon Concentration in the Netherlands

In Dutch.

U.S. Sales Only.

NTIS Prices: PC A06/MF A01

Meijer, R. J. ; Put, L. W. ; Veldhuizen, A.

Ministerie van Volkshuisvesting, Ruimtelijke Ordening en Milieubeheer, The Hague (Netherlands).

Corp. Source Codes: 087985000; 4188742

Report No.: VROM-DSB-86-14; VROM-60197/3-86

Feb 86 116p

Languages: Dutch

NTIS Prices: PC A06/MF A01 Journal Announcement: GRAI8805

Country of Publication: Netherlands

In 1000 dwellings, which can be assumed to be an reasonable representation of the average Dutch dwellings, time averaged radon concentrations, radon daughter concentrations and gamma-exposure tempi are determined during a year with passive dosimeters. They are also determined outdoor at circa 200 measure points. (Auth.). Includes English summary; 58 refs.; 32 figs.; 24 tabs. (Atomindex citation 18:079204) (NTIS)

Activity Measurements in a Group of Twenty Houses in Bernisse (Netherlands) and in an Experimental Room
In Dutch.

U.S. Sales Only.

NTIS Prices: PC A03/MF A01

Hogeweg, B.

Ministerie van Volkshuisvesting, Ruimtelijke Ordening en Milieubeheer, The Hague (Netherlands). Directie Stralenbescherming.

Corp. Source Codes: 087985003; 4188735

Report No.: VROM-DSB-86-16; VROM-60199/3-86

Feb 86 39p

Languages: Dutch

NTIS Prices: PC A03/MF A01 Journal Announcement: GRAI8805

Country of Publication: Netherlands

Twenty dwellings are selected on the base of construction features and building materials used, for radiation dosimetry. The concentration of radon and daughterproducts in these dwellings is determined by a large number of factors. To study the relation between concentration and activity of the materials a number of measurements have been carried out with low-level as well as high-level radioactive materials. Also a series of measurements have been carried out in a test room under conditional circumstances. (Auth.). Includes English summary; 9 figs.; 14 tabs. (Atomindex citation 18:079205) (NTIS)

Radon exposure of the United Kingdom population

Brown, L.; Green, B.M.R.; Miles, J.C.H.; Wrixon, A.D.; Berglund, B.; Berglund, U.; Lindvall, T.; Spengler, J.; Sundell, J. (eds.)

Natl. Radiol. Prot. Board, Chilton, Didcot, Oxon OX11 0RQ, UK

3. International Conference on Indoor Air Quality and Climate Stockholm (Sweden) 1984

ENVIRON. INT VOL. 12, NO. 1-4, pp. 45-48, Publ.Yr: 1986

SUMMARY LANGUAGE - ENGLISH

Languages: ENGLISH

Journal Announcement: V19N2

The National Radiological Protection Board is carrying out a survey of the radon concentrations in dwelling throughout the United Kingdom and is also surveying factors that affect radon concentrations, such as the construction of the dwellings and the window and door-opening habits of the occupants. Initial results of measurements of radon concentrations indicate an average effective dose equivalent to the population of 570 μ Sv/yr. (POL)

Radon in Buildings in Hedmark County

In Norwegian.

U.S. Sales Only.

NTIS Prices: PC A02/MF A01

Stranden, E.; Kolstad, A.K.; Lind, B.

Statens Inst. for Straalehygiene, Oslo (Norway).

Corp. Source Codes: 072040000; 5962300

Report No.: SIS-1986:7

1986 22p

Languages: Norwegian

NTIS Prices: PC A02/MF A01 Journal Announcement: GRAI8718;
NSA1200

Country of Publication: Norway

Alum shale is known to contain enhanced levels of radium, and it may thus be a source of enhanced indoor radon concentrations. In this report studies of the radiological impact of the alum shale in an area in southern Norway rich in alum shale is summarized. Measurements of the activity concentration of soil and shale radon exhalation from the ground and from geological samples are reported together with measurements of indoor radon concentrations in 165 houses. In 48 of the houses the radon concentration exceeded 400 Bq/m/sup 3/, and the highest concentration (mean value for a house) was 5300 Bq/m/sup 3/. Radon exhalation measurements from the ground suggest that alum shale areas generally should be classified as high radon risk areas. (ERA citation 12:023464) (NTIS)

RESULTS OF NATURAL RADON DAUGHTER EXPOSURE MEASUREMENTS BY USING ALPHA DOSEMETERS IN WESTERN INDIVIDUAL HOUSES OF FRANCE

TYMEN G; MOUDEN A; RANNOU A; MADELMONT C; PARMENTIER N
LAB. PHYSIQUE AEROSOLS RADIOACTIVITE ATMOSPHERIQUE, FAC.
SCI., AV. LE GORGEU, 29287 BREST-CEDEX, FR.

13TH INTERNATIONAL CONFERENCE ON SOLID STATE NUCLEAR TRACK
DETECTORS, PALAZZO BARBERINI, ROME, SEPTEMBER 23-27, 1985.
NUCL TRACKS RADIAT

MEAS 12 (1-6). 1986. 751-754. CODEN: NTRMD

Language: ENGLISH

Subfile: BARRM (Biological Abstracts/RRM)

A campaign of measurements using passive and active doseimeters was intended for evaluating indoor radon daughter exposure in individual homes located in western France. Influence of the subsoil and building materials on the potential alpha-energy was studied. Then an estimation of annual equivalent dose was calculated from the results. (BIO)

Indoor Air Quality in New Single Family Houses at Helsinki and Kuopio Regions

In Finnish. The Indoor Climate Project.

U.S. Sales Only. Portions of this document are illegible in microfiche products.

NTIS Prices: PC A06/MF A01

Raunemaa, T.; Ruokolainen, T.

Helsinki Univ. of Technology, Espoo (Finland). Lab. of Heating, Ventilation and Air Conditioning.

Corp. Source Codes: 057176024; 9831080

Report No.: TKK-KO/LVI-C21

1986 122p

Languages: Finnish

NTIS Prices: PC A06/MF A01 Journal Announcement: GRAI8724; NSA1200

Country of Publication: Finland

The aim of this study was to investigate indoor air quality in single-family houses. The study includes formaldehyde, fungi, bacteria, radon and particle concentration as well as temperature and relative humidity. To find possible regional differences the study houses were situated at two regions, Kuopio and Helsinki. The indoor air temperature varied between 20-28 deg C and relative humidity between 15-64%. Formaldehyde concentrations, which were clearly affected by relative humidity, ranged from <0.05 to 0.24 mg/m³, being on an average 0.09 mg/m³. Maximum acceptable formaldehyde level was exceeded in one of the study houses in summer. Bacterial and fungal spore counts were mainly below 2000 cfu/m³, which can be regarded as the upper limit of normal concentration. Indoor fungal spore concentration depended on outdoor concentration and the bacterial concentration correlated with particle concentration. The levels of total suspended particles were mainly below 100 ug/m³ with almost equal amounts for fine and coarse particles. The indoor concentrations followed the outdoor concentrations. The radon concentrations were below the recommended value in 11 but one study house. The characteristics in the houses in Helsinki were found to differ from those in Kuopio in relative humidity values and in bacterial, particle and radon concentrations. All the measured parameters, except particles and radon, were higher in summer than in winter. Between full brick and full wood houses there were slight differences in temperature, in bacterial and in fungal spore counts. (ERA citation 12:037086) (NTIS)

RADON MEASUREMENTS IN SWEDEN: SOME RESULTS (RADON, PASSIVE SMOKING, PARTICULATES & HOUSING EPIDEMIOLOGY)

JONSSON GILBERT

UNIV OF LUND, SWEDEN,

WHO/ET AL 3RD INTL INDOOR AIR QUALITY & CLIMATE CONF, STOCKHOLM, AUG 20-24, 84, V2, P155(5)

CONF PAPER A PLASTIC FILM TECHNIQUE WAS USED TO MEASURE RADON LEVELS INSIDE DWELLINGS IN SWEDEN. SEASONAL MEASUREMENTS INDICATE A HIGHER RADON DAUGHTER CONCENTRATION IN THE SUMMER THAN IN WINTER FOR CONCENTRATIONS IN THE INTERVAL 200-400 BQ/CU M. BASEMENTS HAD HIGHER DAUGHTER LEVELS THAN DID THE FIRST STOREYS OF SINGLE-UNIT HOUSES. (2 GRAPHS, 1 PHOTO, 3 REFERENCES) (ENV)

RADON EXPOSURE OF THE UK POPULATION (RADON, PASSIVE SMOKING, PARTICULATES & HOUSING EPIDEMIOLOGY)

BROWN L.; GREEN B.M.; WRIXON A.D.; MILES J.C.

NATL RADIOLOGICAL PROTECTION BOARD, UK,

WHO/ET AL 3RD INTL INDOOR AIR QUALITY & CLIMATE CONF, STOCKHOLM, AUG 20-24, 84, V2, P61(6)

CONF PAPER RADON DECAY PRODUCTS ARE RESPONSIBLE FOR ABOUT A THIRD OF THE TOTAL DOSE THAT PERSONS RECEIVE FROM ALL RADIATION SOURCES IN THE U.K. RESULTS FROM PASSIVE RADON DOSIMETERS IN A NATIONAL SURVEY FOR 367 DWELLINGS ARE ANALYZED. THE MEAN OF THE RADON CONCENTRATIONS IN THE MAIN BEDROOM IS 71% OF THAT FOR THE LIVING AREA. THE MEAN EFFECTIVE DOSE EQUIVALENT TO THE U.K. POPULATION FROM RADON DECAY PRODUCTS IN DWELLINGS IS PROVISIONALLY CALCULATED TO BE 570 MSV/YEAR. (1 GRAPH, 6 REFERENCES, 2 TABLES) (ENV)

EXPOSURE OF THE SWEDISH POPULATION TO RADON DAUGHTERS (RADON, PASSIVE SMOKING, PARTICULATES & HOUSING EPIDEMIOLOGY)

SWEDJEMARK GUN A. ; MJONES LARS

NATL INST RADIATION PROTECTION, SWEDEN,

WHO/ET AL 3RD INTL INDOOR AIR QUALITY & CLIMATE CONF, STOCKHOLM, AUG 20-24, 84, V2, P37(7)

CONF PAPER THE RESULTS OF THREE DIFFERENT INVESTIGATIONS OF RADON IN SWEDISH DWELLINGS ARE SURVEYED. A NATIONWIDE STUDY WAS CONDUCTED TO DETERMINE THE COLLECTIVE DOSE TO THE POPULATION FROM EXPOSURE TO RADON AND ITS DAUGHTERS. A SUPPLEMENTARY STUDY FOCUSED ON NEWLY BUILT DETACHED HOUSES. MEASUREMENTS MADE BY LOCAL AUTHORITIES TO FIND HOUSES WITH RADON DAUGHTER LEVELS ABOVE NORMS ARE ALSO REPORTED. THE LATTER FOUND THAT 3346 DWELLINGS HAD RADON DAUGHTER CONCENTRATIONS EXCEEDING 400 BQ/CU M; THE MAJORITY OF HOMES IN THE NATIONWIDE STUDY HAD RADON LEVELS BELOW 100 BQ/CU M. (4 GRAPHS, 2 REFERENCES, 2 TABLES) (ENV)

SURVEY OF RADON CONCENTRATIONS IN DUTCH DWELLINGS (RADON,
PASSIVE SMOKING, PARTICULATES & HOUSING EPIDEMIOLOGY)
PUT L.W.; DE MEIJER R.J.
UNIV OF GRONINGEN, NETHERLANDS,
WHO/ET AL 3RD INTL INDOOR AIR QUALITY & CLIMATE CONF,
STOCKHOLM, AUG 20-24, 84, V2, P49(6)

CONF PAPER RADON LEVELS WERE MEASURED IN ABOUT 1000 DUTCH
DWELLINGS AND AT 200 OUTSIDE LOCATIONS USING PASSIVE MONITORS. A
MEDIAN CONCENTRATION OF 24 BQ/CU M WAS FOUND FOR THE DWELLINGS
WITH A HIGHEST VALUE OF 190 BQ/CU M. CORRELATIONS BETWEEN MEDIAN
RADON LEVELS AND CONSTRUCTION PARAMETERS WERE OBSERVED. OUTSIDE
CONCENTRATIONS SHOW AN UNEXPECTED DEPENDENCE ON LOCATION. (2
GRAPHS, 4 REFERENCES, 1 TABLE) (ENV)

V. MITIGATION

Status of EPA (Environmental Protection Agency) Radon Mitigation

Demonstration Program

NTIS Prices: PC A03/MF A01

Craig, A.B.

Environmental Protection Agency, Research Triangle Park, NC.
Air and Energy Engineering Research Lab.

Corp. Source Codes: 034680076

Report No.: EPA/600/D-88/037

Feb 88 11p

Languages: English

NTIS Prices: PC A03/MF A01 Journal Announcement: GRAI8812

Country of Publication: United States

The paper discusses the portion of EPA's radon reduction technology development/demonstration program dealing with the study of reduction methods for existing and new construction houses. The EPA program has as its objective the development and demonstration of cost-effective radon reduction techniques applicable to existing and new construction houses, all housing substructure types, a wide range of house design and construction features, a range of initial radon concentrations, a variety of radon mitigation approaches, and a scope that is national. The program, which started on a small scale in 1984, is divided into four major areas: methods for radon entry diagnosis and reduction performance testing, reduction methods for existing houses, reduction methods for new houses, and program support and information transfer. After 1 year of study, a matrix was developed to try to systematize a very complex problem. As a result of the development of the matrix, it appears that at least 600 houses will need to be studied to cover all the variables to a satisfactory degree, making the mitigation of essentially any housing type possible. The number will be studied over a period of 5-8 years. (NTIS)

Installation and Testing of Indoor Radon Reduction Techniques in 40 Eastern Pennsylvania Houses (Final rept. Oct 84-Jun 87)

Sponsored by Environmental Protection Agency, Research Triangle Park, NC.

Air and Energy Engineering Research Lab.

NTIS Prices: PC A17/MF A01

Scott, A.G.; Robertson, A.; Findlay, W.O.

