

American Association of Radon Scientists and Technologists, Inc.

UPDATE Announcement

*Abstracts Currently Accepted For Presentations
at the
2013 International Radon Symposium
Springfield, Illinois
September 22-25, 2013*

June 20, 2013 - The following nineteen abstracts have been initially accepted for presentation by the peer review committee of the 2013 International Radon Symposium, to be held this year in Springfield, Illinois from September 22-25, 2103. An additional abstract is also under consideration. The Symposium reserves the right to accept additional abstracts for presentation, and to make changes to the program. An initial program has been published and delineate prospective speakers and presentation times.

All presentations and publication of subsequent papers are contingent upon the researchers acceptance and completion of the full requirements of the International Radon Symposium's Proceedings editorial committee.

Please check the International Radon Symposium web site for ongoing program updates:
www.internationalradonsymposium.org



POTENTIAL RADON RELEASE DURING FRACKING IN COLORADO

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Abstract

Hydraulic fracturing or 'fracking' has become the industry standard for oil and gas production in the United States. The process entails fracturing large sections of rock with high pressure to release oil and gas reserves and to produce conduits for these fluids to flow more easily to the surface. Along with the intended natural gas, water, or any other fluids or other substances that might be trapped with the gas in the tight formation shales that are fracked, come to the surface. There is some evidence that radium-226, radon-222 and other toxic substances have been detected in significant concentrations at well heads of fracking operations (McMahon, 2013 and Tait et al., 2013). The foothills and plains along the Front Range in Colorado has become an active area for gas and oil production. Most of this activity takes place in the upper Cretaceous limestone/shale Niobrara formation that generally lies between 2,000 and 3,000 meters below the surface. Our tests of the radium-226/radon-222 equilibrium concentrations in the Niobrara limestone indicate that high levels of radon may be released when the rock is crushed or fracked. The fracked rock releases radon that was trapped by the tight shale formation which then is able to flow along the lateral sections of the fracked zone and be pumped up the well bore to the surface. Radon is then released to the atmosphere at the fracking site in levels which may be of some health concern to nearby workers or residents.

RADON RISK COMMUNICATION STRATEGIES: A REGIONAL STORY

Winnie Cheng

Regional Radiation Specialist, Health Canada

Abstract

Risk communication on radon encounters is never want of challenges. The concern over radon exposure and its health effect may vary according to people's level of knowledge. Homeowners in radon-prone areas usually have greater concern over those who are not. Thus, the latter group are often found resistant to testing. However, there were homes lying outside of the radon-rich zone which showed radon levels above the guideline. Thus, different strategies are required for effective communication. The Environment Health Program of Health Canada in B.C. region has been using a diverse approach in their risk communication through social media, workshop, webinar, public forum, poster contest, radon distribution map, public inquiries, tradeshow and conference event, partnership with different jurisdictions and non-government organization. Five years of valuable lessons are discussed.

**TESTING FOUNDATION TYPES DURING RADON SCREENING AND
ITS IMPLICATIONS FOR CLIENT SAFETY AND MITIGATION**

Wallace O Dorsey Jr

Radon-Ease, Inc.

Abstract

Many structures have multiple methods of attachment to the earth: crawl spaces, slabs, basements and sometimes multiples of each. Testing the living space above each of the various substructures is similar to testing a different home. When testing each area independently, one finds varying radon levels, often substantially so. Sometimes the most elevated readings are in areas other than the basement, such as a bedroom over a crawl space. Here we describe and quantify those differences and the importance of discovering those differences during the initial screening process, potentially protecting our client's health and reducing our liability from future lawsuits.

Radon exposure and medical geology: Is predictive mapping a way to go?

Douma, Stephanie L. MSc., P.Geo., PHRAM (Cert.)

Ottawa, ON Canada

Radon maps based on indoor radon data grouped by geological formations (geogenic maps) have the capability to accurately estimate the percentage of dwellings affected together, with the spatial detail and precision conferred by the geological mapping methods. Radon potential maps have important applications to environmental health and building control legislations. Recent research in assessing the validity of geological-based ecological radon models concluded that they were robust and useful for epidemiological research. Is it time to get serious about using geologically-based robust radon potential mapping and epidemiological studies linking radon exposure to health outcomes?

**The Diurnal Cycle, Ignoring It May Nullify Measurements And Skew
Risk Assessment Based Upon Short-Term Measurements**

Harry Grafton

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Abstract

It has become common in recent years to disregard the diurnal cycle when making radon measurements. EPA's guidance in *Indoor Radon and Radon Decay Product Measurement Device Protocols* places measuring complete diurnal cycles at the foundation of the radon measurement strategy. Ignoring the diurnal cycle biases marginal radon measurements (measurements around EPA's action guideline of 4.0 pCi/L), usually to the low side, rendering false negative recommendations regarding mitigation.

