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- Coal mine main fan power saving project
- The role of the ventilation function in compliance - a practical perspective
- A BCom OSH Degree curriculum for mining and other manufacturers - an exploratory study

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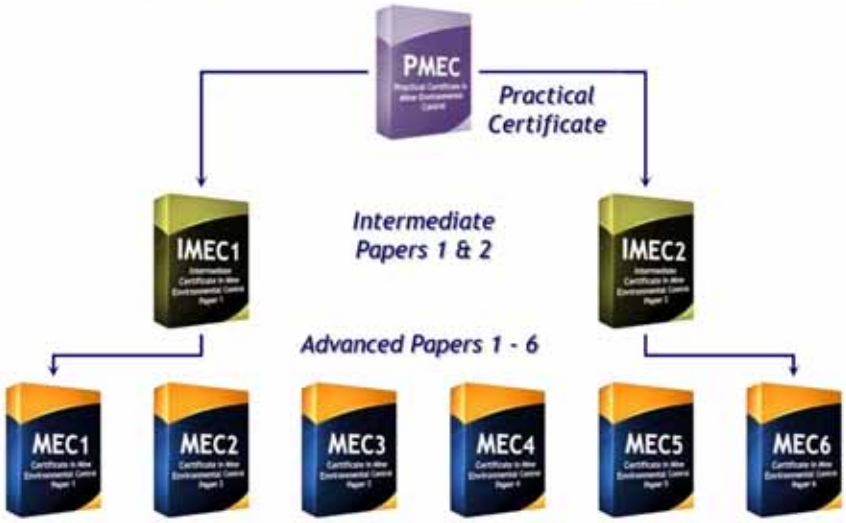

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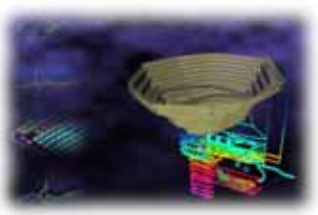

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Cover Picture:

New centrifugal fan installation serving the extension of the Morupule Colliery in Botswana. The fans have been manufactured by Howden fans and the installation is by Howden Projects

Editorial

Marco Biffi
Honorary Editor

Please send your comments and opinions to info@mvssa.co.za

Prevention is better than cure

I am indebted to Mr VJ Nundlall, long standing colleague and member of the Editorial committee for bringing to my attention an editorial note from the November 2011 issue of the IOHA newsletter. In it the editor highlights the latest NIOSH initiative titled "Prevention through Design" – a subject that should be very dear to all of us. In the editorial, the author concedes that often greater importance is placed on assessing the severity of unhealthy working conditions and their consequence rather than their prevention and that not enough emphasis is placed on *actually avoiding hazards* from occurring. He also advocates decision makers "...learn to *dedicate a larger share of resources* [own emphasis] to prevent rather than *only assess exposures* or deal with their unfortunate consequences..."

The editorial also stresses the significance of prevention and that too often there is more importance placed on providing a cure to the hazard rather than preventing it. In addition it emphasises the fact that success in creating safe and healthy working conditions is driven by the "political will" of decision makers and professionals alike in the timely prevention of identifiable hazards.

These aspects have been highlighted previously in this Journal. However, it is worth-while to remind ourselves how to be truly effective in our work. This is particularly opportune considering the theme of the upcoming annual MVSSA conference: "Engineering! A solution to ventilation challenges". Whereas occupational hygienists may be fixated by the measurement and analysis of exposures, mine ventilation engineers often tend to become immersed in the technicalities of providing the right "engineering fix". Often this is unavoidable but then we should ask ourselves why and how we have landed-up in the mess we must fix.

Equally the focus of mine ventilation engineering must be on the prevention first as well as providing the cure if required. Often "retrospective" corrections are more costly than preventative actions. However, in many cases, the risk is not adequately recognised or analysed or cost considerations guide the decision making away from adopting any preventative measures. This points to two very important aspects of our lives: the failure to adopt a more rigorous, risk-based approach to ventilation engineering and that often considerations on the prevention of occupational health hazards are brushed aside by management.

The theme of the MVSSA conference emphasizes an engineering focussed approach to resolving "challenges". It is proposed now that any engineering thrust firstly must be based and be part of a comprehensive and coordinated risk management system. The analysis and prioritisation of all major risks in the working environment of a mine should provide the necessary guidance and indicate the adequate preventative measures based on a hierarchy of controls. It must be said at this point that the risk-based approach is applicable to the engineering process and should be applied to *all* aspects of our work – even for the more basic tasks.

