STUDIES OF INDOOR RADON LEVELS WITHIN KPANDO COMMUNITIES IN THE VOLTA REGION OF GHANA

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Abstract

Measurements of indoor radon levels in different dwellings within the Kpando communities have been studied using CR-39 detectors. The radon detectors were exposure in different dwellings from April to October. The result for the frequency distribution showed that exposure to indoor radon levels in dwellings were not uniformly distributed. The radon concentration values from the dwellings were found to vary from 32.5 to 154.7 Bq/m^3 with average value of 70.5 ± 3.2 Bq/m^3. The dwellings with mud wall structures and clay floor tiles were found to contain highest levels of indoor radon concentration as compared to sandcrete, concrete dwellings. Thirty five percent of the studied results were found to be greater than reference level proposed by WHO (200 Bq/m^3).

OPENRADON LAB: DEMOCRATIZING SOIL RADON MODELING AND MAPPING

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Abstract

The goal of this research is to model the spatio-temporal dependencies of radon gas generation and movement underground. This talk will present an overview of the ongoing research work in developing the *OpenRadon Lab* testbed. *OpenRadon Lab* is a comprehensive open-source testbed that will help study underground radon data using a three-pronged approach (i) theoretical modeling based on physical, chemical, and geological parameters, (ii) simulation using GEANT4, and (iii) data-driven empirical modeling. There are four major components in *OpenRadonLab*: (i) sensor-nest, (ii) soil analysis in the laboratory, (iii) site-level weather and radioactivity sensing, and (iv) cloud computing. The current deployment consists of a 40-node grid in Stone Mountain Park in Atlanta. The deployed sensor grid is over a 50-feet by 20-feet area and measures radon at a depth of five feet from the surface. We target to duplicate this effort in another location (Arabia Mountain) by the end of Summer 2022.

EVALUATING THE EFFECT OF BUILDING PRESSURES ON 3 DIMENSIONAL SUB SLAB VACUUM FIELDS

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Abstract

Sub slab depressurization systems (SSDS) work by creating a sub-slab vacuum field relative to the pressure measured within the subject building. This paper explores the effects of building pressures on a 3-dimensional radius of influence generated by an SSDS. Additionally, it will explain the additive properties of overlapping vacuum fields generated by multi suction point depressurization systems.

NORTHWEST RADON COALITION INITIATIVES TO BUILD AND EXPAND RADON AWARENESS AMONG OUR COMMUNITIES

Tiffany Belser[1*], Scott Burns[2], Joel Migliaccio[3], Gretchen Stewart[4], Steve Tucker[5], Duane West[6]
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Abstract

The NW Radon Coalition is a diverse group of government agencies, private and public businesses, and non-profits working together to raise awareness about radon. The Coalition meets to strategize innovative ways to reach our communities, share resources and collaboration opportunities, and discuss challenges that we are experiencing. Together we have conducted nine annual Radon Forums in the Portland Metro community, providing education on the risks of radon exposure and importance of radon testing and mitigation. Recently, we collaborated with Oregon State University to mentor public health students while they created radon awareness resources for diverse communities. A subcommittee within the Coalition is working to initiate legislation in Oregon focused on implementing radon performance testing of new homes/buildings that already require radon resistant new construction; radon testing of daycares and preschools; and radon testing on all rental properties. We continue to expand our initiatives based on the need in our communities.

COLLABORATION BETWEEN THE NW RADON COALITION AND LOCAL UNIVERSITY TO INSPIRE STUDENTS

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Abstract

During Fall term 2021, Oregon State University Public Health undergraduate students collaborated with the NW Radon Coalition. Students met with Coalition members over Zoom, and completed online assignments to learn about radon induced lung cancer. The term project involved students selecting a type of educational resource to develop such as a brochure or poster for a specific target population including students, the BIPOC community, and families to provide information and a call to action regarding the importance of radon testing. Throughout the term, a total of 23 students developed materials and received feedback from Coalition members. The resources were posted electronically in January during National Radon Awareness Month. The collaboration allowed the coalition to mentor students and receive new resources to distribute widely; and the students were able to gain experience working with community partners around a public health issue and better understand and apply health risk communication skills.