Using common marginal measurements, this presentation will demonstrate the need to observe EPA's requirement of complete diurnal cycles, ± 2 hours. Marginal measurements of two, three, and four days will be presented, illustrating the effects of ignoring the diurnal cycle.

Recent and future measurement protocols must include the requirement to measure complete diurnal cycles in order to compare the results to EPA's action guideline or they should employ another number for recommending the need for mitigation.

Using short-term measurements to assess long-term risk is already riddled with flaws. Introducing skewed measurements into the estimates could render results meaningless.

**APPLYING DYNAMIC CONTROLS AND REMOTE MONITORING TO
RADON MITIGATION SYSTEMS TO ADVANCE ENERGY
CONSERVATION AND THE STABILIZATION OF INDOOR RADON
CONCENTRATIONS**

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Abstract

This paper describes the application of dynamic motor controls and remote monitoring systems that have been designed to achieve maximum operational efficiency, stabilize indoor radon concentrations and demonstrate long term performance of radon mitigation systems. The current generation of radon systems is designed with the intent of lowering indoor radon concentrations to below 4.0 pCi/L in accordance with the USEPA recommendation for corrective action. To achieve these levels, systems are designed to operate at full power year round which contributes to energy inefficiencies. In most cases very little is known about the long term performance of the system and the impacts of season variables that effect pressure differentials and ultimately radon concentrations. The paper demonstrates how the implementation of reactive circuitry and remote monitoring and management systems can achieve specified sub slab pressure differentials, regulate indoor radon concentrations, and improve energy conservation.

**MEASURING RADON CONCENTRATIONS INSIDE A LARGE
HOSPITAL IN SAUDI ARABIA**

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Abstract

Indoor radon concentrations have been measured in the King Abdulaziz Medical City, in Riyadh city, Saudi Arabia. This city includes King Fahed Hospital, Administration Building, College of Medicine, and King Abdullah International Research Center. The Administration, College of Medicine and the research center buildings are occupied about one third of the day (from 8:00 am to 5:00pm) during the working days, however, they are closed for the rest of the day and during weekends without any ventilation. King Fahed Hospital is a huge building spread horizontally with only one ground floor. Due to high temperature in summer and dusty and dry weather in winter, the windows and doors of various building of this city are always kept closed. Therefore, radon can be accumulated inside these buildings, especially in confined areas and ground floors. In this study, we used the time-integrated passive diffusion radon dosimeters, containing CR-39 solid state nuclear track detectors to measure indoor

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radon concentrations in the ground floors of the medical city buildings. The highest average concentration was on the administration building ($44.9 \pm 3.1 \text{ Bqm}^{-3}$) and the lowest on the research center building ($12.9 \pm 1.5 \text{ Bqm}^{-3}$). In general, the average indoor radon concentration King Abdulaziz Medical City was $22.2 \pm 2.0 \text{ Bqm}^{-3}$. This indoor radon concentration is below the average indoor radon concentration in Riyadh city as well as that for the action level recommended by ICRP.

VAPORS FROM RADON MITIGATION SUPPLIES

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Abstract

Unpleasant odors that emanate from caulking and sealing materials used by radon mitigators can be nose, throat, and lung irritants, especially when used in unvented, close-quarter situations. While these odors may irritate occupants of the building for several days until the materials offgas and solidify, the radon mitigators are much more at risk of a breathing irritation since they are exposed during installations. In this study, the vapors from fresh caulking and sealing materials, obtained from radon mitigation suppliers, were analyzed by gas chromatography and mass spectrometry to evaluate the chemical compounds and their source strengths. Results are compared to both Material Safety Data Sheets for the products and commonly used household cleaners.

ADVANCED CALIBRATION EQUATIONS FOR E-PERM® ELECTRET ION CHAMBERS

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Rad Elec Inc

Abstract

The E-PERM® electret ion chambers (EICs) have been widely used for research in indoor and outdoor radon measurements. Because of the continuously decreasing nature of the electret voltages during measurement, calibration factors are not constants and depend upon the initial and final voltages of electrets. Calibration factors are fitted to an equation that relates the calibration factors to the initial and final voltages. Simple calibration equations currently in use restrict the use of electrets to the initial readings of 750-250 volts. Recent research indicated that it is possible to derive the calibration equations applicable for wider ranges. A detailed procedure is described for calibrating SST EICs and deriving an appropriate equation, applicable over the range of 750 volts to 70 volts. Furthermore, the newly derived equation fits the experimental data with better precision, compared to the currently used equations.

