

# Getting some air

Donna Schmidt looks at mining's ventilation sector and new products making the industry safer and more efficient

**“Done well, a ventilation design takes care of itself”**

There are a handful of non-negotiable factors when it comes to mining safely and efficiently, and among that group is proper mine ventilation.

Done well, a ventilation design takes care of itself, but when it is inadequate or not operating optimally, it does not take long to remember just how crucial it is to the everyday environment.

Regardless of mine type, and for a variety of reasons, there is no substitution for the presence of a fan system and a well-designed ventilation pattern from effective modelling. Ensuring mines have that involves knowing what's available and what's to come.

## HOWDEN

Continuing to build upon its 2009 release of Ventsim Visual 1.0, Howden unveiled VentSim Design V5 in early 2018. VentSim Design and sister product VentSim Control, previously known as Ventsim and SmartEXEC, have come together with new components to provide a comprehensive solution to help mines solve almost any ventilation problem.

One of the new features in the software release is Fan Select, which brings the crucial task of fan selection and ventilation into a visual focus, especially considering a user

is eyeing things such as the lowest operating cost and the highest efficiency. VentSim Design can help to calculate 'duty points', or points to determine flow and pressure, for fans across a mine's entire ventilation model.

Other new simulation features include a sensitivity and analysis tool to determine airflow, heat and natural ventilation; a Goal Seek tool to find needed fan pressures; and a simulation engine that provides a 1,000%-plus increase in solving speed.

Mines using the system for heat simulation will find that new capabilities have been added to V5, such as heat and moisture transference from ducts and open water bodies. Users can also model thermal flywheel effects on a daily and annual basis.

Like many new products in the software space, user-friendliness is a high priority for developers, and Howden has put focus here as well, starting with new charts and new change buttons for rapid orientation changes and a new docking window that makes it easier to view airway properties. With Level Wizard, if a setup of a user's model isn't correct, the system can automatically create a series of default levels based on the airways in the model.

The ever-evolving changes to products such as the new VentSim Design V5 release speak to how comprehensive all of VentSim's elements are, but it also lends itself to the rise in requests for ventilation on demand (VOD).

That is where VentSim Control really shines, and Howden has aided mines globally find both cost savings through reduced energy usage and increased production through optimised distribution of available air.

One of the company's recent cases involves a North American hard-rock mine, which wanted to introduce VOD with the VentSim Control technology to improve cost control, as well as bring about changes in safety and reduce its carbon footprint.

"The mine was sunk to extract high-grade copper ore from a deep deposit," the company says, adding it was designed for production of about 1Mt/y. "From the start, environmental protection was a major factor in planning and operating the mine workings.

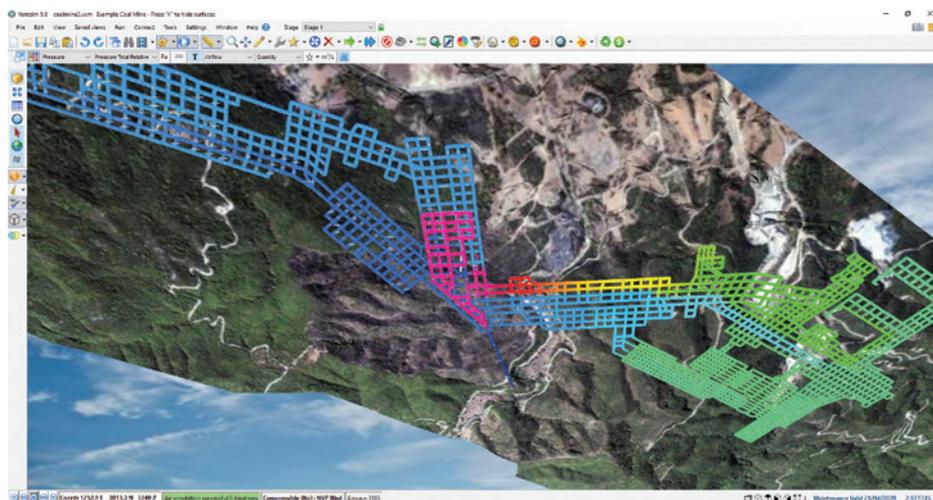
"In addition to the safety of personnel working underground, which is always the overriding factor, the operators were determined that the energy usage and carbon emissions from the project would be kept to the minimum required for personnel safety and comfort."

The mine at the start of the work had a total of 18,000hp (13,423kW) of installed fans, 50% of which were underground auxiliary fans, while the other half were main surface units.

Howden was tasked to provide the client with a management and control system that used the fans effectively, optimising fresh air supply, while reducing power consumption and operational costs.

Howden worked to solve the request by implementing a control strategy to minimise overall resistance and optimise main fan speeds.

*An overview of a coal mine project using Howden's VentSim Design V5*



“This was reckoned to offer the best balance between energy savings and smooth control response,” the company says.

Specifically, fan speeds are governed by the actions of the main ventilation regulator, through a speed optimiser, and the auxiliary fans are equipped with on/off starters.