OM&M AND TELEMETRY: SIMILAITIES AND DIFFERENCES IN RADON AND VI

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Soil gas mitigation systems, both radon and chemical vapors, are long-term health protective solutions. The lifespan of the need for the system typically exceeds the expected lifespan of the blower, and ongoing performance of the system is challenged by aging of the installation, building modifications, and environmental changes (e.g. rising groundwater). While system design and infrastructure are similar for Radon and Chemical Vapor mitigation systems, the performance criteria and impact of performance failures are often significantly different. Utilizing telemetry monitoring to understand short and long-term system variability can be a critical component to OM&M for Chemical Vapor mitigation systems to protect against exposure when acute toxicity impacts are a potential risk. A review of telemetric monitoring data illustrates common performance variability and the risks they pose to inhabitants protected by mitigation systems.

OUTDOOR RADON LEVELS INFLUENCE ON INDOOR RADON LEVELS

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Abstract

The Indoor Radon Abatement Act was signed in 1988 with the goal of reducing indoor radon levels to the radon levels outdoors. Radon mitigation methods have been employed nationwide since that time to reduce, but not eliminate, indoor radon levels. Meeting the goal set in 1988 has not been practiced by the industry primarily because it required making radon measurements indoors and eliminating any direct soil gas entry into the residence. In this study the reduction of indoor radon levels were maximized to the point where outdoor radon levels became the primary source. The data provided in this study is an attempt to determine the influence of outdoor radon levels on indoor radon levels at a single residence. The data include radon levels outdoors and on three levels of the home indoors measured over several months in 2022. The methods used to eliminate the pathways of soil gas into the residence are also included.

RADON IN CONCRETE PASSIVE VENTING MITIGATION

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Abstract

The radon and ventilation levels in four condo units in a six story concrete constructed residential building in Florida measured 8-16 pCi/l of radon and 0.02-0.06 air changes per hour (ACH) of ventilation. ASHRAE outdoor air ventilation recommendations for residential homes have been in the range of 0.35 ACH for decades. The typical radon mitigation for these units is to mechanically add outdoor air into the negative return HVAC closet. In this study the radon mitigation method for four units used the negative pressure when the HVAC was running to induce outdoor air into each unit with a passive vent. The study included measurements of the natural ventilation rate, the HVAC run time, and the changes in radon and humidity levels to determine if this method would reduce the chance of mold growth and provide acceptable radon mitigation.

LEAD-210 AND POLONIUM-210 AS INDICATORS OF HISTORIC RADON EMISSION TENDENCIES

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Abstract

The Interim Waste Containment Structure is a 10-acre earthen structure in Niagara County, New York housing uranium ore processing residues from the Manhattan Engineer District and early Atomic Energy Commission. The site is regulated under the National Emission Standards for Hazardous Air Pollutants as a radon-emitting Department of Energy facility limited to mean annual radon emissions of 0.74 Becquerels per square meter per second (Bq/m^2-s) [20 picocuries (pCi)/m^2-s] across the impoundment. Locally elevated flux occurrences prompted further investigation to characterize the suspect area. Due to the short half-lives of radon-222 and its immediate progeny through polonium-214, radon flux and gamma radiation observations only represented brief "snapshots" of the long-term emission behavior, and more defensible spatial and temporal bounds were desired to plan potential action. A soil sampling strategy is presented to exploit half-life variability in lead-210 and polonium-210 ingrowth to indicate the presence and general age of historic flux occurrences.

INFRARED THERMAL IMAGING TO DETERMINE BACK DRAFTING OF APPLIANCES CAN BE USEFUL IN RADON MITIGATION

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Abstract

Back drafting is a key concern of the radon mitigation process. When the mitigation fan is turned on, leaks in the foundation of the structure can cause gas appliances to backdraft due to the negative pressure under the floor system. Many times, the return duct work or plenums in the HVAC systems have openings at the connection point or filter. These openings can allow an increase in the negative pressure being sucked in when the HVAC fan system is running. This condition can be just enough to cause an imbalance in the air pressure in the lowest level of the structure, which could cause back drafting. The use of a thermal imaging camera will allow a visible way the mitigator can find and seal openings in the HVAC return

system. By sealing these openings, it will help reduce the additional negative pressures that could cause the back drafting condition.