**ADAPTING RADON SYSTEMS FOR VAPOR REMOVAL IN
COMMERCIAL BUILDINGS: A CASE STUDY**

Tony McDonald

A-Z Solutions, Inc.

Abstract

The technology behind radon mitigation systems has been proven effective in treating buildings with soil vapor intrusion. While these two types of systems have similar principles, they differ greatly when it comes to scale and practical application. In order to be successful in using mitigation systems for vapor intrusion in a commercial building a distinct combination of robust sub slab depressurization, sub membrane depressurization and suction trenching should be applied.

The case study property in question was a 50,000 square foot former manufacturing facility with various levels of VOC concentrations in the soil. This building was comprised of 45,000 square feet of commercial space and 5,000 square feet of dirt crawl space. Sub slab communication testing proved different mitigation techniques would be required throughout the building to achieve a continuous negative pressure field.

**AN EVALUATION OF RADON MITIGATION SYSTEM
INSTALLATIONS DEMONSTRATES A NEED FOR IMPROVEMENT**

Susan M. Martino and Patty Dooley-Strappelli

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Abstract

Boulder County Public Health has inspected more than 80 residential active soil depressurization systems throughout Boulder County, Colorado. Inspection objectives are to ensure systems are properly installed, to encourage owners to keep their systems in good repair, and to encourage owners to test their systems every two years. Short-term radon tests were performed with every inspection. System components common to all system types such as exhaust were evaluated based on industry accepted standards. To date, nine of the systems tested exceeded the EPA Action Level of 4.0 pCi/L. Fifty-eight (69%) had incorrectly installed exhaust systems and 83% were incorrectly labeled. Adherence to industry accepted standards for depressurization systems were compared between radon mitigation companies and other installer types. Additionally, implications for mitigation company certification are explored.

**MEASUREMENT OF THORON AND ITS PROGENY IN
TRADITIONAL AND MODERN EARTHEN BUILDINGS IN
GERMANY: METHODOLOGY AND RESULTS**

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Abstract

In the past, the radon isotope Rn-220 (thoron) was often paid little attention to in the context of radiation protection at home. Measurements in buildings on the Central-Chinese Loess Plateau have shown, however, that in dwellings built from unfired earthen material, thoron and its progeny can significantly contribute to the inhalation dose of the dwellers. In Germany, such buildings mainly comprise traditional half-timbered houses and modern ecological low-energy houses with clay boards and plaster. Measurements of thoron in several such houses show concentrations of up to 150 Bq/m³ (at 20 cm distance from the wall). Radon and thoron progeny were measured with a newly constructed device which makes use of aerosol precipitation in an electric field upon solid-state nuclear track detectors. Thoron progeny concentrations were in the range from 100 to 1000 nJ/m³ resulting in a dose contribution of up to about 5 mSv per year.

**IMPACT OF THE NEW BASIC SAFETY STANDARDS IN THE
SPANISH RADON PROGRAM**

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Abstract

The new Basic Safety Standards (BSS) are under discussion at the European Council in order to issue a council directive. The Directive includes the exposure of members of the public to indoor radon. The Annex XVI of the document summarizes the list of items to be covered in the national action plan to manage risks from radon exposures. In the case of Spain, the need for a Radon Program includes the existence of laboratories with expertise on radon measurements. Therefore our group in collaboration with ENUSA S.A. (Spanish National Uranium Company) has created a laboratory on natural radiation (LNR) in the facilities of an old uranium mine where radon concentrations are subjected to daily variations due to changes in environmental conditions. We present the main results of several intercomparison exercises carried out in this laboratory. The results involve active and passive detectors covering a wide range of radon exposures.

The Effect of Energy Efficient Construction Technologies on Indoor Radon

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Abstract

New building concepts like green building or passive houses aim at a new approach for the design and construction in order to reach a high level of energy efficiency and sustainability.

In the framework of two projects the effect of such new building concepts on indoor radon levels was investigated in detail. First, within the EU-project RADPAR the construction, heating, and ventilation technologies used in such dwellings were identified, their potential effect on indoor radon was assessed and verified in a survey in 36 passive houses in radon prone areas in Austria. In a second study various indoor air parameters like formaldehyde, VOC, allergens, ventilation rates as well as radon were determined and assessed in 60 conventional new buildings and 60 new passive houses. The paper gives detailed information on the results of those studies as well as on recommendations to avoid any adverse effect of new building technologies on indoor radon levels.