American ATCON, Inc., Wilmington, DE.
Corp. Source Codes: 085675000
Sponsor: Environmental Protection Agency, Research Triangle
Park, NC. Air and Energy Engineering Research Lab.
Report No.: EPA/600/8-88/002
Jan 88 399p
Languages: English
NTIS Prices: PC A17/MF A01 Journal Announcement: GRAI8806
Country of Publication: United States
Contract No.: EPA-68-02-4203

The report discusses the installation and testing of indoor radon reduction techniques in 40 houses in eastern Pennsylvania. Early in 1985, the Pennsylvania Department of Environmental Resources (PDER) started a large radon survey in communities in the Reading Prong (a granite formation) in eastern Pennsylvania, following the discovery of a house with extremely high radon concentrations, greater than 1.2 MBq/cu m. Candidate houses for the program, with radon concentrations in excess of 750 Bq/cu m, were selected from this survey. A total of 40 houses with representative substructure types were chosen from this group, and mitigation methods were selected and installed from June 1985 to June 1987. Initial soil ventilation installations achieved large reductions in radon concentrations at low cost, but these reductions were not always sustained in colder weather, and several systems were modified during the project to improve their performance. Major reductions in radon concentration were realized in all the houses worked on, with most houses with active soil ventilation systems achieving less than 150 Bq/cu m (4 pCi/L) on an annual average basis in the living areas. (NTIS)

Radon Reduction Strategies and Approaches

NTIS Prices: PC A03/MF A01
Cook, J.E.; Egan, D.J.
Environmental Protection Agency, Research Triangle Park, NC.
Air and Energy Engineering Research Lab.
Corp. Source Codes: 034680076
Report No.: EPA/600/D-88/022
Jan 88 42p
Languages: English
NTIS Prices: PC A03/MF A01 Journal Announcement: GRAI8810
Country of Publication: United States

The chapter is for inclusion in a textbook, Environmental Radon, for graduate students. It gives a flavor of what radon mitigation entails, rather than being a detailed handbook treatment of the subject. It emphasizes the removal or reduction of soil-gas-borne radon (the major source of radon in most houses) and briefly describes the following methods of reducing/removing indoor radon: natural ventilation; forced air

ventilation; forced air ventilation with heat recovery; reducing entry points (sealing); venting radon from the soil surrounding a house by drain-tile soil ventilation, sub-slab ventilation, or wall ventilation; reducing pressure differentials; removing radon from water; and air cleaning. It gives background information on house construction types, the significance of weather phenomena, and the significance of the stack effect in elevating indoor radon levels. (NTIS)

Radon Mitigation Choices in the United States: A Comparison of Private and Public Sector Developments

NTIS Prices: PC A03/MF A01

Witter, K.A.; Sanchez, D.C.; Craig, A.B.

Environmental Protection Agency, Research Triangle Park, NC.

Air and Energy Engineering Research Lab.

Corp. Source Codes: 034680076

Report No.: EPA/600/D-88/011

Jan 88 14p

Languages: English

NTIS Prices: PC A03/MF A01 Journal Announcement: GRAI8810

Country of Publication: United States

The paper compares private and public sector developments relating to radon mitigation in the U.S. In response to elevated radon levels in many U.S. houses, the Federal and State governments and the private sector have undertaken many varied mitigation and public information efforts resulting in a range of radon reduction installations in the U.S. Government-sponsored research and development of radon mitigation techniques in single-family detached houses is compared with radon mitigation approaches undertaken by the private sector. An attempt is also made to compare premitigation diagnostics, the application of mitigation techniques to various substructure types, the performance of mitigation installations, and the cost of the installations. The information collected indicates that subslab ventilation is the most common technique in both public and private sector radon mitigation; however, air-to-air heat exchangers and sealing are employed more frequently in the private sector than in government-sponsored mitigation. (NTIS)

Radon in homes: determining risks and preventing exposures.

Doege TC; Hendee WR

Group on Science and Technology, American Medical Association, Chicago, IL 60610.

Semin Nucl Med (UNITED STATES) Jan 1988, 18 (1) p10-5, ISSN 0001-2998

Journal Code: UNY

Languages: ENGLISH

Knowledge about the effects of radon disintegration products and their levels in the nation's homes indicates that in a small proportion of homes these radioactive substances are increasing the inhabitants' risks of lung cancer. Testing for the problem and reducing its magnitude are the homeowner's responsibility. While practical methods for testing are known, they may not be easily available in all regions. Present understanding of the techniques of prevention and remediation is less satisfactory. (17 Refs.) (MED)

Modeling Point-of-Entry Radon Removal by GAC

Lowry and, J.D.; Lowry, S.B.

Maine Univ. at Orono. Dept. of Civil Engineering.

Journal of the American Water Works Association JAWWA5, Vol. 79, No. 10, p 85-88, October 1987. 7 fig, 3 tab, 28 ref.

Journal Announcement: SWRA2106

A design model for point-of-entry granular activated carbon (GAC) removal of ^{222}Rn from drinking water was developed and GAC technology was installed and monitored in more than 100 homes across the United States. More than 85% of the units employ carbon D and 10% use carbon C. Eighty percent of all units are in the 1.7-cu ft category, with the rest in the 1-3 cu ft range. Three units malfunctioned, probably due to shifting of support gravel in transit leading to GAC channeling. Removal of the results from these units from the data base leads to an average ^{222}Rn removal figure of 98.9%. A number of factors have prevented aeration from becoming as popular as GAC in point-of-entry ^{222}Rn removal. These include: the requirement to repressurize the water supply, an installed cost more than three times that of GAC, limited removal capabilities of some aeration methods, and a significant maintenance requirement, which increases the cost differential with time. (Rochester-PTT) (WRA)

Review of Selected State-of-the-Art Applications of Diagnostic Measurements for Radon Mitigation Planning

(Rept. for Apr 86-Jun 87)

Prepared in cooperation with Princeton Univ., NJ. Center for Energy and Environmental Studies, and Lawrence Berkeley Lab., CA.

NTIS Prices: PC A02/MF A01

Hubbard, L.M.; Harrje, D.T.; Gadsby, K.J.; Sanchez, D.C.; Turk, B.H.

Environmental Protection Agency, Research Triangle Park, NC. Air and Energy Engineering Research Lab.

Corp. Source Codes: 034680076

Sponsor: Princeton Univ., NJ. Center for Energy and

Environmental Studies.; Lawrence Berkeley Lab., CA.
Report No.: EPA/600/D-87/245
Sep 87 10p
Languages: English
NTIS Prices: PC A02/MF A01 Journal Announcement: GRAI8801
Country of Publication: United States

Since late-1984, EPA's AEERL has supported a program to develop and demonstrate radon mitigation techniques for single-family detached dwellings. As part of the program, projects have been started directed at developing and demonstrating the use of diagnostic measurements in all phases of the radon mitigation process. Diagnostic measurements are used to assess: (1) the radon sources' strengths, variability, and locations; and, (2) radon transport to the house and its entry and distribution in the house as influenced by environmental, house characteristics, and occupancy factors. The diagnostic measurements reported include: (1) soil-gas grab sampling; (2) communication (air flow or pressure field extension) tests; (3) whole house infiltration; (4) differential pressure, (5) gamma radiation; and, (6) radon flux. The paper concludes that the above selected diagnostic measurements have been found especially useful in characterizing houses which have indoor radon problems attributable to soil-gas-borne radon which may be amenable to mitigation through the use of subslab ventilation. (NTIS)

Construction and Testing of a Blower-Door Assembly for Regulation of Air Pressure within Structures

Paper copy only, copy does not permit microfiche production. Original copy available until stock is exhausted.

NTIS Prices: PC A03

Steele, W.D.

UNC Geotech, Grand Junction, CO.

Corp. Source Codes: 089787000; 9522464

Sponsor: Department of Energy, Washington, DC.

Report No.: DOE/ID/12584-4; UNC/GJ-35-TMC

Sep 87 45p

Languages: English

NTIS Prices: PC A03 Journal Announcement: GRAI8806;

NSA1300

Country of Publication: United States

Contract No.: AC07-86ID12584

The Technical Measurements Center is evaluating several methods to decrease the time required to determine an annual average radon-daughter concentration in structures. One method involves stabilizing the air pressure within the structure at a constant pressure with reference to external atmospheric or soil-gas pressure. This report describes the construction and preliminary testing of a blower-door system to maintain a

constant differential air pressure within a structure. The blower-door assembly includes a collapsible frame and a large fan to occlude a doorway, a damper with an actuator to control air flow, a controller to drive the damper actuator, and a pressure transducer to measure the differential pressure. Preliminary testing of the system indicates that pressure within the structure in the range of 1 to 20 Pascals can be held to within approximately ± 1 Pa of the set point. Further testing of the blower-door system is planned to provide data on the applicability of this method to short-duration tests for annual average radon-daughter concentration estimates. 13 figs., 1 tab. (ERA citation 13:000395) (NTIS)

Two Studies on the Effects of Small Exhaust Fans on Indoor Air Quality: Field Study of Exhaust Fans for Mitigating Indoor Air Quality Problems; Indoor Air Quality, Exhaust Fan Mitigation

Paper copy only, copy does not permit microfiche production. Original copy available until stock is exhausted.

NTIS Prices: PC A10

Lawrence Berkeley Lab., CA.

Corp. Source Codes: 086929000; 9513034

Sponsor: Honeywell, Inc., Minneapolis, MN. Technology Strategy Center.; Department of Energy, Washington, DC.

Report No.: DOE/BP/13655-1

Jul 87 220p

Languages: English

NTIS Prices: PC A10 Journal Announcement: GRAI8802; NSA1200

Country of Publication: United States

Contract No.: AC79-83BP13655

Overall, the findings show that exhaust fans basically provide small amounts of ventilation compensation. By monitoring the common indoor air pollutants (radon, formaldehyde, carbon monoxide, nitrogen dioxide, and water vapor), it was found that the quality of the indoor air was not adversely affected by the use of exhaust fans. Nor did their use provide any measurable or significant benefits since no improvement in air quality was ascertained. While exhaust fans of this small size did not increase radon, which is the contaminant of most concern, the researchers caution that operation of a larger fan or installation in a very tight home could result in higher levels because depressurization is greater. The daily energy consumption for use of these appliances during the heating season was calculated to be 1.5 kilowatt hours or approximately 3% of the energy consumption in the study homes. The information collected in this collaborative field study indicates that the use of these particular ventilation systems has no significant effect on indoor air quality. (ERA citation 12:043973) (NTIS)

Development and Demonstration of Indoor Radon Reduction Measures for 10 Homes in Clinton, New Jersey

(Final rept. Apr 86-Jan 87)

Sponsored by Environmental Protection Agency, Research Triangle Park, NC. Air and Energy Engineering Research Lab.
NTIS Prices: PC A09/MF A01

Michaels, L.D.; Brennan, T.; Viner, A.S.; Mattes, A.; Turner, W.

Research Triangle Inst., Research Triangle Park, NC.

Corp. Source Codes: 045968000

Sponsor: Environmental Protection Agency, Research Triangle Park, NC. Air and Energy Engineering Research Lab.

Report No.: REPT-471U-3065-52; EPA/600/8-87/027

Jul 87 176p

Languages: English

NTIS Prices: PC A09/MF A01 Journal Announcement: GRAI8721

Country of Publication: United States

Contract No.: EPA-68-02-3992

The report discusses the development and demonstration of indoor radon reduction methods for 10 houses in Clinton, New Jersey, where (in the spring of 1986) the New Jersey Department of Environmental Protection (DEP) located a cluster of houses with extremely high radon levels. The work was to be completed before the 1986-87 winter heating season began. The demonstration houses were selected from 56 in the Clinton Knolls subdivision. All of these houses had shown radon concentrations in excess of 64 pCi/l when monitored in the spring of 1986. Each house was inspected, and 10 representative houses were selected for the radon reduction demonstration project. Following intensive diagnostic work and monitoring in each house, house-specific radon reduction plans were developed. With the agreement of the homeowners, radon reduction systems were installed during the summer of 1986. All 10 of the houses had radon concentrations reduced significantly by the fall of 1986. The average cost of radon reduction was \$3,127. (NTIS)

Use of Diagnostic Measurements to Enhance the Selection and Effectiveness of Radon Mitigation for Detached Dwellings

(Technical rept. (Final))

Prepared in cooperation with Princeton Univ., NJ.

NTIS Prices: PC A02/MF A01

Sanchez, D.C.; Hubbard, L.M.; Harrje, D.

Environmental Protection Agency, Research Triangle Park, NC.
Air and Energy Engineering Research Lab.

Corp. Source Codes: 034680076

Sponsor: Princeton Univ., NJ.
Report No.: EPA/600/D-87/168
Jun 87 10p
Languages: English
NTIS Prices: PC A02/MF A01 Journal Announcement: GRAI8718
Country of Publication: United States

The paper discusses the use of diagnostic measurements to enhance the selection and effectiveness of radon mitigation for detached dwellings. The development of appropriate and cost effective radon mitigation for a specific house is ultimately tied to the degree to which the authors understand the source of the indoor radon problem, how house characteristics affect radon entry rates, and how candidate mitigation systems influence radon entry processes. Diagnostic measurements and procedures allow for qualitative and quantitative assessments of water, materials, and soil as sources of radon and the assessment of soil-gas-borne radon flow potentials related to indoor/outdoor differential pressure driving forces and soil-air permeability. The discussed diagnostics are being developed and tested as part of an intensive State and Federal government study of radon entry and mitigation processes in 14 Piedmont New Jersey houses.
(NTIS)

Review of the Canadian and Swedish Experience for the Control of Indoor Radon
(Published paper)
NTIS Prices: PC A02/MF A01
Sanchez, D.C.
Environmental Protection Agency, Research Triangle Park, NC.
Air and Energy Engineering Research Lab.
Corp. Source Codes: 034680076
Report No.: EPA/600/D-87/181
Jun 87 19p
Languages: English Document Type: Journal article
NTIS Prices: PC A02/MF A01 Journal Announcement: GRAI8718
Country of Publication: United States

The paper reviews Canadian and Swedish experience in controlling indoor radon. Interest in and concern about elevated levels of radon (Rn) and radon daughters (RnD) in the indoor environment have been growing steadily during the last 10 years. During this period the federal governments of Canada and Sweden, in conjunction with provincial authorities, have developed a coordinated response or program for reducing the national health risk of indoor Rn/RnD exposure. The focus of these programs is on characterizing and/or locating the problem areas or dwellings, and providing demonstrated control approaches to deal with the indoor Rn/RnD problem. The investigations by Canada and Sweden have identified numerous control approaches that are effective

when they are applied appropriately and carefully. Among these control techniques are the use of subfloor (depressurization) ventilation, crawlspace ventilation, house ventilation, and new construction practices such as monolithic pours with floor/wall joint sealing. (NTIS)

Testing of Indoor Radon Reduction Techniques in Eastern Pennsylvania: An Update

(Published paper May 85-Mar 87)

Sponsored by Environmental Protection Agency, Research Triangle Park, NC. Air and Energy Engineering Research Lab.

