ALTA 2022 26
20-27 May | Perth, Australia | Online

EVALUATION OF IN-SITU BARRIER TECHNOLOGY FOR RISK MITIGATION AND EXTRACTION OPTIMISATION FOR IN-SITU-RECOVERY OPERATIONS – A REVIEW

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ABSTRACT

The underlying motivation for this review was the need to mitigate potential subsurface contamination from in-situ recovery (ISR) operations, which may pose a risk to the environment and human health. ISR offers an attractive approach to extract metals from minerals, with a low visual impact, no excavation costs, and the possibility to mine inaccessible sites. However, a challenge in ISR may be the containment of leaching reagents to prevent the excursion of mining solutions and the contamination of groundwater outside the leaching area. This paper presents an overview of the various materials that can be used as barriers, and their compatibility with different emplacement techniques, i.e., artificial ground freezing, sheet piling, slurry walls, and grouting.

Three classes of barrier materials are discussed:
1. Cementitious barriers, which consist of ordinary Portland cement and water.
2. Chemical-based barriers, which can be used independently or as additives to cement barriers.
3. Bio-based barriers, which refer to products that consist mainly of a substance(s) that is derived from living matter and can either occur naturally or be synthesised.

Geotechnical site characterisation influences the material and emplacement technique and is an essential component in the choice of an appropriate barrier system. This review discusses its impact on the choice of material used and construction method, along with various barrier emplacement monitoring techniques. This relationship is an essential part of construction quality assurance/control to avoid discontinuities during installation and joint formation, which lead to containment system failure.

Keywords: Subsurface barrier, in situ recovery, cement barrier, chemical-based barrier, bio-based barrier, emplacement technique