**Integration Group for the Safety Case (IGSC) Symposium 2024***MOVING TOWARDS THE CONSTRUCTION OF A SAFE DGR – GETTING REAL*

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| **Abstract Title:**  Regulatory research on copper corrosion processes in the context of a Canadian used fuel canister design, for deep geological disposal. | |
| **Abstract (300-500 words):**  Several international canister designs for disposal of spent nuclear fuel in deep geological repositories (DGRs), include an outer copper layer to prevent canister corrosion. The Nuclear Waste Management Organization (NWMO), the implementing organization responsible for the long-term management of Canada’s used nuclear fuel, has developed a distinctive used fuel container design, that consists of a steel canister and 3mm copper coating; the containers are then planned to be emplaced in prefabricated bentonite prior to emplacement underground. There are unique features of the NWMO design, particularly the integrally bonded, 3 mm copper layer rather than the 50 mm outer casing used in Finnish and Swedish designs, and the unique shape and dimensions. While copper corrosion has been extensively studied, the use of a much thinner copper layer in the Canadian design necessitates more detailed study to identify and consider the totality of compounding corrosion processes. As part of the Canadian Nuclear Safety Commission’s strategic, independent regulatory DGR research program, this project aims to provide detailed evaluations of the potential for copper corrosion throughout the canister’s lifetime using literature reviews, detailed laboratory experiments, and mathematical modelling.  Our targeted literature review identified corrosion that occurs in early repository phases in which unsaturated conditions exist and the compounding influences of continued corrosion in a changing environment as major knowledge gaps in our understanding of copper corrosion behaviour in DGRs. A detailed experimental program has been designed and is underway to target these understudied areas. The planned experimental program includes:   * corrosion experiments under unsaturated conditions that have exposed copper samples to a humid atmosphere with and without bentonite contact to determine the potential for corrosion in the pre-emplacement period, * heated experiments performed under unsaturated conditions aimed at determining if the increase in temperature caused by the spent nuclear fuel will alter the corrosion behaviour or move moisture away from the surface, and * a series of low-oxygen, saturated column experiments that will aim to consider long-term, continued corrosion and how these processes are impacted by corrosion damage and products from previous corrosive environments.   Preliminary findings indicate that corrosion appears to be increased by the presence of bentonite in contact with the surface of the copper. Further evaluation is necessary to determine the exact nature of these impacts and if they will affect overall corrosion. The completion of this research will provide an improved understanding of corrosion progress through time, while accounting for the damage to the copper from previous corrosion processes. | |