Cover and final landform design for the B-zone waste rock pile at Rabbit Lake Mine

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Abstract. A detailed study was undertaken to evaluate various cover system and final landform designs for the B-zone waste rock pile at Rabbit Lake Mine in Canada. Several tasks were completed including physical and hydraulic characterization of the waste and potential cover materials and numerical modelling to examine erosion and slope stability. Soil-atmosphere numeric simulations were conducted to predict net infiltration and oxygen ingress rates through several cover system alternatives. A seepage numerical modelling programme was completed to predict current and future seepage rates from the base of the pile for alternate cover system designs. Several final landform alternatives were developed for the pile along with a preliminary design for a surface water management system. The potential impact of various physical, chemical, and biological processes on the sustainable performance of the final landform was also considered. This paper provides an overview of the investigations completed towards the development of a cover system and final landform design for the B-zone waste rock pile.

Introduction

Rabbit Lake Mine, owned and operated by Cameco Corporation, began operation in 1975, and is the longest operating uranium production facility in Saskatchewan, Canada. The operation is located 700 km north of Saskatoon (Fig. 1). Historic and current operations at this site include four open pits, one underground mine, several mine waste storage facilities, and a mill.

Cameco is developing a decommissioning plan for the B-zone area at Rabbit Lake Mine, which includes a flooded open pit, a waste rock pile, and an ore stor-
age pad. Proper closure of the B-zone waste rock pile (BZWRP) will be important to minimize the impacts of seepage emanating from the stockpile on the long-term water quality of the flooded open pit and other nearby surface water receptors. The BZWRP will be decommissioned in-place meaning that an engineered cover system is required for closure.

A multi-phase study is underway to determine the optimum landform and cover system design for the BZWRP. Several field investigations have been completed to evaluate the geochemical, physical and hydraulic characteristics of the waste rock and locally available cover materials, as well as the hydrogeological setting of the stockpile. Various numerical modelling programmes have been initiated to predict net infiltration, oxygen ingress, and erosion rates for various cover system

![Map of northern Saskatchewan showing the location of Rabbit Lake Mine.](image)

**Fig. 1.** Map of northern Saskatchewan showing the location of Rabbit Lake Mine.