NTIS Prices: PC A02/MF A01

Henschel, D.B.; Scott, A.G.

American ATCON, Inc., Wilmington, DE.

Corp. Source Codes: 085675000

Sponsor: Environmental Protection Agency, Research Triangle Park, NC. Air and Energy Engineering Research Lab.

Report No.: EPA/600/D-87/156

May 87 21p

Languages: English

NTIS Prices: PC A02/MF A01 Journal Announcement: GRAI8717

Country of Publication: United States

Contract No.: EPA-68-02-4203

The paper updates information from EPA tests of indoor radon reduction techniques on 38 houses in the Reading Prong area of eastern Pennsylvania. All were basement houses with hollow-block or poured-concrete foundation walls. The reduction approaches tested in most houses involved active soil ventilation, including: suction on the footing drain tile system; suction under the concrete slabs, using pipes inserted through the slabs from inside the houses; and ventilation of the void network inside hollow-block foundation walls. Heat recovery ventilators (HRVs) were tested in three houses. Current results confirm that, for the houses tested, drain tile suction appears consistently able to provide high radon reductions when a complete loop of drain tile exists, often reducing high-radon-level houses to 4 pCi/l (148 Bq/cu m) and less. Sub-slab suction (with pipes through the slab) can also provide high reductions if enough suction pipes are located properly. Placing one or more sub-slab suction pipes near each perimeter wall appears to aid in treating the major soil gas entry routes, although fewer pipes can sometimes give high reductions if conditions are favorable. Ventilation of block wall voids can be effective if major wall openings can be adequately closed, and if there are no major slab-related entry routes remote from the walls. (NTIS)

Radon Mitigation in 10 Clinton, New Jersey Houses: A Case History

Prepared in cooperation with Camroden Associates, Rome, NY.
Sponsored by Environmental Protection Agency, Research Triangle Park, NC. Air and Energy Engineering Research Lab.

NTIS Prices: PC A02/MF A01

Osborne, M.C.; Brennan, T.; Michaels, L.D.

Research Triangle Inst., Research Triangle Park, NC.

Corp. Source Codes: 045968000

Sponsor: Camroden Associates, Rome, NY.; Environmental Protection Agency, Research Triangle Park, NC. Air and Energy Engineering Research Lab.

Report No.: EPA/600/D-87/164

May 87 16p

Languages: English

NTIS Prices: PC A02/MF A01 Journal Announcement: GRAI8717

Country of Publication: United States

Contract No.: EPA-68-02-3992

The paper discusses an EPA radon mitigation demonstration project in Clinton, NJ, which included testing radon reduction techniques in 10 houses. The 10 houses were selected from a group of 56 volunteers in the Clinton Knolls subdivision. Each of the 10 selected houses received an intensive radon diagnostic evaluation before a house-specific radon reduction plan was developed. Before and after the plans were implemented, radon concentrations were determined by charcoal canisters and continuous radon monitors. A variety of sealing and sub-slab depressurization techniques were applied to the 10 houses. Radon concentrations were reduced by over 95% in all 10 houses. Three-month alpha track radon measurements will continue in the radon reduction demonstration houses for the next 2 years. (NTIS)

Practical Problems Reducing Radon in Houses

Prepared in cooperation with Camroden Associates, Rome, NY.

NTIS Prices: PC A02/MF A01

Osborne, M.C.; Brennan, T.

Environmental Protection Agency, Research Triangle Park, NC.

Air and Energy Engineering Research Lab.

Corp. Source Codes: 034680076

Sponsor: Camroden Associates, Rome, NY.

Report No.: EPA/600/D-87/161

May 87 11p

Languages: English

NTIS Prices: PC A02/MF A01 Journal Announcement: GRAI8717

Country of Publication: United States

The paper discusses practical problems encountered during efforts to reduce radon concentrations in houses. The 10 problems identified represent only a few of the many daily problems encountered by diagnosticians and mitigators. Nonetheless, they are some of the current common problems that need to be considered and hopefully resolved in the near future. The 10 problems are: inconsistent sub-slab aggregate, hidden pathways to chimneys, variations in porosity of concrete/cinder block and block coatings, access to radon entry surfaces, diurnal/seasonal variation in radon concentrations, impact of radon-in-water on radon-in-air, sealing the top row of concrete blocks, insulating half-basements, sealing large thermal by-passes, and coping with direct rock exposure. (NTIS)

Radon Part II - reducing radon in the home. (energy answers)

Gould, Bob

Workbench v43 p72(3) March-April, 1987 CODEN: WRBNA
illustration; chart

CAPTIONS: Energy answers: radon reduction methods.

Some of the methods that can be used to reduce radon levels in the home are discussed. (MMI) (HQL)

Statistical Aspects of Autoregressive Models in the Assessment of Radon Mitigation

Prepared in cooperation with Arkansas Univ., Fayetteville.

NTIS Prices: PC A02/MF A01

Dunn, J.E.; Henschel, D.B.

Environmental Protection Agency, Research Triangle Park, NC.

Air and Energy Engineering Research Lab.

Corp. Source Codes: 034680076

Sponsor: Arkansas Univ., Fayetteville.

Report No.: EPA/600/D-87/085

Mar 87 13p

Languages: English

NTIS Prices: PC A02/MF A01 Journal Announcement: GRAI8715

Country of Publication: United States

The paper discusses statistical aspects of autoregressive models in the assessment of radon mitigation. Radon values, as reflected by hourly scintillation counts, seem dominated by major, pseudo-periodic, random fluctuations. The methodological paper reports a moderate degree of success in modeling these data using relatively simple autoregressive-moving average models in order to assess the effectiveness of radon mitigation techniques in existing housing. While accounting for the natural correlation of successive observations, familiar summary

statistics such as steady state estimates, standard errors, confidence limits, and tests of hypothesis are produced. The Box-Jenkins approach is used throughout. In particular, intervention analysis provides an objective means of assessing the effectiveness of an active mitigation measure, such as fan off/on cycle. Occasionally, failure to declare a significant intervention has suggested a diagnosis of the data collection procedure. (NTIS)

Some Results from the Demonstration of Indoor Radon Reduction Measures in Block Basement Houses

(Rept. for Jun 85-Feb 87)

Sponsored by Environmental Protection Agency, Research Triangle Park, NC. Air and Energy Engineering Research Lab.

NTIS Prices: PC A02/MF A01

Henschel, D.B.; Scott, A.G.

American ATCON, Inc., Wilmington, DE.

Corp. Source Codes: 085675000

Sponsor: Environmental Protection Agency, Research Triangle Park, NC. Air and Energy Engineering Research Lab.

Report No.: EPA/600/D-87/089

Mar 87 11p

Languages: English

NTIS Prices: PC A02/MF A01 Journal Announcement: GRAI8715

Country of Publication: United States

Contract No.: EPA-68-02-4203

The paper gives results of tests of active soil ventilation techniques in 24 block-wall basement houses in eastern Pennsylvania having significantly elevated indoor radon concentrations, generally above 740 Bq/cu m. The results indicate that radon levels can be reduced substantially (often below the U.S. EPA guideline of 148 Bq/cu m) if effective suction can be drawn on the soil underneath the concrete slabs of these houses. Such effective suction appears achievable when either: (a) the house has a complete loop of drain tile around its footings for water drainage purposes, and suction is drawn on that loop; or (b) a sufficient number of suction pipes can be inserted at the proper locations into the crushed rock or soil underneath the slab. (NTIS)

Radon risk information and voluntary protection: evidence from a natural experiment.

Johnson FR; Luken RA

Economics Department, U.S. Naval Academy, Annapolis, Maryland 21402.

Risk Anal (UNITED STATES) Mar 1987, 7 (1) p97-107, ISSN 0272-4332

Journal Code: RIA

Languages: ENGLISH

This study examines the perceived risks and mitigating behavior of Maine households who received new information on their exposures to significant health risks from indoor radon. The observed responses of these households illustrate conceptual issues related to designing an effective risk information program. Despite the involvement of generally well-motivated homeowners and well-intentioned researchers and government officials, we conclude that the risk information approach used in Maine failed to induce appropriate, cost-effective voluntary protection. The results indicate that, after receiving radon test results, information on associated health risks, and suggestions on how to reduce exposures: perceived risks tended to understate objective risks by orders of magnitude, and there was no statistically significant relationship between mitigating behavior and objective risks. These results suggest that the formation of risk perceptions and subsequent behavioral adjustments involve complex interactions among information, contextual, socioeconomic, and psychological variables. Therefore, government programs that seek to reduce health and safety risks with information programs, instead of using more conventional enforced standards, must be crafted very carefully to accommodate this complex process. (NTIS)

Monitoring Before and After Radon Mitigation

Prepared in cooperation with Camroden Associates, Rome, NY.

Sponsored by Environmental Protection Agency, Research Triangle Park, NC. Air and Energy Engineering Research Lab.

NTIS Prices: PC A02/MF A01

Brennan, T.; Osborne, M. C.

Research Triangle Inst., Research Triangle Park, NC.

Corp. Source Codes: 045968000

Sponsor: Camroden Associates, Rome, NY.; Environmental Protection Agency, Research Triangle Park, NC. Air and Energy Engineering Research Lab.

Report No.: EPA/600/D-87/094

Mar 87 14p

Languages: English

NTIS Prices: PC A02/MF A01 Journal Announcement: GRAI8715

Country of Publication: United States

Contract No.: EPA-68-02-3992

The paper discusses a radon reduction demonstration project in 1986 on 10 houses in Clinton, NJ. As part of this effort, radon was measured before and after radon reduction techniques were applied. The purpose of the measurements was to ascertain the effectiveness of the radon control methods being used. Since radon concentrations are normally highest in a depressurized house (commonly observed during cold winter months), efforts were made to emulate winter depressurization. Before radon reduction techniques were applied, four houses were tested using a common window fan to induce 7 Pa of negative pressure. Results of these tests showed that fan-induced negative pressure has a dramatic impact on radon concentrations. For some houses, this technique was shown to adequately emulate winter-time radon entry rates during warm summer months. Potential problems which may cause this technique to fail in some houses were identified. (NTIS)

Resolving the Radon Problem in Clinton, New Jersey, Houses
(Published paper Apr-Dec 86)
NTIS Prices: PC A02/MF A01
Osborne, M.C.
Environmental Protection Agency, Research Triangle Park, NC.
Air and Energy Engineering Research Lab.
Corp. Source Codes: 034680076
Report No.: EPA/600/D-87/093
Mar 87 9p
Languages: English
NTIS Prices: PC A02/MF A01 Journal Announcement: GRAI8715
Country of Publication: United States

The paper discusses the resolution of a radon problem in Clinton, New Jersey, where significantly elevated radon concentrations were found in several adjacent houses. The U.S. EPA screened 56 of the houses and selected 10 for demonstration of radon reduction techniques. Each of the 10 houses received an intensive radon diagnostic evaluation before a house-specific radon reduction plan was developed. Before and after the plans were implemented, radon concentrations were determined by charcoal canisters and continuous radon monitors. A variety of sealing and sub-slab depressurization techniques were applied to the 10 houses. Radon concentrations were reduced by over 95% in all 10 houses. Five meetings were held to explain to homeowners the radon reduction techniques being implemented and to answer questions of homeowners interested in applying similar radon reduction efforts to their houses. (NTIS)

**Draft Environmental Impact Statement on New Energy-Efficient
Homes Programs: Assessing Indoor Air Quality Options:
Summary**

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NTIS Prices: PC A02/MF A01

Bonneville Power Administration, Portland, OR.

Corp. Source Codes: 025155000; 9512400

Sponsor: Department of Energy, Washington, DC.

Report No.: DOE/EIS-0127

Feb 87 20p

Languages: English

NTIS Prices: PC A02/MF A01 Journal Announcement: GRAI8720;
NSA1200

Country of Publication: United States

The primary environmental issue confronting new energy-efficient homes is the effect that reduced levels of ventilation may have on indoor air quality (IAQ). BPA has avoided or minimized this potential effect in most new energy-efficient homes built under its programs by either using air-to-air heat exchangers to maintain ventilation rates at levels found in current practice homes, or monitoring and ensuring that formaldehyde and radon levels do not exceed 0.1 parts per million (ppM) or 5 picocuries per liter (pCi/L), respectively. Other approaches were considered in light of how they would maintain energy savings and protect indoor air quality while giving builders and consumers flexibility in how they address IAQ in energy-efficient homes. Different techniques are analyzed for maintaining IAQ comparable to that found in homes built using current practices. The techniques assessed include devices such as dehumidifiers and air cleaners, pollutant source control techniques, and mechanical ventilation with various control options. (ERA citation 12:027418) (NTIS)

**Impacts of Balanced and Exhaust Mechanical Ventilation on
Indoor Radon INDOOR AIR '87: 4th international conference
on indoor air quality and climate Berlin, F.R. Germany, 17
Aug 1987.**

Portions of this document are illegible in microfiche products.

NTIS Prices: PC A02/MF A01

Fisk, W.J.; Mowris, R.J.

Lawrence Berkeley Lab., CA.

Corp. Source Codes: 086929000; 9513034

Sponsor: Department of Energy, Washington, DC.

