MINING INSIGHTS

IMPROVE YOUR MINE CLOSURE PLAN: 10 THINGS TO CONSIDER

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"Plan your mine for closure". This is a well-known phrase for a very good reason. The mine may be in operation for decades, but the post-mining environment will be there for considerably longer. Closure plans should be more than tick-box exercises for estimation of financial closure guarantees. The following insight provides some important environmental development objectives, which are often neglected during the different stages of closure planning process.

1 | Consider safety as well as environmental performance

An integrated approach to safety and environment is essential in closure and monitoring plans. An excellent environmental solution can present safety risks, meaning alternative solutions should be considered.

2 | Simplified terrain and peak flows

Compared to natural environments, post-mining environments typically have reduced topographic complexity and minimal surficial organic matter. This results in reduced water retention and increased risk of flow peaks. Storm event assessments and capacity assessments for water treatment systems are especially important for post closure environments.

3 | Sumps and hummocks

Topographic variation increases water retention and provides controlled places for surface water flows. Hummocks have northern and southern slopes and therefore in a hummocky landscape snow melt spreads over a longer time period. Hummocks and sumps are beneficial, but they must be correctly placed and designed. Any unoccupied surfaces outside of facilities for reactive mining waste are typically safe and simple places for hummocks. Topography shaping designs for covered mine waste facilities must be derived from the cover system's own technical requirements.

4 | Mining waste and cover – don´t assess one without the other

Cover performance is a combination of parameters like physical and chemical characteristics of waste and cover materials, moisture, compaction, sloping and meteorological factors. One type of cover material does not provide the same environmental performance in different cases. Numerical models can be effectively used for simulation of cover performance and field trials help to calibrate these models.

> SENSITIVITY ANALYSIS IS ONE OF THE MOST CRITICAL TASKS IN CLOSURE PLANNING

5 | Annual variation can cause issues

The most commonly considered annual variation is the water flow rate. However, annual variation in soil moisture, soil temperature, groundwater table and freezing also impact on physical, chemical and biological processes and require site-specific assessments.

6 | The role of vegetation

Vegetation can contribute to evaporation or to water retention. Plants with large root systems provide erosion prevention, but these can also be a risk for sealing layers of mine waste covers. Besides being a biodiversity factor, vegetation is a functional part of the post-closure environment. In the planning work it is a parameter in a mining waste cover performance model.

7 | Eventually, nature will take the lead

Vegetation develops successively and finally vegetation best adapted to the environment will take over. The most fundamental method for controlling vegetation in the long run is adjustment of physical conditions: shaping topography, selecting top soils and adjusting water table.

8 | Know your catchment area

A closed mine or a single mining waste storage facility must never be studied separately from its surrounding environment. The whole sub-catchment area functions as one system and understanding it requires a water balance. Early characterisation of both overburden and bedrock flow regimes is needed for water balances and serves both operational and post-closure mine management.

9 | Sensitivity analysis – one of the most critical tasks in closure planning

Sensitivity analysis means determination of parameters which are most influential to the calculation or model. Sensitivity analysis enables us to recognizing the inputs which require additional studies, in order to reduce the uncertainty of the model. From both environmental and economic perspectives, uncertainties should be adequately understood during closure planning. Sensitivity analysis does not need to be complicated. In the most simple version of sensitivity analysis, one parameter is altered at a time. The same tool kit works even for assessments of climate change impacts.

10 | Early planning = lower costs

Closure planning can and should be done early. It needs to be an integrated process with mine planning. Late planning is likely to result in higher closure costs, for example due to lack of space or difficulties in water management. Any perceived savings made through short-cuts taken in the early planning stages are typically small when compared to the subsequent costs (both financial and social licence to operate) of implementing a poorly designed closure plan.

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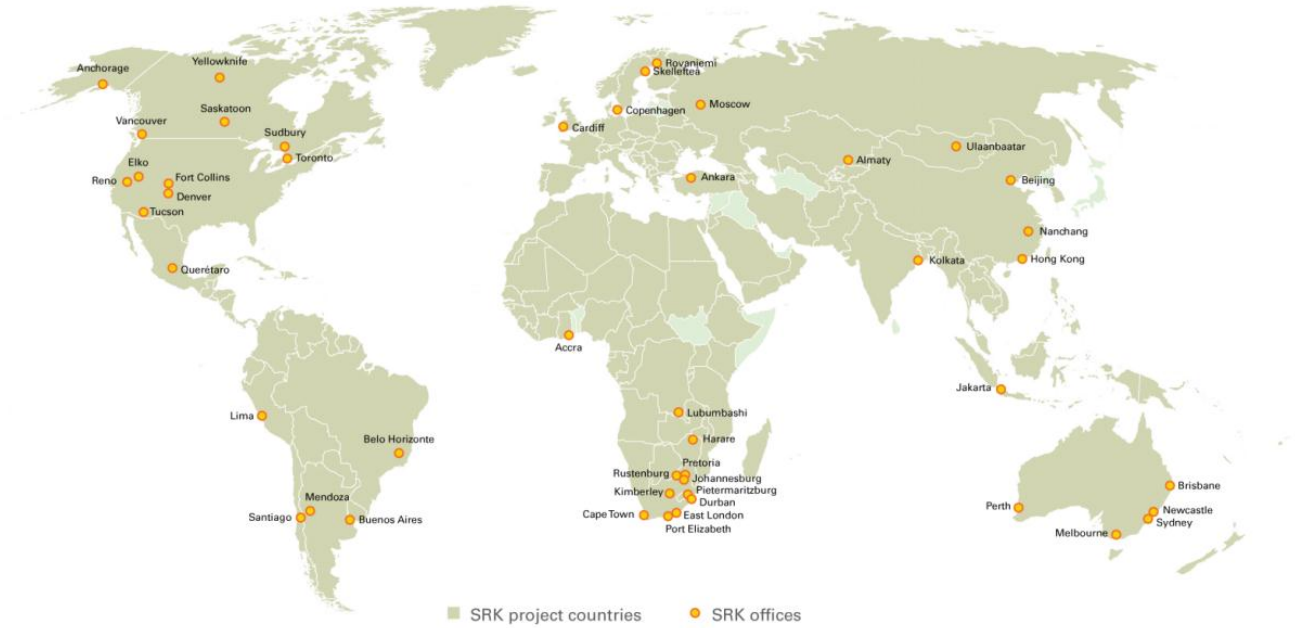

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