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Title

Risk-Informed Application of Radon Monitoring and Mitigation in LLRW Remediation: Port Hope Area Initiative

Abstract

Radon is a significant contributor to radiation dose for both occupationally exposed workers and members of the public and represents a critical indicator in the assessment and remediation of Low-Level Radioactive Waste (LLRW) impacted residential, industrial and commercial properties in Port Hope. Within the Port Hope Area Initiative (PHAI) which is one of Canada's largest environmental remediation programs addressing historic LLRW contamination associated with elevated radium-226 (Ra-226), radon monitoring and mitigation are implemented as integral elements of a risk-informed radiation protection framework.

Radon is applied as both a surrogate indicator of Ra-226 source terms and as a direct, pathway-specific measure of potential radiation dose. Indoor radon concentrations are used for screening and confirmation of Ra-226 impacted properties, remediation prioritization, and post-remediation verification. During active remediation, radon monitoring complements conventional radiological measurements by providing sensitive, near real-time indication of subsurface disturbance, contaminant mobilization, and the effectiveness of engineered and administrative controls.

The presentation describes PHAI's structured radon management approach, encompassing baseline characterization, continuous and task-based monitoring in both indoor and outdoor environments, and trend-based data evaluation. Radon results are linked to predefined action levels and response protocols, supporting risk-informed operational decisions related to work sequencing, ventilation and mitigation measures, barrier integrity, and access controls. This framework supports effective management of occupational exposures and ensures public doses remain consistent with the ALARA principle.

PHAI case studies demonstrate that integrating radon monitoring and mitigation within a risk-informed radiation protection framework reduces uncertainty in complex, community-adjacent remediation activities. Radon is shown to be a practical, scalable, and defensible indicator that linking Ra-226 source contamination, exposure pathways, and dose outcomes. Embedding radon into radiation protection decision-making enhances health protection, regulatory assurance, and public confidence in large-scale LLRW remediation programs.