Report No.: LBL-23136; CONF-870853-4

Feb 87 13p

Languages: English Document Type: Conference proceeding

NTIS Prices: PC A02/MF A01 Journal Announcement: GRAI8724;
NSA1200
Country of Publication: United States
Contract No.: AC03-76SF00098

Models for estimating radon entry rates, indoor radon concentrations, and ventilation rates in houses with a basement or a vented crawl-space and ventilated by natural infiltration, mechanical exhaust ventilation, or balanced mechanical ventilation are described. Simulations are performed for a range of soil and housing characteristics using hourly weather data for the heating season in Spokane, WA. For a house with a basement, we show that any ventilation technique should be acceptable when the soil permeability is less than approximately $10 \text{ sup } -12 \text{ m sup } 2$. However, exhaust ventilation leads to substantially higher indoor radon concentrations than infiltration or balanced ventilation with the same average air exchange rate when the soil permeability is $10 \text{ sup } -10 \text{ m sup } 2$ or greater. For houses with a crawl-space, indoor radon concentrations are lowest with balanced ventilation, intermediate with exhaust ventilation, and highest with infiltration. (ERA citation 12:037712) (NTIS)

**EFFECTIVE REMOVAL OF AIRBORNE RADON-222 DECAY PRODUCTS
INSIDE BUILDINGS**

MAHER E F; RUDNICK S N; MOELLER D W

U.S. AIR FORCE OCCUPATIONAL ENVIRON. HEALTH LAB.,
RADIOANALYTICAL SERV.

BRANCH, BROOKS AIR FORCE BASE, TEX. 78235.

HEALTH PHYS 53 (4). 1987. 351-356. CODEN: HLTPA

Language: ENGLISH

Subfile: BA (Biological Abstracts)

Comparisons were made of the effectiveness of various indoor air treatment methods in reducing the lung dose to inhalation of ^{222}Rn decay products. The comparisons were based upon measurements of the total steady-state concentrations of ^{218}Po , ^{214}Pb and ^{214}Bi , and the concentrations of these nuclides not attached to the particles. These measurements, which were made inside a 78-m³ room before and after air treatment, were used along with a state-of-the art lung dose model to predict reductions in the dose to the radiosensitive bronchial tissues. Results suggest that flow-through air-cleaning methods, such as filtration and electrostatic precipitation, although effective in reducing total potential .alpha. energy concentration, cause a greater quantity of airborne potential .alpha. energy to be unattached to particles. This may result in a substantial increase in the dose to bronchial tissues. The form of air treatment appears to be a combination of nonuniform positive space charge generated by an ion greater and enhanced convection from a fan. This combination of air treatment gave reductions in the mean dose to the bronchial tissues of up to 87%. (BIO)

FOUR COMMON DIAGNOSTIC PROBLEMS THAT INHIBIT RADON MITIGATION

OSBORNE M C

INDOOR AIR BRANCH, EPA'S AIR ENERGY ENG. RES. LAB., RESEARCH TRIANGLE PARK, N.C. 27711, USA.

JAPCA (J AIR POLLUT CONTROL ASSOC) 37 (5). 1987. 604-606.

CODEN: JIJME

Language: ENGLISH

Subfile: BARRM (Biological Abstracts/RRM)

Along with the national emphasis on resolving the homeowner's radon problem has come an awareness of many difficulties that make the task of mitigation more complicated than one might imagine. The U.S. Environmental Protection Agency is currently funding several projects aimed at both diagnosing and resolving some of these problems. The ultimate goal of these projects is to simplify the job and enhance the effectiveness of the radon diagnostician and mitigator. Homeowners can then reduce their radon levels at a lower cost.
(BIO) (AUTH)

MODIFIED DESIGN IN NEW CONSTRUCTION PREVENTS INFILTRATION OF SOIL GAS THAT CARRIES RADON (RADON AND ITS DECAY PRODUCTS)

ERICSON SVEN-OLOV; SCHMIED HANNES

(RADON CONSULTANTS, SWEDEN) AND; (AIB CONSULTING ENGINEERS, SWEDEN),

ACS SYM SERIES 331, 1987, P526(10)

ASSN REPORT INFILTRATING SOIL GAS CARRYING RADON FROM THE GROUND INTO THE BUILDING CONTRIBUTE TO INDOOR RADON LEVELS IN DWELLINGS LOCATED ON PERMEABLE SOILS. ONE HUNDRED HOUSES WERE BUILT ON SITES IN SWEDEN KNOWN TO HAVE ELEVATED SOIL-RADON LEVELS. THE STRUCTURES FEATURE DIFFERENT VARIATIONS IN DESIGN AND CONSTRUCTION FOR PREVENTING INFILTRATION OF RADON. THE FEASIBILITY OF EMPLOYING TIGHT CONSTRUCTION TECHNIQUES, VENTILATED CRAWL SPACES, VENTILATION/DEPRESSURIZATION OF THE CAPILLARY BREAKING LAYER, AND MECHANICAL VENTILATION WITH HEAT RECOVERY WAS TESTED. THESE DESIGN FEATURES HAVE BEEN PROVEN TO EFFECTIVELY PROTECT THE INDOOR ENVIRONMENT FROM RADON ENTRY AT AN ADDED COST OF 0-4% OF THE TOTAL BUILDING COSTS. (5 DIAGRAMS, 2 REFERENCES, 4 TABLES) (ENV)

REMEDIAL MEASURES TO REDUCE RADON CONCENTRATIONS IN A HOUSE WITH HIGH RADON LEVELS (RADON AND ITS DECAY PRODUCTS)
CLIFF K.D.; WRIXON A.D.; MILES J.C.; LOMAS P.R.
UK NATL RADIOLOGICAL PROTECTION BOARD,
ACS SYM SERIES 331, 1987, P536(24)

ASSN REPORT MEASURES TO REDUCE INDOOR RADON CONCENTRATIONS WERE EVALUATED IN AN OLD HOUSE IN THE U.K. IN WHICH THE RADON DECAY PRODUCT CONCENTRATION INITIALLY EXCEEDED 0.3 WORKING LEVEL (WL). INSTALLATION OF A CONCRETE FLOOR, DESIGNED TO PREVENT ENTRY OF RADON IN SOIL GAS, REDUCED THE RADON DECAY PRODUCT LEVEL TO BELOW 0.1 WL. HOWEVER, RADON CONTINUED TO ENTER THE HOUSE THROUGH PORES IN AN INTERNAL WALL OF PRIMITIVE CONSTRUCTION THAT DESCENDED TO THE FOUNDATIONS. RADON FLOW WAS DRIVEN BY THE SMALL PRESSURE DIFFERENTIAL BETWEEN INDOOR AIR AND SOIL GAS. AN UNDERFLOOR SUCTION SYSTEM EFFECTED A SATISFACTORY REMEDY AND MAINTAINED THE CONCENTRATIONS TO BELOW 0.03 WL. (4 DIAGRAMS, 7 GRAPHS, 13 REFERENCES, 2 TABLES) (ENV)

THE EFFECT OF FILTRATION AND EXPOSURE TO ELECTRIC FIELDS ON AIRBORNE RADON PROGENY (RADON AND ITS DECAY PRODUCTS),
JONASSEN NIELS
TECHNICAL UNIV OF DENMARK, DENMARK,
ACS SYM SERIES 331, 1987, P264(8)

ASSN REPORT REMOVAL PROCESSES SUCH AS VENTILATION AND FILTRATION, BOTH PASSIVELY- AND ELECTRIC FIELD-INDUCED, DETERMINE THE LEVEL OF AIRBORNE SHORT-LIVED RADON 222 DECAY PRODUCTS IN INDOOR AIR. VARIOUS TYPES OF MECHANICAL AND ELECTRICAL FILTERS WERE OPERATED IN ROOMS WITH RADON LEVELS IN THE 100-5000 BQ/CU M RANGE. BY USING FILTRATIONS RATES OF UP TO THREE TO FOUR PER HOUR, THE POTENTIAL ALPHA ENERGY CONCENTRATION CAN BE LOWERED BY A FACTOR OF FIVE TO SIX. THE RADIOLOGICAL DOSES TO A CERTAIN PART OF THE RESPIRATORY TRACT WILL ONLY BE REDUCED TO ABOUT 50% OF THE VALUE APPLICABLE TO THE AIR IN THE UNTREATED STATE. (1 GRAPH, 15 REFERENCES) (ENV)

Swedish limitation schemes to decrease Rn daughters in indoor air.
Swedjemark GA
National Institute of Radiation Protection, Stockholm, Sweden.
Health Phys (UNITED STATES) Nov 1986, 51 (5) p569-78,
ISSN 0017-9078
Journal Code: G2H
Languages: ENGLISH

The limitation schemes to decrease Rn daughter concentrations in Swedish homes are described. The application of the Swedish provisional limitation scheme in use since 1980 is also reported and compared with international and national recommendations in other countries. (MED)

Research Review: Indoor Air Quality Control Techniques
Managing indoor air for health and energy conservation,
Atlanta, GA, USA, 20 Apr 1986.

Portions of this document are illegible in microfiche products.

NTIS Prices: PC A03/MF A01

Fisk, W. J.

Lawrence Berkeley Lab., CA.

Corp. Source Codes: 086929000; 9513034

Sponsor: Department of Energy, Washington, DC.

Report No.: LBL-21557; CONF-860446-2

Oct 86 37p

Languages: English Document Type: Conference proceeding

NTIS Prices: PC A03/MF A01 Journal Announcement:

GRAI8718; NSA1200

Country of Publication: United States

Contract No.: AC03-76SF00098

Techniques for controlling the concentration of radon, formaldehyde, and combustion products in the indoor air are reviewed. The most effective techniques, which are generally based on limiting or reducing indoor pollutant source strengths, can decrease indoor pollutant concentrations by a factor of 3 to 10. Unless the initial ventilation rate is unusually low, it is difficult to reduce indoor pollutant concentrations more than approximately 50% by increasing the ventilation rate of an entire building. However, the efficiency of indoor pollutant control by ventilation can be enhanced through the use of local exhaust ventilation near concentrated sources of pollutants, by minimizing short circuiting of air from supply to exhaust when pollutant sources are dispersed and, in some situations, by promoting a displacement flow of air and pollutants toward the exhaust. Active air cleaning is also examined briefly. Filtration and electrostatic air cleaning for removal of particles from the indoor air are the most practical and effective currently available techniques of air cleaning. 49 refs., 7 figs. (ERA citation 12:025832) (NTIS)

How to rid your home of radon gas.

Consumers' Research Magazine v69 p26(6) Oct, 1986

CODEN: CBBPBE

illustration; chart

CAPTIONS: (Diagrams of ventilation systems to rid the house of radon gas.)

Radon gas, according to a recent report from the Environmental Protection Agency, contaminates one out of every eight U.S. homes and exposes residents to at least as much of a cancer risk as smoking half a pack of cigarettes a day. Radon gas is caused by the natural radioactive decay of uranium in virtually all rocks and soils. The gas dissipates in the open, but in closed environments, particularly well-insulated homes, radon clings to smoke and dust particles. It can enter through sump pumps, ventilation systems and defects in foundations, especially foundations built on porous soil. If enough of it is inhaled, radon can cause lung cancer-up to 20,000 lung cancer deaths a year, according to some scientists. The EPA this summer set a safety standard of four picocuries per liter of air-the first time the federal government has quantified the radon threat. (MAG)(AUTH)

RADON REDUCTION METHODS: A HOMEOWNER'S GUIDE

EPA REPORT OPA-86-005, AUG 86 (24)

FED GOVT REPORT INFORMATION IS COMPILED TO AID THE HOMEOWNER IN DETECTING AND CONTROLLING RADON CONCENTRATIONS IN THE HOME. PROCEDURES FOR IMPLEMENTING CONTROL METHODS, AND ASSOCIATED COSTS, LIMITATIONS, AND EXPECTED RADON REDUCTIONS, ARE DELINEATED. NATURAL VENTILATION TECHNIQUES ARE EXPLAINED FOR REPLACING RADON-LADEN INDOOR AIR WITH OUTDOOR AIR. FORCED VENTILATION ACCOMPLISHES THE SAME THING BY USING FANS TO MAINTAIN A DESIRED AIR-EXCHANGE RATE. PROVIDING APPLIANCES WITH SEPARATE SOURCES OF EXTERNAL AIR CAN REDUCE THE AMOUNT OF RADON ENTERING THE HOUSE. OTHER METHODS OUTLINED INCLUDE COVERING EXPOSED EARTH, SEALING CRACKS AND OPENINGS, DRAIN-TILE SUCTION, AND BLOCK-WALL VENTILATION. (ENV)

Analytical and Numerical Models for Estimating the Effect of Exhaust Ventilation on Radon Entry in Houses with Basements or Crawl Spaces

(Thesis)

Portions of this document are illegible in microfiche products.

NTIS Prices: PC A07/MF A01

Mowris, R. J.

California Univ., Berkeley.

Corp. Source Codes: 005029000; 1092000
Sponsor: Department of Energy, Washington, DC.
Report No.: LBL-22067
Aug 86 134p
Languages: English
NTIS Prices: PC A07/MF A01 Journal Announcement:
GRAI8709; NSA1200
Country of Publication: United States
Contract No.: AC03-76SF00098

Mechanical exhaust ventilation systems are being installed in newer, energy-efficient houses and their operation can increase the indoor-outdoor pressure differences that drive soil gas and thus radon entry. This thesis presents simplified models for estimating the pressure driven flow of radon into houses with basements or crawl spaces, due to underpressures induced by indoor-outdoor temperature differences, wind, or exhaust ventilation. A two-dimensional finite difference model is presented and used to calculate the pressure field and soil gas flow rate into a basement situated in soil of uniform permeability. A simplified analytical model is compared to the finite difference model with generally very good agreement. Another simplified model is presented for houses with a crawl space. Literature on radon research is also reviewed to show why pressure driven flow of soil gas is considered to be the major source of radon entry in houses with higher-than-average indoor radon concentrations. Comparisons of measured vs. calculated indoor radon concentrations for a house with a basement showed the simplified basement model underpredicting on average by 25%. For a house with a crawl space the simplified crawl space model overpredicted by 23% when the crawl space vents are open and 48% when the crawl space vents are sealed. (ERA citation 12:001639) (NTIS)

SOME RESIDENTIAL ANSWERS

HARRJE DAVID T.; GADSBY KENNETH J.
PRINCETON UNIV,
ASHRAE J, JUL 86, V28, N7, P32(6)

JOURNAL ARTICLE MAJOR DESIGN AND CONSTRUCTION ACTIONS CAN BE TAKEN IN RESIDENCES TO LIMIT CONDUCTION LOSSES, INCREASE HEATING PERFORMANCE, REDUCE ENERGY LOSSES THROUGH WINDOWS, AND PROVIDE ADEQUATE VENTILATION AIR. THESE ACTIONS ARE HIGHLY RECOMMENDED FOR NEW CONSTRUCTION AND OFTEN CAN BE APPLIED AS RETROFITS TO EXISTING HOUSES. OPTIONS DISCUSSED INCLUDE THE INSTALLATION OF SUPERINSULATION, HIGH PERFORMANCE FURNACE/BOILER, WINDOW SYSTEMS, AND CONTROLLED VENTILATION. REMOVAL OF INDOOR AIR POLLUTANTS FROM VARIOUS ZONES OF A HOUSE CAN BE AIDED BY NATURAL STACK FLOW. FROM THE INITIAL DESIGN PHASE OF A NEW HOME, CARE MUST BE TAKEN TO CONSIDER REDUCING ALL PATHWAYS OF

POLLUTANTS INTO THE LIVING SPACE. WITH RADON SOIL GAS THIS MEANS EMPHASIS ON SUITABLE BASEMENT/CRAWLSPACE DESIGNS THAT PREVENT RADON ENTRY AND AT THE SAME TIME LIMIT ENERGY USE. (5 DIAGRAMS, 1 GRAPH, 15 REFERENCES, 1 TABLE) (ENV)

Overview of Indoor Radon Mitigation Alternatives and a Summary of Recent EPA (Environmental Protection Agency) Mitigation Test Results

Presented at the National Convention of the American Institute of Architects, San Antonio, TX, 9 Jun 86.