The proposed possible solutions arising from the risk-based process are then tempered by the adoption of the ALARA principle (as low as reasonably achievable). Unfortunately different individuals have different interpretations of the word "reasonably". The priorities of a mine or project manager often differ from those of the ventilation engineer. This is where the second aspect of this discussion comes into play. The reluctance often displayed by management (at all levels) to agree to certain corrective or even preventative actions is the source of frustration to many in our profession. The assumption at this point is that management either have "more important" priorities that require the share of resources in question or, more sadly, they do not appreciate the significance of the risk. This is where the skill of the ventilation professional is required to provide the convincing arguments that will change any misconception. It is one of the many skills that is required as with many other professions. Often I have seen motivations based on very valid and technically sound arguments backed-up by reams of mathematical data that totally flummoxed the audience and missed to provide the necessary motivation and the critical "punch-line".

It is therefore required to nourish and develop the ability to "market" ideas, concepts and solutions effectively. To do this, it is important to identify the priorities in the manager's area of responsibility and to use these to drive the motivation. In addition, the adoption of a risk-based approach to managing departments and designing systems will go a long way in ensuring that hazards are treated close to the source and that corrective action after the fact is limited to a minimum.

MVS Public Relations Committee - Communication Facility

The MVS Public Relations Committee would appreciate any feedback on any matter relating to the operation of this society. This facility has been initiated in order to ensure that any matter that is raised is given due attention.

It would be appreciated that the questionnaire below be completed and faxed / e-mailed to any one of the person/s listed below:·

- Mr Marco Biffi, info@mvssa.co.za
- MVS Office, Fax 086 660 7171, e-mail secretary@mvssa.co.za

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This paper was presented at the first Australian Mine Ventilation Conference held in Sydney on the 5 to 6 September 2011. The Editorial Committee is grateful to the University of South Wales and the AusIMM for granting permission to publish this paper.

Coal mine main fan power saving project

F.J. van Zyl, BBE Consulting, Bryanston, South Africa
C.A.S. Thomson, Anglo American Thermal Coal, Emalahleni, South Africa

ABSTRACT:

Anglo American Thermal Coal conducted a high level study of all of its underground collieries to determine if there are electrical power saving opportunities at the main fan stations. A systems approach to electrical power savings was used to identify potential savings in the various components of a primary ventilation system. Furthermore only technological interventions were considered to obtain electrical power savings.

From generic technological driven electrical power saving strategies, four energy savings strategies were identified, namely potential overall reduction in ventilation volume, improved underground air utilisation, optimisation of fan-set efficiency and potential fan drift design optimisation.

The study indicated the colliery [say Colliery D, Shaft A] that showed most potential in the four technology driven energy savings strategies. A detailed study was undertaken at Colliery D, Shaft A to increase the confidence level and the study confirmed that up to 45% of the main fan absorbed power can be saved [450 kW] with an estimated capital payback period of 18 months. The study clearly showed that an integrated approach to optimise the entire mine ventilation system has great potential for power saving, and that a clear, well defined methodology will be applicable to similar underground collieries.

This paper discusses the background to the study and the process followed to implement the energy savings initiative at Colliery D, Shaft A.

1 Introduction and background

1.1 Driver for energy savings initiative

On 24 January 2008 the South African national energy supplier, Eskom, asked 138 industrial customers to cut electricity usage after heavy rain damaged coal stocks, cutting generation that threatened to destabilise the entire grid.

According to the "National Response to South Africa's Electricity Shortage" strategy the Department of Minerals and Energy indicated that the risk of load shedding will remain high until at least 2013. It was identified that specific and immediate interventions were needed to minimise the risk of load shedding until the new peaking plant and base load electricity generating capacity being built comes online.

A short term intervention identified is the core demand reduction programme of which one of the three immediate implementation programmes is the Power Conservation Programme [PCP]. Under PCP the coal mining industry is required to reduce overall power consumption by 10%.

Furthermore, Anglo Thermal Coal is a voluntary signatory of the National Energy Efficiency Accord of 2005 under which they commit to a 15% reduction in electricity consumption by 2015. In light of this, Anglo Thermal Coal needs to reduce its electricity consumption by 10% to 15% by 2015.

Although the work described here developed directly as a result of the above, it created a methodology that should be applied on all underground collieries to minimise electrical power use.