CANADIAN GUIDANCE FOR PUBLIC AND OCCUPATIONAL EXPOSURE TO RADON

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Abstract

The Health Canada action guideline for exposure to radon in dwellings is 200 Bq/m³. A "dwelling" includes homes and also buildings that have a high occupancy time by the same members of the public such as schools, hospitals, long-term care residences, and correctional facilities. This guideline does not apply to radon exposure in workplaces. Radon exposure in Uranium mines is regulated by the Canadian Nuclear Safety Commission; and workplace exposure to radon (and other radiation sources) is regulated by provincial or territorial Health and Safety authorities. The Federal Provincial Territorial Radiation Protection Committee has produced "Canadian Guidelines for Management of Naturally Occurring Radioactive Materials (NORM)", which includes radon. These guidelines are based on the standards used by the Canadian Nuclear Safety Commission. The differences between the two sets of Guidelines are explained, and possible revisions to the NORM Guidelines suggested.

**RADON AND SOLVENTS: A PRELIMINARY INQUIRY INTO THE
POTENTIAL FOR COMBINED EFFECTS ON CANCER**

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Abstract

Radon and anthropogenic chemical contaminants accidentally released to the subsurface, and that form hazardous vapors in soil gas (e.g., solvents, such as TCE), can simultaneously 'intrude' into indoor air. While the public concern over these indoor-air hazards is typically inversely related to the cancer risks independently documented for these two agents, this presentation will focus on a preliminary inquiry into the potential for combined effects by these independently-recognized 'complete' carcinogens. To explore the potential for impacts of radon levels on cancers associated with TCE exposure, this presentation will review of the epidemiologic studies of trichloroethylene (TCE) that the USEPA used to represent the associations between TCE exposures and cancer (Kidney, Non-Hodgkin Lymphoma, and Liver), and compare the available/ecologically-estimated levels of indoor radon for occupational/residential buildings/areas involved in these studies. The limitations and implications of this preliminary inquiry are discussed.

**THE RADON BADGE FOR SOLVING EXISTING PROBLEMS FOR
RADON MEASUREMENTS**

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Abstract

The radon badge is formed by a radon-sorption film facing an alpha-particle detector, enclosed in a radon permeation-bag. This badge is a passive monitor able to make radon measurements in water, in soil, and indoors for any exposure duration, from a few days to years. Other existing technologies require a variety of different devices, which may be conducive to errors, especially when support is required from the occupant. The radon film badge makes it finally possible to use the same device for a multitude of different types of measurements. Radon-badge applications are exemplified by using the same device for measuring radon in water and both short-term- and long-term-exposures indoor exposures

SUPER MOON 2012 SHEDS LIGHT ON RADON GAS MIGRATION

Mark H. Whitehead

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Abstract

This is a case study of environmental influences on a 96 hour residential radon test near Kansas City, Missouri. The test period (May 14-18, 2012) was during dry mild weather, lacking typical spring time atmospheric turbulence. The media coverage of the “Super Moon” which occurred earlier in May prompted comparison of environmental influences. This case involves one dwelling, typical of many mid-American single family homes. The absence of major weather turbulence during the test period provided a good opportunity to compare temperature, barometric pressure, and wind. To evaluate the influence of the moon, 97 radon measurements were plotted with the Galveston Bay tide chart, which falls on the same longitude, about 600 miles south of the test site. The plotted data shows significant synchronicity between radon readings and tidal fluctuations. The timing of the tides closely matched the timing and magnitude of changing radon levels.

PREDICTED INDOOR RADON CONCENTRATIONS FROM A MONTE CARLO SIMULATION OF GRANITE COUNTERTOPS

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Abstract

Previous research examining radon exposure from granite countertops relied on a limited number of exposure scenarios. We expanded upon this analysis and determined the probability that installing a granite countertop in a home would lead to meaningful radon exposures via Monte Carlo simulation. The analysis included estimates of the probability that a particular type of granite would be purchased, the radon flux associated with that type, the size of the countertop purchased, and the volume and air exchange rates of that home. One million purchases were simulated and 99.99% of the resulting radon concentrations were lower than the average outdoor radon concentrations in the U.S. The median predicted indoor concentration was 0.06 Bq/m^3 ($1.59 \times 10^{-3} \text{ pCi/L}$), which is over 2,000 times lower than the EPA’s action level for indoor radon. The results show that there is a low probability of a granite countertop causing elevated levels of radon in a home.