NTIS Prices: PC A03/MF A01

Henschel, D.B.; Craig, A.B.

Environmental Protection Agency, Research Triangle Park, NC.
Air and Energy Engineering Research Lab.

Corp. Source Codes: 034680076

Report No.: EPA/600/D-86/148

Jul 86 40p

Languages: English

NTIS Prices: PC A03/MF A01 Journal Announcement:
GRAI8622

Country of Publication: United States

The discussion is specific to single-family homes (detached houses), as opposed to apartment buildings, other multiple family dwellings, or office and other public use buildings. Introductory information covers indoor radon sources, health effects of radon exposure, radon level monitoring methods, and a discussion on how radon enters and builds up in house air. Covered are nine methods for reducing indoor radon in detached houses: natural and forced-air ventilation, forced-air ventilation with heat recovery, active avoidance of house depressurization, sealing major radon sources, sealing radon entry routes, drain-tile soil ventilation, active ventilation of hollow-block basement walls, and sub-slab ventilation. For each method, information is presented on principles of operation, applicability, how much confidence one can have that the method can achieve radon reduction, and an estimate of installation costs. Where appropriate, drawings depict the details of method installation using terminology familiar to the building trades. (NTIS)

Getting rid of radon: ventilation is freeing some homes of the cancer-causing gas.

Gilbert, Susan

Science Digest v94 p19(1) June, 1986

CODEN: SCDIBG

SIC CODE: 9511

DESCRIPTORS: Radon--Isotopes; United States.

Environmental Protection Agency--research;
Ventilation--innovations; Lungs--Cancer

The EPA has been testing antiradon ventilation systems in 18 Pennsylvania homes. The systems reverse the pressure difference between the basement and the outdoors, sucking up to 90% of the radon out of the foundation walls. (MAG) (AUTH)

Modified design in new construction prevents infiltration of soil gas that carries radon

Ericson, S.O.; Schnied, H.; Hopke, P.K. (ed.)

Radon Consult., Edsviksvaegen 33, S-182 33 Danderyd, Sweden
191. Meeting of the American Chemical Society New York, NY
(USA) 13-18 Apr 1986

RADON AND ITS DECAY PRODUCTS. OCCURRENCE, PROPERTIES AND
HEALTH EFFECTS pp. 526-535, Publ.Yr: 1987

AMERICAN CHEMICAL SOCIETY, WASHINGTON, DC (USA)

SUMMARY LANGUAGE - ENGLISH; ACS. 331.

Languages: ENGLISH

Dwellings located on permeable soil with strong exhalation of radon often get a contribution to indoor radon from infiltrating soils gas carrying radon from the ground into the building. 100 dwellings have been built on radon dangerous land with different modifications in design and construction in order to prevent infiltration of radon. Tight construction, ventilated crawl space, ventilation/depressurization of the capillary breaking layer (crushed stone), and mechanical ventilation with heat recovery by air to air heat exchangers or heat pumps have been tested. Added building costs and measured concentration of radon after construction and 3-5 years later are reported. It is concluded that it is possible to build radon protective and radon safe dwellings on any land. The added costs have ranged from zero to 4% of total building costs. (POL)

EPA (Environmental Protection Agency) Program to Demonstrate Mitigation Measures for Indoor Radon: Initial Results

(Published paper Sep 84-Feb 85)

Prepared in cooperation with American ATCON, Inc.,
Wilmington, DE.

NTIS Prices: PC A02/MF A01

Henschel, D.B.; Scott, A.G.

Environmental Protection Agency, Research Triangle Park, NC.
Air and Energy Engineering Research Lab.

Corp. Source Codes: 034680076

Sponsor: American ATCON, Inc., Wilmington, DE.

Report No.: EPA/600/D-86/060

Apr 86 16p

Languages: English

NTIS Prices: PC A02/MF A01 Journal Announcement:
GRAI8612
Country of Publication: United States

The paper gives initial results of an EPA program to demonstrate mitigation measures for indoor radon. EPA has installed radon mitigation techniques in 18 concrete block basement homes in the Reading Prong area of eastern Pennsylvania, all designed to demonstrate techniques which would have low to moderate installation and operating costs. Where major openings in the block walls can be closed effectively, suction on the wall voids has proved to be extremely effective. However, where major openings within the walls are inaccessible, it is more difficult and/or more expensive to develop adequate suction on the void network, and performance is reduced. Testing is continuing to demonstrate how to achieve high performance with wall suction in homes with such difficult-to-close walls. (NTIS)

Reduction of Radon Progeny in Indoor Air

(Master's thesis)

NTIS Prices: PC A05/MF A01

Weidner, John A.

Air Force Inst. of Tech., Wright-Patterson AFB, OH. School of Engineering.

Corp. Source Codes: 000805002; 012225

Report No.: AFIT/GNE/ENP/86M-13

Mar 86 83p

Languages: English Document Type: Thesis

NTIS Prices: PC A05/MF A01 Journal Announcement:
GRAI8702

Country of Publication: United States

The effectiveness of using three different types of air treatment methods to reduce the concentrations of radon progeny in a residence was evaluated. The air treatment devices were two types of electrostatic precipitators that were designed for use with a whole house heating and cooling system and an ionization air cleaner that was designed for table-top use in a single room. The air treatment devices were tested in a 100 cubic meter chamber at typical radon gas concentrations of 12.5 to 20.5 picocuries per liter. The modified Tsivoglou method was used to determine radon progeny concentrations and a continuous monitor for radon concentration was in operation, allowing calculation of the equilibrium factor under non-constant radon conditions. Reduction in average working level measurements and reduction in equilibrium factor were used to evaluate the effectiveness of the air treatments. Radon progeny reductions of greater than 50 percent were observed for all three devices tested at air treatment rates that were comparable to those that would be used in a residence. (NTIS)

**Radon and Remedial Action in Spokane River Valley
Residences: An Interim Report**

Air Pollution Control Association annual meeting and
exhibition, Minneapolis, MN, USA, 22 Jun 1986.

Portions of this document are illegible in microfiche
products.

NTIS Prices: PC A03/MF A01

Turk, B.H.; Prill, R.J.; Fisk, W.J.; Grimsrud, D.T.; Moed,
B.A.

California Univ., Berkeley. Lawrence Berkeley Lab.

Corp. Source Codes: 005029222; 9513034

Sponsor: Department of Energy, Washington, DC.

Report No.: LBL-21399; CONF-860606-13

Mar 86 28p

Languages: English Document Type: Conference proceeding

NTIS Prices: PC A03/MF A01 Journal Announcement:

GRAI8702; NSA1100

Country of Publication: United States

Contract No.: AC03-76SF00098

Fifty-six percent of 46 residences monitored in the Spokane River Valley in eastern Washington/northern Idaho have indoor radon concentrations above the National Council for Radiation Protection (NCRP) guidelines of 8 pCi/l. Indoor levels were over 20 pCi/l in eight homes, and ranged up to 132 pCi/l in one house. Radon concentrations declined by factors of 4 to 38 during summer months. Measurements of soil emanation rates, domestic water supply concentrations, and building material flux rates indicate that diffusion of radon does not significantly contribute to the high concentrations observed. Rather, radon entry is dominated by pressure-driven bulk soil gas transport, aggravated by the local subsurface soil composition and structure. A variety of radon control strategies are being evaluated in 14 of these homes. Sub-surface ventilation by depressurization and overpressurization, basement overpressurization, and crawlspace ventilation are capable of successfully reducing radon levels below 5 pCi/l in these homes. House ventilation is appropriate in buildings with low-moderate concentrations, while sealing of cracks has been relatively ineffective. (ERA citation 11:005517) (NTIS)

**Limitation Schemes to Decrease the Radon Daughters in Indoor
Air**

U.S. Sales Only.

NTIS Prices: PC A03/MF A01

Swedjemark, G.A.

Statens Straalskyddsinstitut, Stockholm (Sweden).

Corp. Source Codes: 100859000; 9860158
Report No.: SSI-86-01
4 Feb 86 33p
Languages: English
NTIS Prices: PC A03/MF A01 Journal Announcement:
GRAI8711; NSA1100
Country of Publication: Sweden

The limitation schemes to decrease the radon daughter concentrations in Swedish homes are described. The application of the Swedish provisional limitation system in use since 1980 is also reported. As a background the radon source and the international and national recommendations in other countries are reviewed. (author). With 54 refs. (ERA citation 11:054823) (NTIS)

INDOOR IONIZING RADIATION: TECHNICAL SOLUTIONS AND REMEDIAL STRATEGY

ERICSON SVEN-OLOV; LINDVALL THOMAS; MANSSON LARS-GORAN
SWEDISH COUNCIL FOR BUILDING RESEARCH REPORT D7, 1986 (51)

ABSTRACT ONLY IN SWEDEN RADON IN DWELLINGS IS THE SINGLE MOST IMPORTANT CONTRIBUTOR TO RADIATION DOSE BURDEN. INVESTIGATIONS ON THE HEALTH EFFECTS OF SUCH RADIATION EXPOSURE ARE SUMMARIZED. SOURCES OF INDOOR RADON ARE IDENTIFIED AS SOIL, BUILDING MATERIALS, AND DRINKING WATER. THE MEAN INDOOR EQUILIBRIUM EQUIVALENT CONCENTRATION OF RADON IS ESTIMATED TO BE 15 BQ/CU M IN THE TEMPERATE REGIONS OF THE WORLD. IN SWEDEN, THE COMBINATION OF RADON INFILTRATION FROM SOIL AND THE USE OF AERATED CONCRETE BASED ON ALUM SHALE HAS RESULTED IN A MEAN INDOOR CONCENTRATION OF RADON DAUGHTERS ESTIMATED TO BE 53 +- 16 BQ/CU M. REMEDIAL ACTIONS FOR PREVENTING OR MITIGATING INDOOR EXPOSURE TO RADON ARE OUTLINED, AND COST-EFFICIENCY IN RADON PROTECTION IS CONSIDERED. (2 DIAGRAMS, 10 REFERENCES, 3 TABLES) (ENV)

VI. MEASUREMENT TECHNIQUES

Adequacy of time averaging with diffusion barrier charcoal adsorption collectors for ^{222}Rn measurements in homes.

Cohen BL; Gromicko N

Department of Physics, University of Pittsburgh, PA 15260.

Health Phys (UNITED STATES) Feb 1988, 54 (2) p195-202,
ISSN 0017-9078

Journal Code: G2H

Languages: ENGLISH

Radon-222 levels in homes are known to undergo short-term fluctuations over times ranging from less than an hour to a few days, as well as long-term seasonal variations. The author concludes that little practical advantage is achieved in use of long-term averaging devices, such as nuclear track detectors, over DBCA that would justify their greater cost (\$25 versus \$12) and time delays (1 mo versus 1 wk) unless the former measurements are extended long enough to average seasonal variations.

(MED) (HQL)

AN ELECTRET PASSIVE ENVIRONMENTAL RADON-222 MONITOR BASED ON IONIZATION MEASUREMENT

KOTRAPPA P; DEMPSEY J C; HICKEY J R; STIEFF L R

RAD-ELEC. INC., P.O. 310, GERMANTOWN, MD. 20874.

HEALTH PHYS 54 (1). 1988. 47-56. CODEN: HLTPA

Language: ENGLISH

Subfile: BA (Biological Abstracts)

The electret passive environmental ^{222}Rn monitor** (E-PERM) is an extension of electret dosimeters used for measurement of x and .gamma. radiation. An E-PERM consists of a small cup or canister, having an electret at the bottom, and a filtered inlet at the top. The ^{222}Rn gas entering through the filter and the decay products formed inside the cup generate ions which are collected by the electret. The reduction of charge (or surface potential) on the electret is a measure of time integrated ^{222}Rn exposure. An E-PERM of 220-mL volume with an electret of 0.23 cm thickness gave a surface potential drop of 2.5 V for 37 Bq m⁻³ d (1 pCi L⁻¹ d). The electret voltage was measured with a specially built surface potential voltmeter. This sensitivity was found adequate for a 1-wk measurement of ^{222}Rn in homes. For longer term measurements, an E-PERM of 40-mL volume and an electret of 51-.mu.m thickness was developed which gave a surface potential drop of 2.6 V for 37 Bq m⁻³ y (1 pCi L⁻¹ y). Other combinations of chamber volume and electret thicknesses gave

responses between these two values. The surface potential of electrets made from Teflon FEP.dag. were shown to stay stable even under extreme conditions of relative humidity. The ion collection process in E-PERMs was also shown to be independent of humidity down to an electret surface potential of 100 V. (BIO)

AN ELECTROSTATIC INTEGRATING RADON-222 MONITOR WITH CELLULOSE NITRATE FILM FOR ENVIRONMENTAL MONITORING

IIDA T; IKEBE Y; HATTORI T; YAMANISHI H; ABE S; OCHIFUJI K; YOKOYAMA S

DEP. NUCLEAR ENG., FAC. ENG., NAGOYA UNIV., NAGOYA, JPN.