REVIEW OF THE EVOLUTION OF VAPOR INTRUSION AND EXPECTED FUTURE TRENDS

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Abstract

As we approach nearly 20 years of vapor intrusion investigations, we reflect what have done right, what we have done wrong, and how we can improve the scientific approach based on lessons learned. The first 20 years were spent on the development of sampling techniques, predicting indoor air concentrations through modelling, relying on the analytical results from other media (groundwater and soil) as a first cut at assessment, and the development of screening levels. Now the focus has shifted to a more pragmatic approach of assessing vapor intrusion What lies ahead?

This discussion will review the evolution of the vapor intrusion assessment process and how it has changed over the last 20 years and where we believe it is headed for the next twenty years. We will discuss the current state of the art, how the data has driven us, and why some of this data may have misinformed us. We will also provide a case study on a major project in the United States that evolved from a classical look at vapor intrusion as a result of groundwater contamination to one that was dominated by the influence of preferential pathways.

A SUCCESSFUL VAPOR INTRUSION PROJECT BEGINS WITH A CAREFULLY CONCEIVED CONCEPTUAL SITE MODEL

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Abstract

The discussion presents case studies demonstrating the use of high quality, rapidly obtained, active sub-slab soil gas measurements, evaluation of preferential pathways, visual data interpretation and utilization of GIS methods. This information is necessary to locate VOC sources and better define your CSM Model providing time saving methods, lower cost to the client and allowing re-development to proceed.

IMPLEMENTATION OF A STRATEGIC APPROACH FOR VAPOR INTRUSION ASSESSMENT AND MITIGATION ALONG A 1.3 MILE TRICHLOROETHENE GROUNDWATER PLUME

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Abstract

Historical operations at a manufacturing facility resulted in the release of trichloroethene (TCE) to groundwater, ultimately resulting in a 1.3 Mile TCE plume migrating beneath industrial and residential properties. TCE was present in shallow groundwater at concentrations suggestive of possible vapor intrusion risk. A total of 266 residential homes and 8 industrial facilities were identified to be problematic for vapor intrusion. In cooperation with Stakeholders and State officials, a strategic approach was developed to evaluate and mitigate potential vapor intrusion risk along the TCE groundwater plume through community reachouts designed to facilitate collection of soil gas, subslab soil gas and indoor air samples. Vapor mitigation challenges included brick-lined basements and beneath slab-on- grade HVAC venting. This case study presents the technical and community challenges, and lessons learned, associated with large scale vapor assessment and mitigation in industrial and residential settings.

VISUALIZING RADON THROUGH NEW MAPPING INITIATIVES

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Abstract

New Wi-Fi equipped highly sensitive c-CRM devices now enable mappings conveying unprecedented information. Upon set-up of such c-CRMs, manufacturers should present opting-in as in the public interest. Such mappings can convey annual and seasonal averages and will allow better targeting of outreach efforts. The granularity possible can focus the resources of government and non-profits. Examples of mappings / data analytics for various states will be presented. Of educational interest, these can show diurnal variation, variation likely due to weather, and the change of seasons. Homes averaging 2.0 to 4.0 pCi/L, may, given the magnitude of daily and seasonal variations, in the aggregate spend a considerable fraction of the year above long-term averages. Granular mappings of radon hazards will

facilitate the overlay of epidemiology enabling the discovery of possible correlation to long-term health outcomes other than lung cancer. Data may also be gathered to support before and after studies of mitigation.