“Different levels of control are used to control the auxiliary fans, ‘scheduling’ and ‘VOD’, used in parallel to optimise their use. In the ‘scheduling’ mode, the fans are started and stopped at the beginning and end of the shift in the relevant zone of the mine,” Howden says.

“The ‘VOD’ mode is enabled at the start of the shift and uses the data provided by the electronic vehicle and personnel tags. This leads into high energy savings for both the auxiliary and main fans.”

The 90 auxiliary fans at the mine site were outfitted with scheduling control, and approximately half of them already had dynamic control strategy. Now the fans are switched on only when vehicles and/or



personnel are present and are switched off when they leave the working zone.

At the end of the project, Howden crews sat down with the client’s figures to determine the savings realised from the introduction of VOD via VentSim Control. Over a 96-day period, scaled up to one year, the companies saw a reduction of

15,000MWh, or US\$1.2 million.

It located additional savings from running the main surface fans in a ‘speed optimiser’ mode, thus decreasing the fan’s speed for around 90 minutes at the end of every shift.

“Comparing electricity consumption with figures from a previous period showed that the annual energy saving in the ▶

*LMS’ HardLine flexible tubing is available for coal as well as positive pressure environments*

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**“No two mines are the same, and many have unique characteristics that traditional vent tubing struggles to work around”**

*LMS' Cerklefskie inspects some of the company's flexible ventilation tubing ready for placement*



▶ main fans was about 9,500MWh [and] the cumulative cost saving was calculated to be around US\$1.7 million,” the company states.

Even after pocketing about US\$2.9 million in savings, the mine also achieved other benefits. The mine now has the flexibility to draw more air as and where required, giving it increased production as well as the capability to respond quickly to any future adverse conditions including extreme weather, power outage, fire or even communications loss.

“In addition, the system optimises production by minimising blast clearing times, which enable workers to get back to work more quickly,” Howden says. “Such control would not have been possible without the use of the advanced Howden Ventsim Control system.”

#### **LONGWALL MINING SERVICES**

Don't let the name fool you – Longwall Mining Services (LMS), based in Pennsylvania, US, has become known for more than its work with the specialty coal operations of the globe. One of the other specialties it has taken on over the past few years is ventilation – specifically semi-rigid tubing for even the highest air-level demands.

The company has worked with Engineered Performance Ventilation Systems (EPVS) to grow the interest in HardLine ventilation tubing along with the latter company's sister product FlexLine, and to change

the idea many mines have that ventilation tubing needs to be stiff and unyielding.

No two mines are the same, and many have unique characteristics that traditional vent tubing struggles to work around. Not so with these products, which can offer greater capabilities for airflow gains.

“The coal market has proved to be the most challenging task, as the tubing sees high negative pressure during startup and operation,” LMS vice president of sales and marketing Bryon Cerklefskie says.

“With a majority of operations using tubing on development sections, the tubing is constantly moved. As you might suspect, this isn't a gentle process, and each operation operates a little different.”

Cerklefskie has worked with counterpart Michael Shulte, who serves as EPVS' USA sales manager, in somewhat of a 'tag team' approach to bring mine projects the best result.

Beginning with a thorough audit of a site's current ventilation system that includes an underground tour and discussions with key personnel, the pair becomes educated to the specific challenges of an operation as well as those who will be tasked with handling the new system.

Often, he says, top issues include inadequate air volume, excessive noise generation and inherent flaws of fibreglass tubes (failing and breaking).

“Anyone who has dealt with the irritation of getting material embedded into their skin, or have cut themselves on sharp edges, is glad to entertain an alternative,” Cerklefskie points out.

This makes this area of mining, which already causes pressure for staff, a little easier to handle when the section's tubing doesn't make the job more unsafe and just plain uncomfortable; this is often examined in great detail by the US Mine Safety and Health Administration (MSHA).

With the problems identified, Cerklefskie says the pair come together to provide detailed ventilation models – which use the latest version of VentSim – that outlines various layouts using existing fan curves and the mine's section map.

“This is where customers can

begin to see the drastic differences between HardLine and fibreglass,” he explains. “The most extreme scenario has been a mine in Alabama that was using 28in (71.2cm) and 24in (61cm) fibreglass reinforced pipe (FRP). They are now using 20in (50.8cm) HardLine for a majority of their needs.”

One trend LMS and EVPS have made note of in the growth of the product lines is requests for longer runs. LMS is several months into a testing project in Colorado to prove the operation can increase its block distances and, thus, offer cost savings for the mine.

“It will allow quicker development as well as a reduction in the number of seals and stoppings that are required. This is all being done concurrently with a reduction from 24in FRP to 20in HardLine,” Cerklefskie says.

Despite the progress made, both companies note the process has not been an easy one and that the products will continue to evolve, with their staff learning from every deployment and absorbing the feedback of mines to make the tubing the best it can be from a performance and environmental perspective.

“It could be as simple as location of the Pitot hole or handles, but [the feedback] can make a huge difference,” Cerklefskie says.

Standard diameters for the tubing include 16in (40.6cm), 20in and 24in for coal, but the lines can extend to a 72in (182.8cm) diameter in positive pressure environments.

