Goldschmidt 2026 Abstract
https://doi.org/10.46427/gold2026.37476

Geoenvironmental Characterization of Crystalline Silica in the Mining Context: Towards a Better Assessment of Exposure

NESSRINE MOHAMED[1], BART DE BAERE[2], VINCENT LAMOTHE[1], JULIEN POIRIER[1] AND CHRISTIAN SOLE[1]

[1]WSP Canada Inc.
[2]WSP

Crystalline silica is a major component of the Earth's crust and exists in several polymorphic forms, including alpha-quartz, cristobalite, and tridymite. As a common mineralogical phase in ore deposits, crystalline silica can be released as respirable dust during mining activities (e.g., drilling, blasting, etc.) as well as from wind erosion of stockpiles, posing a significant health risk to workers (e.g., silicosis). Existing guidance involves targeted sampling of representative geological materials followed by mineralogical analysis (using XRD and FTIR) to quantify their crystalline silica content [1]. These quantitative measurements of crystalline silica serve as input parameters for air quality modeling, allowing for the prediction of crystalline silica distribution and potential release.

To better assess and manage this risk, WSP has evaluated the geoenvironmental characterization methodologies capable of quantifying crystalline silica. In particular, a comparative study involving both XRD and FTIR data has been carried out to evaluate the consistency of both methods in the mineralogical characterization of crystalline silica.

This study also highlights the impact of analytical uncertainty in mineralogical testing on air quality modeling. Modeling serves as a risk management tool to support the implementation of appropriate preventive measures for crystalline silica in mining environments, while considering applicable exposure regulations. A case study reflecting the geological and operational context of a Québec mine site is presented.

The results of this case study underline the importance of carefully evaluating the analytical methods put forward for the geoenvironmental characterization of crystalline silica.

Reference :

[1] Ministère de l’Environnement, de la Lutte contre les changements climatiques, de la Faune et des Parcs. (2025). Lignes directrices relatives à l’échantillonnage et l’analyse de la silice cristalline dans des matériaux en vrac pour le secteur minier (Draft Version 1 – Avril 2025, 16 p.).