INDOOR AND OUTDOOR RADON MEASUREMENT USING DIGITAL TECHNOLOGY, CHARCOAL TEST KITS, AND SOIL GAS SAMPLING

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Abstract

Our transdisciplinary, community-academic team-led project known as Radon on the RADAR (**R**esidents **A**cting to **D**etect and **A**lleviate **R**adon) addresses community concerns about lung cancer by identifying geologic and atmospheric conditions that increase radon intrusion into homes. We recruited 60 citizen scientists from four rural Kentucky counties and trained them to measure indoor home radon using Airthings® Corentium Home detectors and short-term charcoal test kits, and to record and report weather conditions. Citizen scientists tested for two-week periods in the summer and winter/spring months of 2021-2022. Geologists visited each of the 60 homes during each of the two testing periods and measured soil radon concentrations at two locations outside of each home. We will present our findings comparing indoor radon values collected using digital technology and charcoal-based test kit to soil gas samples, controlling for atmospheric conditions, seasonality, geology, topography, and smoking in the home.
This project is supporting by NIEHS grant R01 ES030380. Its contents are solely the responsibility of the authors and do not necessarily represent the official views of the NIEHS.

TEMPORAL UNCERTAINTY VERSUS COEFFICIENT OF VARIATION FOR INTERNATIONAL STANDARDIZATION OF INDOOR RADON MEASUREMENTS

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Abstract

Measurements of indoor radon to conformity assessment of a room with a norm fundamentally differ between Europe and the US. The EU applies long-term tests – usually 1-3 months, while the US applies widely short-term tests – from 2 to 7 days. None of the measurement approaches considers the temporal uncertainty of indoor radon, a factor that usually significantly exceeds

instrumental uncertainty (including in long-term tests) and is 2-3 times the coefficient of variation (COV) commonly used to estimate temporal variations. This problem significantly complicates creation of a harmonized international (ISO) standard implementing the rational concept of "measurement uncertainty" that allows controlling the coverage probability or reliability of decision making.
Within the ISO rules, a criterion of conformity assessment of a room with a norm covering short- and long-term tests, as well as an algorithm for determining the temporal uncertainty depending on the test duration and ventilation mode, is proposed.

CONSORTIUM STANDARDS COLLABORATION ON RADON WITH THE INTERNATIONAL STANDARDS ORGANIZATION COMMITTEE – DEVELOPING A QA/QC STANDARD FOR RADON CHAMBERS, DEVICE MANUFACTURERS & TEST DEVICE ANALYSTS

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Abstract

ISO Technical Committee 85 / Working Group (WG) 17 is tasked with developing standards pertaining to nuclear energy/technology, radiological protection and radioactivity measurement. Among the topics of focus for WG 17 is the revision and development of a multi-part (ISO 11665) series of standards pertaining to radon. This presentation will focus on the on-going direct involvement of AARST Consortium on National Standards committee members to impart a North American perspective to this important new international radon QA/QC standard being developed. The focus of the standard is Quality Assurance / Quality Control for radon chambers, device manufacturers & test device analysts. The draft standard has completed the balloting process by ISO TC85 WG17 international experts and should receive a formal ISO Standard number May 2022. The authors will provide an overview of key sections of the standard and will discuss its potential impact and application for the North American radon industry.

A NATIONAL COMPARISON BETWEEN THE COLLOCATED SHORT-TERM AND LONG-TERM RADON MEASUREMENTS IN THE UNITED STATES

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Abstract

Tens of millions of short-term radon measurements have been conducted. However, the massive measurements have not been commonly used in assessing exposures because of their heterogenious correlations with long-term measurements. We compared 2,245 pairs of collocated short- and long-term measurements and evaluated the correlations under different conditions with stratified regression and bootstrapping resampling. We found that the extent to which a long-term measurement can be predicted by the collocated short-term measurement is a joint function of two factors: the temporal difference between two measurements and the measuring length of long-term measurement. Short-term measurements could explain 79% (0.95 Confidence Interval [CI]: 0.73 to 0.84) of the variance in long-term measurements when the temporal differences were <7 days and lengths of long-term measurements were <120 days, meanwhile could only explain 17% (0.95 CI: 0.11 to 0.46) of the variance when temporal differences were >90 days and lengths of measurements were >270 days.