“Don't let the name fool you,” Cerklefskie stresses, adding LMS can also stand for Limitless Mining Solutions.

“Although our core business is in longwall mining, we provide equipment for all types of underground mines.”

Among LMS' product lines are axial and centrifugal main fans, complete fan-to-face packages, Tiger Bretby, conveyor accessories, Morley motors, dust scrubbers and shield pocket fillers.

#### **STRATA WORLDWIDE**

Strata Worldwide mining engineers say there are a few main ventilation factors mines must consider, particularly if work involves getting deeper underground.

Providing adequate air quantities to mines becomes a greater chal- ▶

► lence in those cases, and also costlier. A typical result of increased depth is a rise in temperatures, as well as increased frictional losses as air needs to be pushed further and deeper to workers in a deeper working area.

A complex job is often made easier, however, with good, solid engineering practices paired with a well-designed mine plan.

Strata notes that one of the easiest, most cost-effective ways for a mine to improve its ventilation system is ensuring minimal fresh air leakage.

"There is a finite amount of air that can be brought into an underground mine," senior engineer Mike Fabio notes.

"Ensuring that the maximum amount of air is brought to the working areas is paramount to good ventilation."

With the proper system in place, an operation can quickly reap the benefits, starting with a major priority: better air quality for the safety and health of its workers.

There are also environmental benefits such as the advantage of

consuming less energy because the fans are working at an optimal efficiency.

Strata notes that its main research and development efforts focus on seals that will meet all standards for MSHA regulations.

Additionally, there is a consistent push by the company to identify more efficient materials and methods for seal construction, overcasts and stoppings.

"Mining customers are asking for the above-mentioned products to be constructed quicker and at a lower cost, while still maintaining their integrity," Fabio notes.

In an effort to satisfy these requirements, Strata completed an asset acquisition agreement with Illinois-based Precision Mine Repair (PMR) last July.

PMR, which had been known to many as a provider of underground ventilation control structures and mining construction services, designed the MSHA-approved 120psi (827.4kPa) PMR reinforced concrete seal and spray-panel overcasts using EVG 3-D panels.

Included in the acquisition was PMR's EVG 3D EPS panel machine, which creates the 3-D panels. Using the panels in the construction of the ventilation structures significantly reduces the labour time, materials handling and number of crew members required.

The PMR 120psi ventilation seal is one of three MSHA-approved 120psi ventilation seals that Strata offers.

## SRK

Following Mine Ventilation Services' merger into SRK Consulting (US) in April 2016, and the addition of an established principal consultant in mine ventilation in Sudbury, Canada, SRK notes it has strengthened its capacity for delivering valuable ventilation engineering solutions for operations across North America.

It now has a team of experts, each recognised in the ventilation field, that work from its offices in Clovis, California, and Sudbury, Ontario.

SRK's John Bowling notes that the mine ventilation group has taken on projects assisting two major

*Strata Worldwide goes to work closing an entry and controlling ventilation flow using a bulkhead constructed from its panels*



underground gold producers in Ontario that were seeking to improve energy consumption via their ventilation systems at three operations.

The team, working under the project management of Jacques Jodouin, evaluated the impact of numerous ventilation improvements for a large Ontario underground mine as part of a study via Ontario's Independent Electricity System Operator (IESO) Industrial Accelerator Program (IAP); the programme offers financial incentives for engineering studies and other industrial energy efficiency improvements.

A full ventilation study was conducted by SRK, which also established a calibrated ventilation model and identified and analysed the potential methods of energy improvement the mine can take on in the future.

As the most effective measures are enacted, the firm says, the mine will receive funding from the IAP as a function of the realised power savings, which will offset the capital expenses it has taken



*SRK specialists produce an overall plan then conduct engineering studies to help produce a ventilation and air conditioning design*

on to reach the power savings goal.

Next, SRK took on a project with another major Ontario gold producer to examine the energy impacts of battery-electric vehicle implementation to either add to or comprise the entire fleet at two operations.

The company notes that the studies' results are being used in a similar manner to apply for IESO-IAP funding for battery electric vehicle (BEV) equipment and ventilation controls. That work also realised substantial savings through the reduction of capital ventilation infrastructure, as well as operating costs.

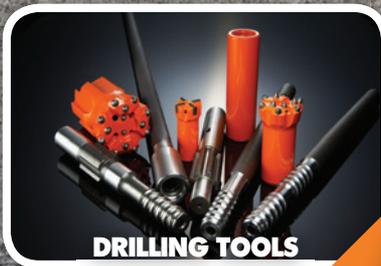
"We have certainly seen building interest in energy efficiency and battery-electric vehicles, and project

more focus in these areas in the future as the capabilities of BEVs expand and the cost and availability of BEVs make them more attractive," Bowling says.

"It is important to recognise that BEVs aren't the miracle solution once promised, as with the introduction of Tier 4 diesel engines: they don't remove the need for ventilation," says Bowling, adding that they also do not produce diesel particulate matter (DPM) or noxious combustion products – all of which help to improve the working atmosphere.

"BEVs do still generate dust and some heat, however, and these aspects must be carefully considered in ventilation planning for BEV fleets," Bowling concludes. ▼

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