HEALTH PHYS 54 (2). 1988. 139-148. CODEN: HLTPA

Language: ENGLISH

Subfile: BA (Biological Abstracts)

This paper describes a new type of electrostatic integrating ^{222}Rn monitor designed for the environmental ^{222}Rn monitoring. The window area of the monitor was selected to make the exchange rate optimal. The collecting electrode was positioned on the basis of calculating the internal electric field. A drying agent, P_2O_5 , was placed in the bottom of the monitor, since the collection efficiency of $^{218}\text{Po}^+$ atoms depends on the humidity of the air. The monitors have been calibrated against known ^{222}Rn exposures. The detection limit is 1.2 Bq m^{-3} for an exposure time of 2 mo. In a small survey, annual mean ^{222}Rn concentrations between 3.7 and 9.5 Bq m^{-3} in outdoor air and between 6.4 and 11.9 Bq m^{-3} in indoor air were measured. (BIO)

EGARD: an environmental gamma-ray and ^{222}Rn detector.

Maiello ML; Harley NH

New York University Medical Center, New York 10016.

Health Phys (UNITED STATES) Sep 1987, 53 (3) p301-5, ISSN 0017-9078

Journal Code: G2H

Contract/Grant No.: ES-00260; CA13343

Languages: ENGLISH

EGARD, an environmental x-ray and radon detector consists of a thermo-luminescent dosimeter (TLD) based system. (MED) (HQL)

Validation of the Prompt alpha-Track Method

Portions of this document are illegible in microfiche products. Original copy available until stock is exhausted.

NTIS Prices: PC A04/MF A01

George, J.L.; Langner, G.H.

UNC Geotech, Grand Junction, CO.

Corp. Source Codes: 089787000; 9522464
Sponsor: Department of Energy, Washington, DC.
Report No.: DOE/ID/12584-6; UNC/GJ-33(TMC)
Aug 87 67p
Languages: English
NTIS Prices: PC A04/MF A01 Journal Announcement:
GRAI8803; NSA1200
Country of Publication: United States.
Contract No.: AC07-86ID12584

The Technical Measurements Center has evaluated the reliability of using short-term exposures of alpha-track radon detectors to estimate annual-average radon-daughter concentrations (RDC) in structures in the Grand Junction, Colorado, area. Two sets of data were collected, each consisting of two-, three-, four-, five-, and six-month-long exposures of radon detectors manufactured by Terradex Corporation. Terradex Type SF Track Etch detectors were exposed at 50 stations in 34 structures where previous annual average radon and/or radon-daughter-concentration data were collected. Two detectors were deployed at each station for each short-term exposure. Three additional annual detectors were deployed at each station concurrently with the six-month Fall detectors. The Track Etch detectors were processed at a sensitivity level of 0.2 picocurie. month per liter. All of the short-term Track Etch measurements can reliably estimate the annual average indoor radon concentration in structures in the Grand Junction, Colorado, area. The precision of both the short-term measurements and the prompt alpha-track method of using these measurements is acceptable at 4 picocuries per liter (pCi/l). Glenwood Laboratories began marketing Radtrak radon detectors in February 1986. To conduct a preliminary field evaluation of these devices, two Radtrak detectors were deployed at each station in addition to the Track Etch detectors for the two-month and three-month Spring exposures of this study. Based on this limited data set, short-term Radtrak exposures estimate the annual average radon concentration at 4 pCi/l as reliably as short-term Track Etch exposures. The use of Radtrak detectors deserves further investigation. 8 refs., 18 figs., 10 tabs. (ERA citation 12:046186) (NTIS)

THE INFLUENCE OF CHANGING EXPOSURE CONDITIONS ON MEASUREMENTS OF RADON CONCENTRATIONS WITH THE CHARCOAL ADSORPTION TECHNIQUE

RONCA-BATTISTA M; GRAY D

ENVIRON. PROT. AGENCY, 401 M ST. S.W., WASHINGTON, D.C. 20460.

THIRTY-SECOND ANNUAL MEETING OF THE HEALTH PHYSICS SOCIETY, SALT LAKE CITY, UTAH, USA, JULY 5-9, 1987. HEALTH PHYS 52 (SUPPL. 1). 1987.

S30-S31. CODEN: HLTPA
Language: ENGLISH
Document Type: CONFERENCE PAPER
Subfile: BARRM (Biological Abstracts/RRM)

The conclusions of these investigations led to a change in exposure time from 96 hours to 48 hours in the EPA charcoal canister measurement exposure program, and an improved understanding of the limitations and capabilities of the charcoal adsorption technique. (BIO) (HQL)

EERF (Eastern Environmental Radiation Facility) Standard Operating Procedures for Radon-222 Measurement Using Charcoal Canisters

(Final rept.)

NTIS Prices: PC A03/MF A01

Gray, D.J.; Windham, S.T.

Eastern Environmental Radiation Facility, Montgomery, AL.

Corp. Source Codes: 062831000

Report No.: EPA/520/1-87/005

Jun 87 36p

Languages: English

NTIS Prices: PC A03/MF A01 Journal Announcement:

GRAI8722

Country of Publication: United States

The report describes in detail EPA's office of Radiation Programs Eastern Environmental Radiation Facility's standard operating procedures for radon-222 measurement using charcoal canisters. It lists the materials and equipment that are used and explains their laboratory and survey methods. (NTIS)

Radon detectors: how to find out if your house has a radon problem. (includes relate articles on hazards of radon exposure, ways to) (directory)

Consumer Reports v52 p440(8) July, 1987

CODEN: CONRA

illustration; chart; graph

ARTICLE TYPE: directory

Radon: how big a risk?; Ways to make your house safer.

This article contains a discussion of radon detection methods, how to estimate the hazards, and ways for making a home safer from radon. A list of manufacturers of radon detectors is provided. (MAG) (HQL)

Validation of the Abbreviated Radon Progeny Integrating Sampling Unit (RPISU) Method for Mesa County, Colorado
Portions of this document are illegible in microfiche products. Original copy available until stock is exhausted.
NTIS Prices: PC A05/MF A01
Langner, G.H.
UNC Geotech, Grand Junction, CO.
Corp. Source Codes: 089787000; 9522464
Sponsor: Department of Energy, Washington, DC.
Report No.: DOE/ID/12584-5; UNC/GJ-34-TMC
Jun 87 76p
Languages: English
NTIS Prices: PC A05/MF A01 Journal Announcement:
GRAI8724; NSA1200
Country of Publication: United States
Contract No.: AC07-86ID12584

The US Department of Energy (DOE) Office of Remedial Action and Waste Technology established the Technical Measurements Center at the DOE Grand Junction, Colorado, Projects Office to standardize, calibrate, and compare measurements made in support of DOE remedial action programs. Indoor radon-daughter concentration measurements are made to determine whether a structure is in need of remedial action. The Technical Measurements Center conducted this study to validate an abbreviated Radon Progeny Integrated Sampling Unit (RPISU) method of making indoor radon-daughter measurements to determine whether a structure has a radon-daughter concentration (RDC) below the levels specified in various program standards. The Technical Measurements Center established a criterion against which RDC measurements made using the RPISU sampling method are evaluated to determine if sampling can be terminated or whether further measurements are required. This abbreviated RPISU criterion was tested against 317 actual sets of RPISU data from measurements made over an eight-year period in Mesa County, Colorado. The data from each location were tested against a standard that was assumed to be the same as the actual annual average RDC from that location. At only two locations was the criterion found to fail. Using the abbreviated RPISU method, only 0.6% of locations sampled can be expected to be falsely indicated as having annual average RDC levels below a given standard. (ERA citation 12:037820) (NTIS)

Buyer beware: evaluating radon tests.

Kahn, Miles.

EPA (Environmental Protection Agency) J 13:9-10 Ap '87, il

LANGUAGE: Engl

DOC TYPE: P

Incidence of radon measurement scams; pitfalls in selecting

competent contractors for radon mitigation; U.S. Efforts by New Jersey and other states to regulate these services. (PAIS)

APPLICATIONS OF THE DOE-GJPO RADON-RADON-DAUGHTER ENVIRONMENTAL CHAMBER

PEARSON M D

UNC TECHNICAL SERV. INC., P.O. BOX 14000, GRAND JUNCTION, COLO. 81502-5504.

THIRTY-SECOND ANNUAL MEETING OF THE HEALTH PHYSICS SOCIETY, SALT LAKE CITY, UTAH, USA, JULY 5-9, 1987. HEALTH PHYS 52 (SUPPL. 1). 1987.

S40-S41. CODEN: HLTPA

Language: ENGLISH

Document Type: CONFERENCE PAPER

Subfile: BARRM (Biological Abstracts/RRM)

The Department of Energy's (DOE) Technical Measurements Center operates a Radon/Radon-Daughter Environmental Chamber at the DOE in Grand Junction, Colorado for the purpose of calibrating, testing, and evaluating radon and radon daughter measuring instruments. The 25,000-liter chamber is an environmentally controlled stainless-steel vessel capable of airflow rates from 0 to 4000 liters per minute, radon concentrations ranging from 1 to 1000 pCi/l, temperatures from 0 to 45 degrees C, dew points from -10 degrees C to saturated, and condensation nuclei concentrations ranging from 10 to 10^6 particles per cm^3 . Radon and radon-daughter samples are drawn out of the chamber through one of 24 sampling ports. (BIO)(AUTH)

INDOOR RADON GAS AND ITS DETECTION WITH KODAK PLASTIC FILM (ENGLISH)

JONSSON G

UNIV LUND, DEPT PHYS, SOLVEGATAN 14/S-22362 LUND//SWEDEN/

NUCLEAR TRACKS AND RADIATION MEASUREMENTS-INTERNATIONAL JOURNAL OF RADIATION APPLICATIONS AND INSTRUMENTATION PART D, V13, N1, P85-91, 1987

The indoor radon problem is reported from the Swedish standpoint. The radon sources, problems with the radon daughters, the radon detector Kodak LR115-II and some experimental results are discussed from a teaching point of view of the subject. (SCI)(AUTH)

A NEW PORTABLE WORKING LEVEL METER FOR INDOOR RADON (ENGLISH)

THOMSON I; NIELSEN TK

THOMSON & NIELSEN ELECTR LTD/KANATA K2K 2A3/ONTARIO/CANADA/
HEALTH PHYSICS, V52, S1, PS 42, 1987

A new radon working level meter has been developed specifically for indoor radon measurements in buildings. The instrument consists of an air sampling pump, radon daughter collection system and a gross alpha particle counting system. The operation of the system is similar to that described at last year's HPS meeting. (SCI) (AUTH)

INTERCOMPARISON OF DIFFERENT INSTRUMENTS THAT MEASURE RADON CONCENTRATION IN AIR (RADON AND ITS DECAY PRODUCTS),
SHIMO MICHIKUNI; IIDA TAKAO ; IKEBE YUKIMASA
NAGOYA UNIV, JAPAN,
ACS SYM SERIES 331, 1987, P160(12)

ASSN REPORT THE PERFORMANCE OF DIFFERENT INSTRUMENTS FOR THE MEASUREMENT OF RADON IN AIR WAS CONTRASTED. DEVICES TESTED INCLUDE AN IONIZATION CHAMBER, THE CHARCOAL-TRAP TECHNIQUE, A PULSE-COUNTING TECHNIQUE, A TWO-FILTER METHOD, AN ELECTROSTATIC COLLECTION SYSTEM, AND A PASSIVE INTEGRATING RADON MONITOR. MEASUREMENTS WERE PERFORMED OVER A CONCENTRATION RANGE FROM ABOUT 3.5 BQ/CU M IN OUTDOOR AIR TO 110 BQ/CU M IN INDOOR AIR. RESULTS OBTAINED FROM ALL TECHNIQUES EXCLUDING THE TWO-FILTER TECHNIQUE ARE COMPARABLE. RADON DAUGHTER CONCENTRATION MEASURED USING A FILTER-SAMPLING APPROACH WAS ABOUT 52% OF RADON CONCENTRATION. (1 DIAGRAM, 2 GRAPHS, 23 REFERENCES, 2 TABLES) (ENV)

MONITORING OF INDOOR RADON LEVEL BY PASSIVE ACTIVATED-CHARCOAL TOGETHER WITH EMBEDDED TLD (ENGLISH)
IWATA E; MA JZ; SAKAUE M
KANAZAWA UNIV, LLRL/ISHIKAWA 92312//JAPAN//; MINIST NUCL IND CHINA, INST RADIAT PROTECT/TAIYUAN//PEOPLES R CHINA/
JOURNAL OF RADIATION RESEARCH , V28, N1, P74-74, 1987

A very convenient and cheap method of measuring indoor Rn level with activated charcoal is discussed. (SCI) (HQL)

A PASSIVE INTEGRATING INDOOR RADON DETECTOR WITH ACTIVATED CARBON
REN T; LIN L
MINIST PUBL HLTH, IND HYG LAB, POB 8018/BEIJING//PEOPLES R CHINA/
RADIATION PROTECTION DOSIMETRY , V19, N2, P121-124, 1987

A passive method of determining radon concentration has been developed. The detector is a plastic canister containing 85g of activated carbon. The radon adsorbed in the canister is measured by a gamma ray spectrometer. The detector's performance has been tested with respect to response, air-tightness, reproducibility and the effects of temperature, humidity, exposure time, etc. Its advantages have been demonstrated in an investigation of indoor radon levels in Beijing. (SCI) (HQL)

**THE USE OF A COLOR TELEVISION SCREEN AS A MEANS FOR
PREDICTING INDOOR RADON CONCENTRATIONS**

COHN G R

419 6TH ST. NO. 7, ATLANTA, GA. 30308.

THIRTY-SECOND ANNUAL MEETING OF THE HEALTH PHYSICS SOCIETY,
SALT LAKE CITY, UTAH, USA, JULY 5-9, 1987. HEALTH PHYS 52
(SUPPL. 1). 1987.

S2.