PREDICTING MONTHLY COMMUNITY-LEVEL RADON CONCENTRATIONS WITH SPATIOTEMPORAL RANDOM FOREST METHOD: A STUDY IN NORTHEASTERN AND MIDWESTERN UNITED STATES

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Abstract

Most previous radon-related epidemiological studies relied on an out-of-date county-level radon exposure model without temporal variation. Tens of millions of radon measurements have been conducted in the U.S, therefore enabling us to estimate radon concentrations at higher resolutions with better accuracy. We obtained over four million radon measurements from Spruce Environmental Technologies, Inc. Community-level monthly radon concentrations were predicted based on geological, architectural, meteorological, and socioeconomic factors. Our innovative spatiotemporal random forest method extended the original one by allowing the relation between radon and its predictors to vary across space and time. The abundance of measurements enabled us to predict concentrations in the basement and upstairs respectively. The correlation (R^2) between the predicted and observed geometric mean of radon concentrations is 0.77 in the basement and 0.57 in the upstairs if there are over 10 radon measurements in the same zip-code tabulation area and month.

IDENTIFYING HAZARDS FOR VAPOR AND RADON MITIGATION TECHNOLOGIES

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Abstract

Radon and vapor intrusion mitigation strategies have become more interchangeable and more companies are providing these services concurrently. As vapor intrusion and radon mitigation technologies become commonplace, companies must adapt to identifying hazards associated with these technologies. Hazard identification and project planning is crucial in protecting employees from the various hazards associated with these types of projects. To explore the potential hazards, this presentation will review effective project planning and hazard identification during the project planning and the mitigation fieldwork phase of the project.

A SIMPLIFIED APPROACH FOR CALCULATING RADIUS OF INFLUENCE OF A RADON MITIGATION SYSTEM

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Abstract

Geosyntec developed the high volume sampling (HVS) method a decade ago (McAlary, 2010) and since that time we have conducted hundreds of HVS tests. Geosyntec has a large data set, from a variety of sites that has been evaluated using a model that can calculate a radius of influence of a mitigation system. The presentation will describe a new simplified method to calculate a mitigation systems radius of influence and building-specific attenuation factors using data collected during pressure-field extension testing. This involves three simple measurements; extraction flow rate, cross-slab applied vacuum at a radial distance of 3 feet and cross-slab applied vacuum at a radial distance of 10 ft. 2018). The intent is to provide a practitioner with a rapid and useful screening level assessment of whether a more detailed mathematical analysis of the flow and vacuum data (McAlary, 2018) for a mitigation system would be beneficial.

OVERVIEW AND RISK ASSESSMENT OF THE RADON LEVELS IN THE GROUNDWATER WELLS OF QATAR

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Abstract

This work aims to present the latest overview about radon levels in groundwater (GW) in one of the aridic regions (Qatar). A total of 80 samples from GW wells across the map of Qatar were sampled, analyzed and the results were plotted using ArcGIS software. The radiological risk assessment of radon in Qatar was highlighted. Radon concentrations in the GW were determined using radon detector RAD7. A total of 32 and 33 samples exceeded the proposed US EPA's maximum contamination level of 11 Bq/L and other EPA's drinking water guidelines, respectively, were observed. The mean annual effective dose from ingestion and inhalation of water-borne radon were 4.3 and 51.95 micro-Sv/y respectively. The mean annual effective dose from ingestion and inhalation of GW are slightly higher than the recommended values of UNSCEAR. The reported levels need further investigation in order to understand their sources, fate and impacts on human health and environment.

SIZE MATTERS: DESIGNING EFFECTIVE VI MITIGATION SYSTEMS FOR LARGE SCALE BUILDINGS

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Abstract

Sub Slab Depressurization is an effective tool in the environmental professional's arsenal when treating vapor intrusion, but only when done successfully.
This presentation focuses on the importance of design when dealing with buildings over 100,000 square feet. Large scale buildings offer a set of unique challenges for the mitigation professional such as communication voids, multiple building add-ons and techniques for minimizing the riser piping for practical building use. Using a case study approach, we look at the components of successful system design in large scale buildings. Using this approach, we can look at the unique characteristics these buildings possess and how to avoid some of the common pitfalls that can occur in the design stage of a project. The presentation is designed to educate the environmental professional about vapor intrusion mitigation by using a real-life project as an illustration of how VI mitigation works and how critical the design process can be to a successful outcome for the client.

