International Standard

ISO 22280-1

Groundwater remediation for in situ leach uranium mining —

Part 1: Determination of remediation targets

Remédiation des eaux souterraines post exploitation minière d'uranium par lixiviation in situ —

Partie 1: Détermination des cibles de remédiation

First edition
2026-09

Reference number
ISO 22280-1:2026(en)

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Published in Switzerland

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Foreword

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This document was prepared by Technical Committee ISO/TC 85, *Nuclear energy, nuclear technologies, and radiological protection*, Subcommittee SC 5, *Nuclear installations, processes and technologies.*

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Introduction

Uranium in situ leach mining has many unique advantages compared to conventional mining technologies, such as: small investment, short construction period, little production cost, less energy consumption, low labour intensity, high production efficiency, no tailings and waste rock, and minimal impact on the natural landscape. Uranium production by in situ leach has ranked first among various uranium mining/milling methods since 2009[1]to[5], among which the global production of natural uranium produced by in situ leach reached approximately 27 773 tU in 2022[6], accounting for 56 % of the world's natural uranium production (49 355 tU).

Groundwater environmental impacts can be substantial due to in situ leach mining and should be considered throughout planning, operation and remediation[7]. In the case of Königstein in situ leaching (Germany), a total of 100 000 t of sulfuric acid was injected with the leaching liquid into the ore deposit. The liquid contains high contaminant concentrations, for example, expressed as multiples of the drinking water standards: cadmium 400x, arsenic 280x, nickel 130x, uranium 83x, etc. This liquid presents a hazard to an aquifer that is of importance for the drinking water supply of the region. Groundwater impact is much larger at the Czech in situ leaching site of Stráz pod Ralskem: 28,7 million m^3 of contaminated liquid is contained in the leaching zone, covering an area of 5,74 km^2. This zone contains a total of 1,5 million tonnes of sulphate, 37,500 t of ammonium, and others. The contaminated liquid has spread out beyond the leaching zone horizontally and vertically, thus contaminating another area of 28 km^2 and a further 235 million m^3 of groundwater.

Decommissioning and environmental remediation are the last steps in the whole process of site selection, design, operation, and decommissioning of nuclear facilities. Determination of groundwater remediation targets is a key point for in situ leach groundwater remediation[8]to[10]. No standards on determination of groundwater remediation targets for in situ leach uranium have been published at the international level.

This document sets out the fundamental principles of determining the groundwater remediation targets for post in situ leach (also referred as in situ recovery) uranium mining. This document is one of a set of International Standards on groundwater remediation for in situ leach uranium mining.

This document is formulated in order to manage the groundwater environment protection of uranium in situ leaching, ensure human health and ecological receptors safety, and standardize the determination of groundwater remediation target values for uranium in situ leaching.

This document provides the basic principles and procedures for determining the groundwater remediation target values for in situ leach uranium mining, including requirements for groundwater environmental investigation, stakeholder engagement, identification of groundwater remediation technology, and determination and adjustment of groundwater remediation target values.