CODEN: HLTPA

Language: ENGLISH

Document Type: CONFERENCE PAPER

Subfile: BARRM (Biological Abstracts/RRM)

This paper describes the techniques used to verify the collective properties of a color television screen to radon progeny. The test data in this paper imply that the measurement of progeny accumulated on a color television screen can predict the immediate concentration of radon daughters in a home. (BIO) (AUTH)

**Method to Automate the Radiological Survey Process Annual
meeting of the Southeastern Regional Health Physics Society
chapters, Williamsburg, VA, USA, 7 May 1987.**

Portions of this document are illegible in microfiche products.

NTIS Prices: PC A02/MF A01

Berven, B.A.; Blair, M.S.

Oak Ridge National Lab., TN.

Corp. Source Codes: 021310000; 4832000

Sponsor: Department of Energy, Washington, DC.

Report No.: CONF-8705132-1

1987 9p

Languages: English Document Type: Conference proceeding

NTIS Prices: PC A02/MF A01 Journal Announcement:

GRAI8724; NSA1200

Country of Publication: United States

Contract No.: AC05-84OR21400

This document describes the USRAD system, a hardware/software ranging and data transmission system, that provides real-time position data and combines it with other portable instrument measurements. Live display of position data and onsite data reduction, presentation, and formatting for reports and automatic transfer into databases are among the unusual attributes of USRADS. Approximately 25% of any survey-to-survey report process is dedicated to data recording and formatting, which is eliminated by USRADS. Cost savings are realized by the elimination of manual transcription of instrument readout in the field and clerical formatting of data in the office. Increased data reliability is realized by ensuring complete survey coverage of an area in the field, by elimination of mathematical errors in conversion of instrument readout to unit concentration, and by elimination of errors associated with transcribing data from the field into report format. The USRAD system can be adapted to measure other types of pollutants or physical/chemical/geological/biological conditions in which portable instrumentation exists. 2 refs., 2 figs. (NTIS)

Use of Vehicle-Mounted Radiological Equipment in the Diagnosis of Houses with Elevated Levels of Radon and Its Short-Lived Progeny

Radon diagnostic workshop, Princeton, NY, USA, 10 Apr 1987.

NTIS Prices: PC A02/MF A01

Dudney, C.S.; Berven, B.A.; Matthews, T.G.; Hawthorne, A.R.
Oak Ridge National Lab., TN.

Corp. Source Codes: 021310000; 4832000

Sponsor: Department of Energy, Washington, DC.

Report No.: CONF-8704119-1

1987 7p

Languages: English Document Type: Conference proceeding

NTIS Prices: PC A02/MF A01 Journal Announcement:

GRAI8722; NSA1200

Country of Publication: United States

Contract No.: AC05-84OR21400

Vehicle-mounted radiological equipment can be used in a variety of ways to identify and diagnose houses with radon problems. Some of the capabilities can be duplicated using modern portable electronic devices, but not all. In some cases the presence of a vehicle is needed due to the weight of shielding required or the presence of generators, computers, and other equipment for more sophisticated analyses. (ERA citation 12:031689) (NTIS)

**High-Volume Screen Diffusion Batteries and
alpha-Spectroscopy for Measurement of the Radon Daughter
Activity Size Distributions in the Environment**

Reineking, A., and J. Porstendorfer

Journal of Aerosol Science, Vol. 17, No. 5, pages 873-879,
17 references

October 1986 CODEN: JALSB7

An experimental device of high volume screen diffusion batteries was developed for the measurement of radon (²²²Rn) daughter activity size distribution in the 0.5 to 2000 nanometer particle size diameter in connection with alpha spectroscopy. The entire system was used to measure the separate activities of polonium-218 (²¹⁸Po), polonium-214 (²¹⁴Po), and lead-214 (²¹⁴Pb), being sensitive to particle size distribution of these products at activity levels as low as 1 Becquerel per cubic meter (Bq/m³). The system consisted of a set of batteries with different screen numbers which was set up for a volumetric flow rate of approximately 2 cubic meters/hour. Measurements performed in enclosed buildings demonstrated bimodal activity size distributions for ²¹⁸Po and unimodal distribution patterns for the ratio of ²¹⁴Pb to ²¹⁴Po; in the presence of additional aerosols, occasional trimodal or bimodal size distributions were recorded. The activities were collected on membrane filters before and after each screen diffusion battery, and surface barrier detectors were used to measure the alpha activities during and after sampling. The size distributions were determined by comparing the measured values with simulated penetration values, using a nonlinear optimization method and a least square fit. The device was also found to be effective for determining the properties of thoron (²²⁰Rn) daughters, bismuth-212 (²¹²Bi) and polonium-212 (²¹²Po), with a sampling time of several hours. (OSH)

**THE USE OF THE TIME-AVERAGED WL SURVEY METER FOR INDOOR
RADON MEASUREMENT**

PAI H L

SERV. INSTRUMENTS LTD., 50 SILVER STAR BLVD., UNIT 208,
SCARBOROUGH, ONT. M1V 3L3, CAN.

THIRTY-FIRST ANNUAL MEETING OF THE HEALTH PHYSICS SOCIETY,
PITTSBURGH, PA., USA, JUNE 29-JULY 3, 1986. HEALTH PHYS
50 (SUPPL. 1). 1986.

CODEN: HLTPA

Language: ENGLISH

Document Type: CONFERENCE PAPER

Subfile: BARRM (Biological Abstracts/RRM)

In 1980, we had reported the development of a time-averaged WL survey meter for indoor measurement of radon. Latest

developments in radon dosimetry had necessitated modification in our design. Currently, there is an urgent need to provide economical short term measurements to facilitate the locating of seriously radon-contaminated houses and estimation of the relative risk to the exposed public. Both of these applications require the estimation of daily and annual averages. To accomodate this, we have modified our instrument. In the light of the current knowledge of diurnal and seasonal variation, it is now capable of being used for both "screening" and risk estimation without resorting to the extended sampling times. As a result, surveys performed with this instrument can be both simple and inexpensive. (BIO) (AUTH)

ESTIMATING ANNUAL AVERAGE RADON CONCENTRATIONS FROM SHORT-TERM TRACK ETCH EXPOSURES

GEORGE J L; LANGNER G H JR

BENDIX FIELD ENG. CORP., P.O. BOX 1569, GRAND JUNCTION, CO 81502, USA.

THIRTY-FIRST ANNUAL MEETING OF THE HEALTH PHYSICS SOCIETY, PITTSBURGH, PA., USA, JUNE 29-JULY 3, 1986. HEALTH PHYS 50 (SUPPL. 1). 1986.

S60. CODEN: HLTPA

Language: ENGLISH

Document Type: CONFERENCE PAPER

Subfile: BARRM (Biological Abstracts/RRM)

The Uranium Mill Tailings Remedial Action Program currently estimates the annual average radon-daughter concentrations(RDC) within structures from year-long measurements of radon or radon daughters. Reliable RDC estimates made from shorter-term measurements would be extremely useful, but short-term methods with currently investigating short-term exposure of Terradex Track Etch^r radon detectors in residences in the Grand Junction, Colorado, area. (BIO) (AUTH)

Protocol for the Estimation of Average Indoor Radon-Daughter Concentrations

Portions of this document are illegible in microfiche products. Original copy available until stock is exhausted.

NTIS Prices: PC A03/MF A01

Langner, G.H.; Pacer, J.C.

Bendix Field Engineering Corp., Grand Junction, CO.

Corp. Source Codes: 056119000; 9502148

Sponsor: Pennsylvania Power and Light Co., Allentown.; Department of Energy, Washington, DC.

Report No.: GJ/TMC-09

Jun 86 45p

Languages: English

NTIS Prices: PC A03/MF A01 Journal Announcement:
GRAI8705; NSA1100
Country of Publication: United States
Contract No.: AC07-76GJ01664

The US Department of Energy Office of Remedial Action and Waste Technology established the Technical Measurements Center (TMC) in 1982 at the Grand Junction, Colorado, Projects Office. The TMC mission is to provide standardization, calibration, comparability, verification of data, quality assurance, and cost-effectiveness for the environmental measurement requirements of DOE remedial action programs. One measurement requirement is the measurement of radon-daughter concentration within structures. The Technical Measurements Center has developed a protocol which specifies the procedures to be used for determining indoor radon-daughter concentrations in support of Department of Energy remedial action programs. This document is the central part of the protocol and is to be used in conjunction with the individual procedure manuals. The manuals contain the information and procedures required to implement the proven methods for estimating average indoor radon-daughter concentration. Proven in this case means that these methods have been determined to provide reasonable assurance that the average radon-daughter concentration within a structure is either above, at, or below the standards established for remedial action programs. This document contains description of the generic aspects of methods used for estimating radon-daughter concentration and provides guidance with respect to method selection for a given situation. The methods discussed are: Kodak-Pathe alpha-track film method; radon progeny integrating sampling unit (RPISU) unit; and radon grab method. (ERA citation 11:050175) (NTIS)

A diffusion barrier charcoal adsorption collector for measuring Rn concentrations in indoor air.

Cohen BL; Nason R

Health Phys Apr 1986, 50 (4) p457-63, ISSN 0017-9078

Journal Code: G2H

Languages: ENGLISH

Development of a practical detector for collecting Rn by adsorption in charcoal with a time integration of 2 d or more, achieved by use of a diffusion barrier through which Rn enters, is described. The sensitivity is adequate for monitoring Rn levels in houses. It is easily sent and returned by mail, and instructions for use are simple enough for any householder to follow. The cost per measurement is apparently well below that for competitive techniques. (MED)

Application of Passive and Active Measuring Methods to Quantify Radon Sources and Radon Behaviour in Swiss Dwelling-Houses: First Results

In German.

U.S. Sales Only.

NTIS Prices: PC A03/MF A01

Pensko, J.; Burkart, W.

Eidgenoessisches Inst. fuer Reaktorforschung, Wuerenlingen (Switzerland).

Corp. Source Codes: 010503000; 2314000

Report No.: EIR-587

Feb 86 31p

Languages: German

NTIS Prices: PC A03/MF A01

Journal Announcement:

GRAI8701

Country of Publication: Switzerland

Sources of radon and pathways in which radon can reach dwelling-rooms are discussed and the most important impacts of environment and climate are defined. Some proposals for further studies of radon behaviour indoors are formulated. In continuation of the previous measurements of radon in Swiss dwellings the complementary passive method for radon concentration measurements in the room atmosphere and for radon exhalation rate measurements from walls and soil surfaces are introduced. An example of the application of these methods for measuring radon and decay products concentration, equilibrium factor and radon exhalation rate estimation in two dwelling-houses as well as some application of these data for radon behaviour examination indoors are discussed. (Atomindex citation 17:035658) (NTIS)

COMPARISON OF NUCLEAR TRACK AND DIFFUSION BARRIER CHARCOAL ADSORPTION METHODS FOR MEASUREMENT OF RADON-222 LEVELS IN INDOOR AIR

COHEN B L

DEP. PHYS., UNIV. PITTSBURGH, PITTSBURGH, PA. 15260.

HEALTH PHYS 50 (6). 1986. 828-829. CODEN: HLTPA

Language: ENGLISH

Subfile: BARRM (Biological Abstracts/RRM)

The nuclear track method of measuring ^{222}Rn levels in indoor air has developed into a commercial service and is in widespread use throughout the world. Another method suitable for large-scale surveys, using diffusion barrier charcoal adsorption collectors (DCBA), has been developed recently, and has been used in many thousands of measurements. This article compares the advantages and disadvantages of the two methods. (BIO) (AUTH)

Procedure Manual for the Estimation of Average Indoor Radon-Daughter Concentrations Using the Radon Grab-Sampling Method

NTIS Prices: PC A03/MF A01

George, J.L.

Bendix Field Engineering Corp., Grand Junction, CO.

Corp. Source Codes: 056119000; 9502148

Sponsor: Department of Energy, Washington, DC.

Report No.: GJ/TMC-11

Apr 86 47p

Languages: English

NTIS Prices: PC A03/MF A01

Journal Announcement:

GRAI8622; NSA1100

Country of Publication: United States

Contract No.: AC07-76GJ01664

The US Department of Energy (DOE) Office of Remedial Action and Waste Technology established the Technical Measurements Center to provide standardization, calibration, comparability, verification of data, quality assurance, and cost-effectiveness for the measurement requirements of DOE remedial action programs. One of the remedial-action measurement needs is the estimation of average indoor radon-daughter concentration. One method for accomplishing such estimations in support of DOE remedial action programs is the radon grab-sampling method. This manual describes procedures for radon grab sampling, with the application specifically directed to the estimation of average indoor radon-daughter concentration (RDC) in highly ventilated structures. This particular application of the measurement method is for cases where RDC estimates derived from long-term integrated measurements under occupied conditions are below the standard and where the structure being evaluated is considered to be highly ventilated. The radon grab-sampling method requires that sampling be conducted under standard maximized conditions. Briefly, the procedure for radon grab sampling involves the following steps: selection of sampling and counting equipment; sample acquisition and processing, including data reduction; calibration of equipment, including provisions to correct for pressure effects when sampling at various elevations; and incorporation of quality-control and assurance measures. This manual describes each of the above steps in detail and presents an example of a step-by-step radon grab-sampling procedure using a scintillation cell. (ERA citation 11:037651) (NTIS)

MEASUREMENT OF RADON CONCENTRATION IN DWELLINGS BY USING SIMPLE METHOD WITH ACTIVE CHARCOAL (ENGLISH)

IWATA E; SAKANOUE M

KANAZAWA UNIV, LOW LEVEL RADIOACT LAB/TATSUNOKUCHI T/ISHIKAWA

The simple method to measure radon concentration in dwellings was examined by using active charcoal for adsorption of radon. Since this method may be liable to be influenced by humidity, its adsorption and retention characteristics for radon were investigated on the different settings of charcoal in connection with humidity. From these results, the canisters containing 100g of active charcoal were used to know the concentration levels of radon in 89 dwellings (total measurements were 116, including 7 outdoors experiments) at Hiroshima, Kanazawa and Mihama in Fufui Pref. from Dec. 1984-Aug. 1985. (SCI) (AUTH)

MEASUREMENTS OF RADON IN DWELLINGS WITH CR-39 TRACK DETECTORS (ENGLISH)

MAJBORN B

RISO NATL LAB/DK-4000 ROSKILDE//DENMARK/

NUCLEAR TRACKS AND RADIATION MEASUREMENTS-INTERNATIONAL JOURNAL OF RADIATION APPLICATIONS AND INSTRUMENTATION PART D, V12, N1-6, P763-766, 1986

A passive integrating dosimeter has been designed for measuring natural radiation in dwellings. The dosimeter contains one or two CR-39 track detectors to measure radon and three thermoluminescence dosimeters to measure external radiation. The dosimeter was investigated in a pilot study in 1983/84, and it is now used in a nation-wide survey of natural radiation in Danish dwellings. The characteristics of the dosimeter with respect to radon measurements are presented, and the radon monitoring results obtained in the pilot study are summarized. (SCI) (AUTH)

A RADON-222 MONITOR USING ALPHA-SPECTROSCOPY

WATNICK S; LATNER N; GRAVESON R T

ENVIRON. MEASUREMENTS LAB., U.S. DEP. ENERGY, NEW YORK, N.Y. 10014.

