

**23rd Annual International Real Options Conference, London, June 27-29, 2019**

**Evaluation of Tailings Dam Failure in Mining Operations**

**M Armstrong, N Langrené, R Petter, W Chen & C Petter**

**Extended Abstract**

Traditional mining projects store the byproducts of mining operations behind a tailings dam. When the wall of a tailings dam is breached, it causes serious environmental damage and often loss of life. Most studies on tailings dam failures focus on the technical causes of the dam failure, or on the loss of life and the environmental damage. Investing in the safety of tailings dams or in alternative mine designs devoid of such dams should be the preferred option from both financial and environmental point of views. This work focuses on the evaluation of the financial impact of such disasters within a real option framework for the mining companies. We establish a closed-form formula for the expected value of a conventional mining project subject to the risk of tailings dam failure. The stochastic components considered are the metal price, the occurrence of a tailings dam failure, the penalty cost and recovery period after such a failure. These components are calibrated to the available statistical data on tailings dam failures. We analyse two dynamic options available to mining companies: to perform preventive maintenance and temporary repairs, and to retrofit the mine with an alternative design such as dry processing. We obtain a semi-analytic value for these two real options by a dynamic programming numerical scheme combined with Monte Carlo simulations of the dynamic risk factors. We analyse the results and discuss the factors that could lead to a growing recourse to dry processing in the future.