Establishing a Strategic Mine Plan for a Centuries-Old Mine: Challenges, Optimizations, and Implementations

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ABSTRACT

Ridder Sokolny Mine is a centuries-old mine in Eastern Kazakhstan, exploiting a world-class Volcanogenic Massive Sulfide type deposit consisting of a mostly exhausted polymetallic ore body underlined by an Au-Cu stockwork of narrow mineral veins. Over the past decade, the mine transitioned from manual mining to full mechanization and modern geological modeling tools. Today, the mine produces 1.8 million tonnes per year (Mtpy) across 18 geological areas using Sublevel Stoping in narrow veins.

Developing and integrating short, mid, and long-term plans has been challenging due to the complex geological environment and operational constraints. This paper outlines the path followed to establish a Strategic Mine Plan, covering geological, mine planning, operational, and geotechnical aspects. It exposes the challenges encountered and mitigated and presents the optimization process using Dynamic Equipment Optimization and Production Scaling (DEOPS) and Operational Risk Scoring and Characterization (ORSC) methods.

Mine plan scenarios and DEOPS simulate key production factors by varying equipment numbers and cut-offs to determine optimal fleet requirements and production rates. ORSC prioritizes and de-risks the mine plan using risk scores, based on empirical impacts on planning compliance and production drivers. These methods aim stabilizing the mine plan and find a balance between production rates, costs, and development meters.

The investigation highlights that production could increase to 2 Mtpy in the first four years while controlling geological and operational uncertainties, with potential for further increases in subsequent years, given successful exploration and timely infrastructure development. It provides insights into operational risks, facilitating the development of a more robust medium and long-term strategy.

Major challenges included stabilizing geological modeling and characterizing operational constraints across various mine areas, which were critical in quantifying their impacts on production. Addressing these challenges required strong interdepartmental collaboration as well as multiple mine plan simulations.