HEALTH PHYS 50 (5). 1986. 645-646. CODEN: HLTPA

Language: ENGLISH

Subfile: BARRM (Biological Abstracts/RRM)

A newly developed monitor which has been installed at the Environmental Measurements Laboratory's calibration facility is described. (BIO) (HQL)

Radon Measurement Methods: An Overview

Health Physics Society meeting, Pittsburgh, PA, USA, 30 Jun 1986.

Portions of this document are illegible in microfiche products.

NTIS Prices: PC A03/MF A01

Jenkins, P.H.

Monsanto Research Corp., Miamisburg, OH. Mound.

Corp. Source Codes: 018512003; 9515000

Sponsor: Department of Energy, Washington, DC.

Report No.: MLM-3371(OP); CONF-8606139-5

1986 38p

Languages: English Document Type: Conference proceeding

NTIS Prices: PC A03/MF A01 Journal Announcement:

GRAI8626; NSA1100

Country of Publication: United States

Contract No.: AC04-76DP00053

The purpose of this paper is to present an overview of methods used for measuring radon and radon progeny to persons familiar with radiation measurement techniques, but who have little or no experience with measuring radon or radon progeny. There are numerous approaches that can be used to measure radon and radon progeny, and all of them have probably been used at one time or another. Therefore, a large variety of instruments and methods have evolved and are in use today. It is the intention that this paper be a comprehensive overview; but, with so many different techniques in existence, inevitably some will be omitted. (ERA citation 11:005518) (NTIS)

USE OF CELLULOSE NITRATE AS RADON AND RADON DAUGHTERS DETECTORS FOR INDOOR MEASUREMENTS (ENGLISH)

RANNOU A; JEANMAIRE L; TYMEN G; MOUDEN A; NAOUR E; PARMENTIER N; RENOARD H

CEA, INST PROTECT & SURETE NUCL, DEPT PROTECT SANITAIRE, SEAPS, BP 6/F-92265

FONTENAY ROSES//FRANCE/; FAC SCI BREST, PHYS AEROSOLS LAB/F-29200

BREST//FRANCE/; COSTIC/F-78470 ST REMY CHEVREUSE//FRANCE/ NUCLEAR TRACKS AND RADIATION MEASUREMENTS-INTERNATIONAL JOURNAL OF RADIATION APPLICATIONS AND INSTRUMENTATION PART D, V12, N1-6, P747-750, 1986

A passive dosimeter based on LR 115 track detector has been developed. A series of experiments has been performed to determine the alpha track registration properties of the Kodak film, the reliability of automatic spark counting and the suitability of the passive method for indoor measurements. Comparison between passive and active dosimeters has also been investigated. (SCI) (AUTH)

THE USE OF OPEN TRACK FILMS FOR RADON-222 MEASUREMENTS IN DWELLINGS

HERTZMAN S; SAMUELSSON C

DEP. RADIATION PHYSICS, SAHLGREN HOSP., S-413 45 GOTHENBURG.
13TH INTERNATIONAL CONFERENCE ON SOLID STATE NUCLEAR TRACK
DETECTORS, PALAZZO BARBERINI, ROME, SEPTEMBER 23-27, 1985.

NUCL TRACKS RADIAT MEAS 12 (1-6). 1986. 755-758. CODEN:
NTRMD

Language: ENGLISH

Subfile: BARRM (Biological Abstracts/RRM)

Numerous epidemiological investigations during the last years to study the possible health effects of an exposure to radon and its daughter products have shown the need for a cheap and reliable large scale indoor radon daughter detector. The alpha sensitive track film could be a very useful tool to calculate a yearly average value of the exposure to radon daughters in an individual dwelling. (BIO) (AUTH)

Interlaboratory Radon-Daughter Measurement Comparison Workshop

Interlaboratory radon-daughter measurement comparison workshop, Grand Junction, CO, USA, 9 Sep 1985.

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NTIS Prices: PC A03/MF A01

Pearson, M.

Bendix Field Engineering Corp., Grand Junction, CO.

Corp. Source Codes: 056119000; 9502148

Sponsor: Department of Energy, Washington, DC.

Report No.: GJ/TMC-25; CONF-8509306-SUM.

Jun 86 47p

Languages: English Document Type: Conference proceeding

NTIS Prices: PC A03/MF A01 Journal Announcement:

GRAI8702; NSA1100

Country of Publication: United States

Contract No.: AC07-76GJ01664

The US Department of Energy (DOE) Office of Remedial Action and Waste Technology established the Technical Measurements Center to provide standardization, calibration, comparability, verification of data, quality assurance, and cost-effectiveness for the measurement requirements of DOE remedial action programs. One of the remedial-action measurement needs is the estimation of average indoor radon-daughter concentration (RDC). The Technical Measurements Center sponsored an interlaboratory workshop during the period 9-12 September 1985 for the purpose of providing an opportunity for comparison of radon-daughter measurements, in the absence of an absolute calibration standard for such radon-daughter measurements. The Radon-Radon-Daughter

Environmental Chamber at the DOE Grand Junction Projects Office was used for the workshop. Primary consideration was given to radon-daughter grab-sampling methods, but Radon Progeny Integrating Sampling Unit (RPISU) measurements and radon-flux measurements were also investigated. Results from the workshop indicate that comparable results for radon-daughter measurements can be obtained by a variety of instruments and technicians all employing the same method. Special attention must be given to the accuracy of air volume sampled, but with appropriate care any of a number of instruments can provide a reliable radon-daughter concentration value. The radon-daughter grab-sampling results also verify the comparability of two different methods for making such measurements, alpha spectroscopy and the Thomas-modified Tsivoglou method. The two additional facets of the workshop, RPISU and radon-flux measurements, demonstrate that reliable measurements with RPISUs and charcoal canisters can be made with appropriately calibrated instruments from widely dispersed laboratories. (ERA citation 11:041122) (NTIS)

Interim Indoor Radon and Radon Decay Product Measurement Protocols

(M. /Ronca-Battista;P. /Magno ;S. /Windham;E. /Sensintaffa)

NTIS Prices: PC A04/MF A01

Office of Radiation Programs, Washington, DC.

Corp. Source Codes: 038529000

Report No.: EPA/520/1-86/04

Apr 86 65p

Languages: English

NTIS Prices: PC A04/MF A01 Journal Announcement:

GRAI8620 Country of Publication: United States

The report provides EPA's procedures for measuring radon concentrations in houses with continuous radon monitors, charcoal canisters, alpha-track detectors, and grab radon techniques. It also provides procedures for measuring radon decay product concentrations with a continuous working level monitor, a radon progeny integrating sampling unit (RPISU), and grab radon decay product methods. Specifications for the location of the measurement, the house conditions during the measurement, and minimum requirements for quality control are included in each procedure. (NTIS)

Affordable new radon detection technology

Anon.

EMERG. PLANN. DIG VOL. 13, NO. 4, pp. 29-30, Publ.Yr: 1986

Languages: ENGLISH

Radon gas, which is produced by the decay of radioactive materials in many geological formations in Canada and the United States, is becoming a major concern. It can seep into the basements of homes in vulnerable areas and prolonged breathing of it can cause lung cancer. The gas is colourless and odourless, and can be detected only using a monitor to sample the air over a period. To date, such radio monitors have relied upon computer technology to analyse the result of samples, which requires a user to send samples away and await results. (POL)

MONITORING RADON IN INDOOR AIR

ANON

ANAL CHEM 58 (1). 1986. 44A, 46A-47A. CODEN: ANCHA

Language: ENGLISH

Subfile: BARRM (Biological Abstracts/RRM)

Several simple and inexpensive methods of monitoring radon in homes and other buildings have been developed. These include a plastic detector that is sensitive to the alpha particles emitted by radon and a canister containing mesh activated carbon which absorbs radon. (BIO) (HQL)

Ultra-Clean Underground Counting Facility for Low-Level Environmental Samples

Symposium on environmental radiochemical analysis, Harwell, UK, 1 Oct 1986.

Portions of this document are illegible in microfiche products.

NTIS Prices: PC A03/MF A01

Winn, W.G.; Bowman, W.W.; Boni, A.L.

Du Pont de Nemours (E.I.) and Co., Aiken, SC. Savannah River Lab.

Corp. Source Codes: 009966002; 2204000

Sponsor: Department of Energy, Washington, DC.

Report No.: DP-MS-85-157; CONF-8610174-1

1986 49p

Languages: English Document Type: Conference proceeding

NTIS Prices: PC A03/MF A01 Journal Announcement:

GRAI8713; NSA1200

Country of Publication: United States

Contract No.: AC09-76SR00001

An underground counting facility with cleanroom environment has been designed and constructed to improve detection of low-level radioisotopes in the environment. The 3.0 m x 4.3 m x 2.4 m counting chamber is placed 14.3 m below ground, has 10.2-cm thick walls of pre-WWII naval armor plate, and is further shielded by a minimum of 1.2 m of specular hematite. The total

overburden of shielding is equivalent to 31.7 m of water. Careful selection of building materials and a special air filtering system maintain a cleanroom environment with minimum contamination potential. Background improvements are noted relative to an earlier ground-level counting chamber with 30.5-cm-thick walls of pre-WWII naval armor plate. The gamma background continuum is reduced by a factor of 3 to 4 in the region of 0 to 10 MeV. A minimum of 10.2 cm of low-background lead around the detector optimizes this factor at 4 to 6. Discrete gammas from airborne natural radon daughters are eliminated by controlling the air near the detectors. Detectors constructed with low-level materials will further realize the improvements in background. A constant background is required for long counts of low-level samples, and the underground detectors are well shielded against surface operations. Performance appraisals of facility detectors include a large dual NaI(Tl) coincidence system, three smaller NaI(Tl) detectors, an HPGe well detector, and gas proportional and geiger counters. Major electronics for the detectors are located at a ground level control center to eliminate any associated backgrounds. Because an individual sample may be counted several days, uninterruptable power is used. An IBM PC/XT computer processes spectra from multichannel analyzers using custom-developed software. (ERA citation 12:012301) (NTIS)

A SURVEY OF INDOOR AIR MONITORING SERVICES: IS THERE A PRIVATE DEMAND FOR HEALTHFUL INDOOR AIR QUALITY?
SEXTON KEN
CALIFORNIA DEPT HEALTH SERVICES, BERKELEY,
APCA J, JUN 85, V35, N6, P626(6)

JOURNAL ARTICLE NATIONAL SURVEY RESULTS ON FEE-FOR-SERVICE COMPANIES THAT MAKE INDOOR AIR MEASUREMENTS IN NONINDUSTRIAL SETTINGS ARE EXAMINED. MAKEUP OF THE FIRMS, TYPES AND NUMBERS OF BUILDINGS, TYPICAL CONTAMINANT MEASUREMENTS, AND ASSOCIATED COSTS ARE DESCRIBED. RESULTS INDICATE THAT A SUBSTANTIAL PRIVATE DEMAND EXISTS FOR GOODS AND SERVICES WHICH AID BUILDING OCCUPANTS IN EVALUATING AND IMPROVING INDOOR AIR QUALITY. COSTS TO HOMEOWNERS FOR MEASUREMENTS OF FORMALDEHYDE, ASBESTOS, VOLATILE ORGANIC COMPOUNDS, RADON, AND AIR-EXCHANGE RATE ARE LIKELY TO BE GREATER THAN \$100 FOR EACH PARAMETER MONITORED. (6 REFERENCES, 5 TABLES) (ENV)

CONTINUOUS RADIATION WORKING-LEVEL DETECTORS
DROULLARD R.F.; HOLUB R.F.
USBM, CO,
USBM REPORT IC 9029, 1985 (24)

FED GOVT REPORT IMPROVED DESIGNS FOR CONTINUOUS WORKING-LEVEL DETECTORS FOR MONITORING RADIATION WORKING LEVELS AND RADON DAUGHTER PRODUCTS IN MINES AND DWELLINGS ARE DESCRIBED. DEVICES FOR FILTER SURFACE AND AMBIENT AIR COUNTING ARE ADDRESSED. FACTORS AFFECTING ACCURACY ARE IDENTIFIED, INCLUDING VOLUMETRIC AIRFLOW VARIATIONS AND RADON DAUGHTER MIXTURE VARIATIONS. (2 DIAGRAMS, 8 GRAPHS, 13 PHOTOS, 21 REFERENCES, 1 TABLE) (ENV)

Analytical Capability of the Environmental Radiation Ambient Monitoring System

NTIS Prices: PC A04/MF A01

Broadway, J.A.; Mardis, M.

Eastern Environmental Radiation Facility, Montgomery, AL.
Corp. Source Codes: 062831000

Report No.: EPA-520/5-83-024

Sep 83 74p

Languages: English

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Country of Publication: United States

The ERAMS program is composed of a network of sampling stations throughout the United States plus an associated radioanalytical and assessment support group. These components provide a capability to evaluate environmental consequences from both normal ambient concentrations of radiation and time dependent changes as measured by the samples. The program is structured to measure concentrations of radionuclides in air, milk, surface water, and drinking water and to estimate dose and health impact. Several examples of short-term and long-term assessments of dose and health effect calculations from the ERAMS data base have been presented in this report. (NTIS)

VII. APPENDIX

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