PRIVACY PROTECTION FOR ADDRESS-LEVEL RADON DATA USING CDC TOOLS FOR ADDRESS DE-IDENTIFICATION, GEOCODING, AND MAPPING

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Abstract

The CDC Environmental Public Health Tracking Program is working with states and national radon testing laboratories to create a national radon database. This effort has been facilitated and encouraged by EPA, AARST, and CRCPD. Maintaining privacy of a dataset that contains address-level data is very important. However, without an address, geocoding to a census tract is not possible. We developed a tool to de-identify address-level data and prepare it for submission to a geocoding service offered by Texas A&M University (TAMU). Geocoded data can then be combined with de-identified radon testing results, identified to county and census tract, ensuring privacy protection.

EPA: Environmental Protection Agency
AARST: American Association of Radon Scientists and Technologists
CRCPD: Conference of Radiation Control Program Directors

THE 100 TEST KIT CHALLENGE – BUILDING MOMENTUM FOR RADON TESTING ACROSS CANADA

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Abstract

Take Action on Radon (TAOR) is a national Canadian program designed to increase awareness, testing and mitigation of radon gas. TAOR developed a hyper-local program, the 100 Test Kit Challenge, to explore opportunities to galvanize radon action in communities. The program has tested over 5,500 homes nationally and yearly evaluations offer important insights into the steps needed to support grassroots radon action. This presentation outlines the 100 Test Kit challenge approach, its evolution over time and showcases the resources that have been refined using community insights and recommendations. The lessons learned through this research are useful for other agencies interested in encouraging municipal testing efforts in urban, rural and remote communities.

MEASUREMENT OF RADON AND RADIUM CONTENT WITHIN MINING COMMUNITIES IN NEW ABIREM OF EASTERN REGION, GHANA

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Abstract

The radon and radium concentration levels in dwellings and soils have been studied in bedroom, kitchen, sitting rooms, and soils within the communities of New Abirem using CR-39 and HPGe techniques. The results were presented in the form of a range of 23.8 to 125.7 Bq/m^3, and mean values of 54.7 ± 23.7 Bq/m^3 for dwellings. Bedrooms contained the greatest indoor radon concentrations. The radium concentration from the soil were found to be in the range of 19.5 to 38.9 Bq/kg, with a mean of a 29.0 ± 16.0 Bq/kg. Radon exhalation rate measurement from the soil were found to be varied from 21.3 to 112.1 µBq/m^{2}h, with mean value of 65.1 ± 27.6 µBq/m^{2}h. Strong and weak Pearson correlation were found to exist between radium and radon levels in soil and dwellings. Eight and 30 percent of the result from dwellings and soils, respectively, were found to be greater than reference levels proposed by WHO and UNSCEAR in 2000

HORIZONTAL DRILLING FOR MITIGATION BENEATH POST-TENSIONED SLABS IN COLORADO

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Abstract

Post-tensioned foundation slabs are often used in Colorado to address expansive soils. Post-tensioned slabs contain numerous interior grade beams, which inhibit lateral airflow when installing radon mitigation systems after construction. A property with 8 residential apartment buildings with post-tensioned slab foundations and several grade beams below each residential unit had 41 ground floor units containing radon at levels greater than 4.0 pCi/L. Radon mitigation systems were designed and installed which consisted of horizontally drilling and installing two horizontal perforated pipes beneath each building, creating negative pressure beneath each ground floor unit. Each sub-slab pipe is connected to two radon fans (one on each end) and connected to vent stacks on each end of each building. Following mitigation system installation, radon levels in the units did not exceed 4.0 pCi/L and radon levels in all units improved by an average of 80%.

