



The anaerobic corrosion of the carbon steel overpack under anoxic alkaline conditions representing the Belgian supercontainer concept

Roberto Gaggiano

ONDRAF/NIRAS, 1210 Brussels, Belgium

Correspondence: Roberto Gaggiano (r.gaggiano@nirond.be)

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Abstract. The Belgian Agency for Radioactive Waste and Enriched Fissile Materials (ONDRAF/NIRAS) is responsible for the management of all radioactive materials (currently existing and future waste) generated in Belgium. Disposal in deep stable geological formations is, at present, accepted at an international level to be the most promising option for the long-term management of high-level and/or long-lived radioactive waste. ONDRAF/NIRAS currently recommends underground disposal in a geological stable and poorly indurated clay formation as the reference management option to steer their RD&D research programmes. The supercontainer concept is currently being considered as the reference design for the final disposal of vitrified high-level radioactive waste (VHLW) and spent fuel (SF) in Belgium. It comprises a prefabricated Portland cement-based buffer that completely surrounds a carbon steel overpack. In this highly alkaline environment (pH \sim 13.6), and under normal conditions (i.e. without the ingress of aggressive species), the carbon steel overpack will be protected by a passive oxide film, which is expected to result in very low uniform corrosion rates.

The main goal of the ongoing R&D corrosion studies performed at ONDRAF/NIRAS is to provide confidence that the integrity of the carbon steel overpack will not be jeopardized at least for the duration of the thermal phase. Considering the long timescales applicable to waste disposal, determining accurate and reliable estimates of the uniform corrosion rate under anoxic conditions forms a very important part of the R&D methodology of ONDRAF/NIRAS' corrosion programme. On the other hand, the occurrence of localized forms of corrosion cannot be neglected, and therefore it is also crucial to demonstrate that no other form of corrosion apart from uniform corrosion can take place.

This paper gives an overview of the status of the research performed at ONDRAF/NIRAS with respect to the uniform corrosion, pitting corrosion and stress corrosion cracking behaviour of the carbon steel overpack of the supercontainer.

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