Case study

Ventilation control delivers dramatic cost reduction

Howden was invited to design and implement a ventilation control system that would optimize the supply of fresh air to underground workers while reducing energy consumption and operating costs.

The Goldcorp Éléonore gold mine in Canada is owned and operated by Goldcorp mining company. They worked in partnership with Howden to introduce radically new VentSim™ CONTROL technologies that brought impressive cost and energy savings while also raising productivity.

The challenge

In most underground mines, the largest consumer of energy is the ventilation system. Vital for providing essential fresh air to miners, ventilation systems have traditionally been very static; fans are set to run continuously 24 hours a day, 7 days a week. As well as preventing the build-up of dangerous levels of diesel equipment gases (CO, NOx) and diesel particulate matters (DPM) underground, they also evacuate respirable dust and the noxious gases associated with extracting ore and other waste chemicals.

The Goldcorp Éléonore gold mine has a fresh air capacity of more than 900 kcfm (425 m^3/s). The principal ventilation system consists of two Howden Alphair 12300-AMF-6600 exhaust axial fans with a nominal power of 2,000 HP (1,471 KWh) each, configured in parallel. There is also an exploration shaft that has two Howden Alphair 11200-AMF-6600 main intake fans with a nominal power of 750 HP (551.62 KWh), again configured in parallel. The mine also has over 140 auxiliary and booster fans operated in conjunction with seven dampers and air regulators, and a heating system fuelled by propane.

Goldcorp commissioned us to provide them with a control system that would provide safe, efficient ventilation while reducing energy demands and costs.

The solution

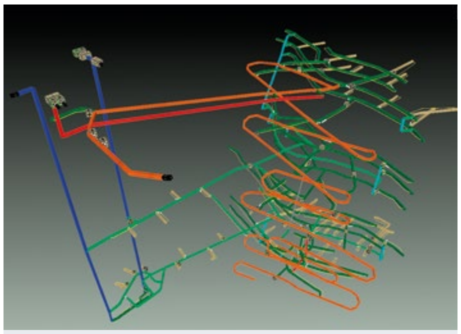
We set out to create an automated system covering all the ventilation equipment in the Éléonore mine, including the main fans, underground auxiliary fans and airflow regulators. 30 Ventilation Monitoring Stations (VMS) were installed to determine the quantity and quality of fresh air at various points underground. Each VMS includes one flow sensor and three gas sensors, to detect CO, NOx and C3H8, and is an integral part of the VentSim™ CONTROL system.

A mine-wide tracking system was installed to detect the presence of vehicles and personnel underground. Each of the 144 vehicles was fitted with a Radio Frequency Identification (RFID) tag that indicates its position in the mine and whether the engine is operating. Everyone working underground was also given a unique RFID tag that connects to one of 254 zone-based Access Points.

The tracking data is transmitted from these Access Points to the control room on the surface through a hybrid fiber optic network. There is currently between 60% and 70% wifi coverage in the mine, with plans for 100% coverage during full production. The data from the RFID tags provides enhanced safety and management of the movement of vehicles and personnel, as well as Ventilation on Demand (VOD).

The data from the tracking system allows ventilation requirements for each zone to be calculated by the VOD logic software. This information is then used to automatically modify the speed of each of 140 underground auxiliary fans, to ensure that each zone of the mine receives enough fresh air.

The control system in the Éléonore mine can be easily expanded as the mine grows in size, to maintain adequate, safe ventilation in every part of the workings as new areas and levels are opened up.



VentSim™ CONTROL

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The outcome

The installation of the VentSim™ CONTROL system, with its Ventilation Monitoring Stations and automation of all ventilation equipment, means that the supply of fresh air to individual work zones is maintained with complete safety, ensuring all underground personnel have a comfortable working environment. At the same time, the waste associated with continual ventilation of the whole mine has been eliminated.

As a result, there have been marked benefits in production and sustainability as well as safety. To quantify some of these benefits, an energy saving analysis was carried out.

The investigation covered energy consumption in the underground auxiliary fans and the main intake and exhaust fans, as well as the volume of propane used in heating the mine.

To date, there has been a 43% reduction in mine heating costs, a drop of 56% in underground ventilation electricity costs and a remarkable 73% decrease in the cost of surface ventilation electricity, as detailed in the table below. While these figures are impressive, the full potential savings will grow even greater when the mine reaches full capacity.

Primary exhaust fan

	Kcfm without VOD	Propane[1a] base (litre)	Real ave. Kcfm delivered	Real ave. Temp. (ºC)	Propane[1b] used (litre)	% savings	Ug elect.[2a] base (kWhr)	Ug elect.[2b] used (kWhr)	% savings	Surface electricity[3a] base (kWhr)	Surface electricity[3b] used (kWhr)	Surface electricity [3] used (kWhr)	%[3c] savings
January	997	1 786 542	749	-23,2	1 061 996	41%	4 799 987	2 221 696,00	54%	1 939 732		732 193	62%
February	997	1 943 776	870	-27,2	1 174 174	40%	4 281 475	2 552 577,00	40%	1 749 888		787 243	55%
March	963	1 149 281	731	-15,6	776 548	32%	3 946 064	2 049 635,00	48%	1 729 800		564 951	67%
April	871	393 434	685	-3,4	251 895	36%	5 028 609	2 854 524,00	43%	1 674 000		440 029	74%
May	852	0	655	4,8	0		5 059 946	2 505 882,00	50%	2 684 352		466 616	83%
June	915	0	741		0		5 445 636	2 666 228,00	51%	2 597 760		594 039	77%
July	886	0	596		0		5 697 102	2 214 274,00	61%	2 684 352		809 630	70%
August	886	0	797		0		5 831 086	2 694 978,00	54%	2 684 352		516 953	81%
September	1 043	0	743	12,9	0		3 416 268	1 256 929,00	63%	1 298 836	720 699	337 469	74%
October	1 040	138 953	690	2,8	15 849	89%	3 590 105	1 271 459,00	65%	1 342 025	726 062	425 252	68%
November	1 040	356 639	774	-2,1	144 457	59%	4 448 434	1 290 602,00	71%	2 527 250	941 933	452 823	82%
December	1 040	762 127	801	-7,7	300 364	61%	4 745 471	1 336 456,00	72%	2 678 081	994 623	423 501	84%
Sub total		6 530 752			3 725 283	43%	56 290 183	24 915 240	56%	25 590 428		6 550 699	73%

1a Based on cfm requirement without VOD and average monthly temperature
1b Based on real cfm delivered and real average temperature
2a Based on predicted ug electricity consumption without VOD
2b Measured consumption with VOD.
3a Predicted electricity consumption for the main fans in surface without the VOD (design 2012)
3b Predicted electricity consumption for the main fans in surface with out VOD using the fan during the month adjusted at a lower speed to respect required equipment cfm
3 Measured electricity consumption
3c Saving based on theoretical 2012kW fr main fans installed and available
3d Saving based on HQ base case criteria (fans at lower speed delivering x kcfm to respect listed equipment requirements.