TESTING FOR ELEVATED RADON IN OREGON SCHOOLS

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Abstract

In 2015, Oregon Legislative Assembly enacted Oregon Revised Statue (ORS) 332.341 and 332.345, Tests of schools for elevated levels of radon. These statues required Oregon school districts to develop a plan to test for radon and test for radon in school buildings. To support school districts, Oregon Health Authority's Radon Awareness Program was designated to provide radon expertise and information to assist school districts in complying with the statue.
This presentation will cover details about ORS 332.341-345, the role Oregon Radon Awareness Program had in providing support for school districts, types of outreach and educational material created, and radon testing training provided to school and district personnel.

DEVELOPING RADON POLICIES IN CANADA: FOCUSING ON ENERGY EFFICIENCY UPGRADES

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Abstract

Radon policies in Canada remain relatively undeveloped, in part because of the federal-provincial division of powers. However, there remain multiple duties to keep spaces safe and not to do harm to one's neighbour. These can be harnessed to drive action on radon (such as government testing of its own facilities). Currently, the Canadian federal government and some provinces have robust policies to address climate change through home energy retrofits but ignore the potential of upgrades to increase radon levels. Our research project (combining legal research and social science qualitative research methods) reviewed links between energy efficiency upgrades and increased radon levels in homes, and existing legal duties of care and to warn of danger in Canada. We reviewed funding problems, the energy advising process and interviewed energy advisors. We found significant gaps in Canada's energy efficiency policies and systems and explored the potential for change through either or both of strategic legal action and legislative reform.

RADON MEASUREMENTS ON HIGHER FLOORS IN SWEDISH MULTI-FAMILY HOUSES

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Abstract

The Swedish radon measurement protocol for multi-family houses requires that 20% of the apartments on non-ground contact floors should be measured. Radonova has analyzed their radon measurements to estimate how often buildings have apartments on higher floors above the reference level of 200 Bq/m^3 (5.4 pCi/l) where no measurements on the ground floor is above the reference level. Houses without the radon emitting building material "Blue Concrete" which had some measurement above the reference level, and with 5 or more measured apartments, were selected in the analysis. In this data set, 24% of the houses didn't have any measurements above the reference level on the ground floor. The data are discussed in more detail with respect to parameters such as foundation type, ventilation and total measured number of apartments in the building. Comparisons with measurements in workplaces are also made.

RADON ADSORPTION IN DETECTOR PLASTIC – A SOURCE OF ERROR

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Abstract

A large amount of radon can be adsorbed in the alpha-track detector holder plastic. Even after 24 hours of outgassing, a major part of this adsorbed radon remains and could give additional exposures if detectors are put in sealed bags after outgassing. This effect could be a source of error in the evaluation of short-time exposures as in calibration and proficiency test exposures. This effect had been studied in detail for the 4 different detector holder types of Radonova. It has been found that after a three-day exposure followed by 24 hour outgassing, the additional exposure in a sealed bag could be more than 20% of the given exposure.

ON-SITE RADON IN WATER MITIGATION IN TWO PRIVATE WELLS IN GEORGIA USING AIRWELL® MITIGATION SYSTEM

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Abstract

In Georgia, an increasing number of wells are showing radon concentration exceeding EPA's suggested AMCL of 4,000 pCi/L , preferably below their proposed MCL of 300 pCi/L. Mitigation of radon in water is fairly new relative to soilgas reduction in homes. A point of entry 'Aeration' or 'Granular Activated Carbon' treatment system is commonly used. However, mitigation of radon higher than 100,000 pCi/L water has not been well documented by any methods. Airwell® technology that claimed to be able mitigate any high level of radon in water seemed to lack enough supportive evidence from real-life situations. To test the application, in collaboration with the company, we installed onsite demonstrations of radon mitigation using Airwell® in two private wells in Walton County, Georgia containing 9,302 and 145,498 pCi/L radon. Post-mitigation radon concentrations in these two wells are being monitored for two years at various intervals to evaluate the long-term mitigation performance along with maintenance needed.

