

Outstanding Underground Project Award Recipient— Vale Inco Mine 5280 Ore Bin Rehabilitation

In January of 2006, work began on rehabilitating an ore bin on the 5280 level of Vale Inco's Creighton Mine. The 5280 ore bin is a steel-lined circular bin that is 100 ft (30 m) deep and 20 ft (6 m) in diameter and processes approximately 600,000 tons of ore annually. Due to the vast quantity of ore put through the bin since its construction, it was in need of reconditioning. To bring the bin back to its original state, much time would have to be spent removing the worn and damaged plates that were still intact followed by the fabrication and installation of new steel liner plates. Once these plates were installed, concrete or nonshrink grout must be placed behind the liner plates to eliminate any voids. This method of rehabilitation is extremely labor-intensive and would take a great deal of time and labor to complete.

Another alternative explored by Vale Inco management and engineers was the use of impact/abrasion resistant shotcrete. Impact/abrasion-resistant shotcrete is specifically designed for ore passes, ore bins, dump walls, and other surfaces that are subjected to constant bombardment caused by the transfer of moving rock and ore. Impact/abrasion-resistant shotcrete comprises specialty cements, high-strength aggregates, steel fibers, and other carefully selected components. They are not only designed to withstand the conditions within the ore circuit environment, but some are also designed with set times that allow the circuit to start moving by the time the gear has been pulled out of the work area.

After reviewing the options, specifically the project cost and time allotted for the project, Vale Inco selected the use of King's Armour Guard Shotcrete for the bin rehabilitation.

On January 10, 2006, the bin was inspected and project safety precautions were assessed and discussed between crews and management. Following the preliminary inspection and process review, prep work began on January 18, 2006. The first order of business was to remove large sections of oxidized ore from an area in the bin on either side of the feed belt. Once this was removed, crews cut out all of the remaining worn liner plates with the exception of the plates behind the oxidized, much due to the fact that the steel was still the original thickness and would have been difficult to remove. Wire mesh was then installed throughout the bin. Holes were drilled in the remaining liner plates and anchors were installed in the concrete behind the plates so that the Armour Guard would have a sufficient anchorage.

The shotcrete process allowed workers at the mine to effectively apply a liner designed for the harsh conditions within the bin in a time period that would not affect the mine's production or operating budget. The work had to be done within the allotted time slot and on budget.

The Armour Guard was applied using an Aliva AL-252 dry-mix shotcrete machine that was setup at the top of the bin and 60/80 semi-wet nozzle assembly. The machine was fed with 2205 lb (1000 kg) bulk bags. The Armour Guard shotcrete was applied around the circumference of the bin at a thickness of 4 in. (100 mm). Because the dry shotcrete process allows for long conveyance distances and ease of nozzle manipulation when hand-held spraying, the shotcrete application began on January 27, 2008, and was completed the following day.

On the next shift, the scaffolding was disassembled and removed along with the other job-specific equipment and the bin was put into use. Vale Inco was extremely pleased with the outcome of the Armour Guard shotcrete alternative. To date, they have performed numerous inspections on the bin and have not noted any significant wear.