



# Electrifying Stillwater haul

*Witness testing the overhead trolley line and power collector operation from ABB's remote control panel located in the front grill of the truck*

A single Kiruna is able to provide the same work as several diesel trucks. Faster speeds up steeper ramps result in a much smaller total truck fleet of electric trucks for the same ore haulage as a larger number of diesel trucks.

The Kiruna truck also offers reduced noise levels in the confined underground workings. The measured outside noise level at maximum output is 85-90 dBA in the mine – appreciated not only by the operator but also by the miners working in the vicinity.

Electric power also allows easy and smooth stop/start operations with less strain on the operator and truck components. A 75 kW Tier 3 diesel engine automatically starts up for off line duties such as loading, dumping and turning sites. In passing areas no complicated overhead trolley lines are required. The operator simply drops the power collector which starts the diesel engine, allowing the oncoming vehicle to pass.

## Better economics

The mining company undertook a feasibility study into all of its options in deepening the mine. These included extending the existing shaft, stepping off, using conveyors, expanding its current fleet of diesel trucks as well as the electric 'trolley' trucks.

Whilst the study indicated that initial costs were comparable, according to Jacobs all options, other than the electric trolley operation, meant a capital cost outlay with no payback for some years. "We therefore opted in favour of the Kiruna trucks as a 'pay as we go' option," he said.

Also favouring the electric truck option was the difficulty in reducing DPM concentrations below the statutory limit of 160  $\mu\text{g}/\text{m}^3$  with additional diesel trucks and without additional ventilation fans and corridors.

Tony DiGrappa, Project Director, ABB in Canada also indicated that ventilation legislation in North American mines is expected to be an issue in the coming months. "The reduction in ventilation required with the Kirunas will provide a 'real' significant cost saving."

He added, "The combination of both the DPM and ventilation requirements means that there is considerable interest around North America in the Stillwater operation."

In placing the order for the Kiruna trucks, Stillwater had used the haulage operation at Canada's Inco mines as a model. A number of visits to Inco's two operations featuring six 50 t capacity Kiruna trucks, allowed SMC personnel

*Stillwater Mining has opted for electric trolley haulage for its future deep mine production with an order for two Kiruna K635EDs*

These two K635Ds are Stillwater Mining Company's (SMC) first electric vehicles and intended to help comply with diesel particulate matter (dpm) legislation in North American underground mines. The extensive work that SMC is doing in cutting dpm emissions was reported in *IM*, February 2009 (p48). SMC's Curt Jacobs, Chief Engineer, Rick Collins, Electrical Maintenance Superintendent and Karl Haumberger, General Foreman – Maintenance, were recent visitors to Sweden's GIA, to witness the factory acceptance certification for the two Kiruna K635ED electric trucks, prior to their delivery.

SMC is developing deeper production tunnels at its palladium and platinum operations in southern Montana, USA, later this year. The mine has been producing 400,000 oz annually from the only known significant source of platinum group metals (PGMs) in the US. The operation occupies over a 10-km segment along the eastern end of the 45-km long JM Reef, located in the Beartooth Mountain Range. It is accessed by a 595 m

vertical shaft – collared at an elevation of 1,525 m – and a system of horizontal adits and drifts.

In four development phases over the next three years SMC plans to deepen its electric truck haulage operation by a further 320 m taking it to an elevation of 610 m median. In addition to the two 32-t capacity Kiruna trucks from GIA, ABB will also be supplying 1,645 m of overhead trolley line in phase 1, increasing to approximately 3,660 m over phases 1 to 4, by 2012.

Produced in Sweden in cooperation between GIA Industri and ABB, the Kiruna trucks operate via a 3-phase AC 690 V overhead trolley line secured to the back of the truck. Kiruna electric trucks are engineered (electrically), sold and serviced by ABB in Canada for the North American market. The complete design incorporates an all AC electric system with one motor for each axle, making it a true four-wheel drive truck. Two electric traction motors drive all four wheels allowing it to maintain a high speed, particularly on steep ramps compared with diesel trucks; resulting in a higher productivity per truck unit.



Left to right: Leif Bergstrand, responsible for Kiruna assembly, GIA; Curt Jacobs - Chief Engineer, Stillwater Mining; Karl Haumberger - General Foreman Maintenance, Stillwater Mining; Rick Collins - Electrical Maintenance Superintendent, Stillwater Mining; Tony DiGrappa - Project Director, ABB in Canada

to witness the quiet operation and speed of the trucks.

Collins confirmed that they had also been very impressed with the operating and low

maintenance costs of the six 50 t Kirunas at both operations. "We were also able to use the Inco operations as a resource of information and, in fact, based our proposed ramp designs on Inco's experience," he said.

Stillwater is pursuing final road surface using emulsified asphalt and compacted gravel similar to Inco's installations. The ramps in the new phases below 610 m will be laid in this format at a maximum grade of 15% allowing the Kirunas to reach uphill speeds of up to 18 km/h.

Electric vs diesel (summary):

- Operating costs are reduced by about 50% using electric trucks
- Reduction in the number of electric trucks for the same t/h
- Longer life – seven years compared with diesel trucks' five years
- Environmentally friendly – reduced fumes/less noise
- Fewer operators/drivers needed
- Reduced energy and maintenance costs
- Electric trucks can use steeper ramps at faster speeds
- Reduced need for ventilation.

SMC conducts mining operations at the Stillwater mine near Nye, Montana and the East Boulder mine south of McLeod, Montana. Both mines are located on the J-M Reef.

SMC is transforming its mine operations from mechanised bulk mining methods to less mechanised but more selective methods. Sub-level mining is being de-emphasised over time at both mines. At Stillwater up to 35% of ore will be mined by various captive cut and fill mining methods and 65% by mechanised ramp cut and fill. At East Boulder up to 100% of ore will come from various captive cut and fill mining methods. This transitioning of mining methods emphasises margin and sustainability. Selective mining methods are important:

- Increased opportunity to mine with less dilution, thus increasing the ore grade to the mill
- Increased recovery of the in place mineral deposit
- Decreased amount of primary and secondary development per ounce of production, reducing operating costs
- Decreased reliance on mobile equipment reducing capital expenditures and mining support costs.

Concentrating plants are operated at both mines to upgrade the ore. The company also operates a smelter, refinery and laboratory at Columbus, Montana to further upgrade the concentrate to a PGM-rich filter cake. Spent catalyst material is also recycled at the smelter and refinery to recover PGMs. **IM**

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