THE USE OF RADON AS A TRACER GAS AS PART OF VAPOR INTRUSION MITIGATION SYSTEM PERFORMANCE MONITORING: A CASE STUDY OF TWO PROJECT SITES AND LESSONS LEARNED

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Abstract

Subsurface vapor intrusion to indoor air is a potential pathway for human exposure at sites impacted by volatile organic compounds (VOCs). This pathway continues to attract increasing attention due to regulatory guidance and heightened public awareness. At sites where vapor intrusion is occurring at levels that may pose an unacceptable human health risk to building occupants, the pathway can be controlled by a variety of technologies similar to radon mitigation strategies, including installation of low permeability engineered barriers and sub-membrane venting systems. Collectively, these systems are referred to as Vapor Intrusion Mitigation Systems (VIMS).

Two case studies will be presented, each including a brief discussion of the environmental assessment of each property, evaluation of the vapor intrusion risk, resulting mitigation strategies, and performance monitoring to evaluate the effectiveness of the installed systems

utilizing a multiple-lines-of-evidence approach including the use of naturally occurring radon as a tracer gas.

DEVELOPMENT OF A RADON NEED-TO-TEST METRIC

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Abstract

While understanding that all buildings should be tested for radon, radon program managers face difficult decisions presented by limited resources. Recognizing that targeting areas of high average radon levels or low testing rates may yield different guidance, this project develops and characterizes a tool to assist such decision-makers based on both concerns. Using radon testing data provided to the CDC National Environmental Public Health Tracking Network, along with housing information from the U.S. Bureau of the Census, 49 state-level summary reports were prepared describing at the county level both raw data and model-based maps, as well as providing tabular results. The proposed need-to-test metric combines information about radon levels with a weighting scheme designed to highlight regions with comparatively low testing rates. We describe the development of this metric, demonstrate its use, discuss implications for decision-makers, and outline opportunities for refinement.

EVALUATING THE E-PERM RT CHAMBER FOR USE MEASURING RN-220 IN A CAVE ENVIRONMENT

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Abstract

Standard E-PERM sensors respond mainly to Rn-222, with only a small percentage of any Rn-220 being detected due to most of these isotopic species decaying prior to diffusing into the chamber interior. The RT chamber was designed to allow most of the Rn-220 to be counted, while still responding fully to Rn-222. Construction of the RT chamber involves cutting circular holes in the thermoplastic side walls of a standard S chamber and covering

them with a layer of Tyvek, which provides a new and more rapid diffusion route for airborne radon to enter the chamber after it has been opened. This study probes whether the structural modification of the S chamber to shorten radon diffusion time also alters the degree of background radiation shielding provided, and whether this will impact cave radon measurements.

PROJECT COMMUNICATION WITH ALL STAKEHOLDERS

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Abstract

This presentation provides a brief intro regarding vapor mitigation systems and at what point during an environmental assessment a discussion should be had with the client and stakeholders. That would preferably be during a Phase I ESA and subsequent subsurface investigation, under the assumption that the report was being used for redevelopment and the issues/Recognized Environmental Conditions (RECs) identified the potential for vapor intrusion into proposed structures. Using two "hypothetical" project examples, one where the communication broke down early and often, which resulted in project delays, cost overruns and potential scrutiny of the system's ability to impede vapors in the eye of a regulator. The second example will be a successful project that included all team members, including the regulator, in the planning/design process, in order to construct a mitigation system that was on time, within budget, and could pass the muster of a sceptical regulator.

IMPACT OF RADON EXPOSURES ON NON-CANCER OUTCOMES AND FUTURE PERSPECTIVES

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Abstract

Radon is a naturally occurring radioactive gas formed from the decay of primordial radionuclides (Uranium and Thorium) in the Earth's crust. It infiltrates into homes from soil, water, and construction materials. Indoor radon is one of the leading cause of lung cancer. Our recent studies have showed short- and middle-term exposures to indoor radon are also related to increased risk of cardiovascular, pregnancy and respiratory morbidity and mortality. These findings bring a new direction for radon exposures and health outcomes studies. In this overview, we will present our most recent studies on radon exposures and non-cancer outcomes, describing from biological mechanisms to future directions for public health policies.