1.2 Energy savings potential in mining ventilation systems

The Industrial Technologies Program in the U.S. Department of Energy's Office of Energy Efficiency and Renewable Energy analyses energy intensive U.S. industries to identify potential for energy savings and reduction in environmental impact.

One facet of the analysis includes energy bandwidth studies which analyse the energy saving potential of key processes in a specific industry.

In 2007 an energy bandwidth analysis was conducted for the US mining industry to identify energy saving opportunities in energy intensive processes / operations in coal, metals, and mineral mining. In the mining extraction category, ventilation was identified as an energy intensive process/ operation. From the bandwidth study it was found that by applying best and practical minimum energy absorption, practices between 9% and 23% of ventilation energy can potentially be saved.

This would mean that for a mine group that uses 30% of its operational underground energy consumption for ventilation potentially up to 7.5% of the overall mine absorbed energy can be saved.

Considering only Anglo Thermal Coal's underground mining operations, it confirmed that one of the main energy consumers is the primary ventilation system, consisting of between 27% and 34% of the energy demand. As this is a significant part of an underground coal mine's energy demand, potential savings can assist Anglo Thermal Coal in achieving its goal of 10% to 15% energy saving by 2015

1.3 Corporate energy management benefits

Energy management has been identified as an important part of the business process from the early 2000s [Fawkes 2005]. Apart from the current need to reduce energy, there are other benefits for implementing energy savings strategies. These include the business case for increasing profit to maintain economic competitiveness [increase shareholder value] by reducing operational energy costs.

Furthermore the need to reduce greenhouse gas emissions [green bottom line] is achieved where coal generated energy is used, which is the case for coal mines. There are also potential operational non-energy benefits such as better equipment reliability, longer equipment life, reduction in maintenance costs and downtime [Papar et al, 1999].

1.4 Anglo Thermal Coal operations

In South Africa, Anglo Thermal Coal operates nine thermal coal mines. Of these, four are underground collieries and form part of this study. All the mines have bord-and-pillar operations using continuous miners. One of the collieries also has a single wall section.

A total of 14 operational fan stations provide ventilation to the various shafts. The total absorbed power for the main fan stations is nominally 9.5 MW with a current annual operating power cost of US$5.1M [estimated at 2010 annual energy cost]; the amount of air moved is approximately 3 800 m^3/s.

2 Main fan station energy savings alternatives

2.1 Energy savings strategies

2.1.1 Generic corporate energy management strategies

Abdelaziza et al [2010] found that the industrial sector, which includes mining, uses more energy than any other end-use sector. For the study, a comprehensive literature review about industrial energy saving by management, technology and policy intervention was conducted. For these three main strategies the following generic sub-steps for each strategy were identified:

1) Energy management
   a) Organisational structure and energy manage ment programme
   b) Types of energy savings by management
      i) Energy audit
      ii) Energy efficiency courses and training programme
      iii) Energy saving by housekeeping
2) Generic energy saving technologies
   a) Introducing energy saving processes or technologies
   b) Energy recovery from existing processes
   c) Replacing existing components with most energy efficient alternatives
   d) Energy savings through system loss minimisation
   e) Energy savings due to system pressure reduction
3) Industrial energy saving by policies
   a) Regulations/standards
   b) Fiscal policies

From the energy saving technologies study it was found that in the industrial sector a sizeable amount of electric energy, emissions and operational costs could be saved by implementing appropriate energy savings technologies. It was also found that the payback periods for implementing these technologies are economically viable in most cases.

2.2 Mine ventilation energy savings technologies investigated

Potential energy savings strategies under each of the proposed five generic energy savings technology categories were investigated with specific reference to underground mines. The potential technologies that were found are listed below.

2.2.1 Introducing energy saving processes or technologies

i. Main fan energy management

ii. Variable Speed Drives [Murphy, 2006],

iii.The hermit crab concept to improve fan efficiency of fans operating at nondesign duty points [Belle 2008]

2.2.2 Energy recovery from existing processes

No specific literature could be found around energy recovery for technologies for shallow non-cooled coal mines.

2.2.3 Replacing and selection of most energy efficient components

iv.Correct selection of main fans, especially in multiple fan mines [Kumar et al 1995]

v. Utilisation of high efficiency motors [Lowe 2010, Belle 2008, Rapar et al 1999],

vi.Using ventilation simulation software to optimize system ventilation design [van den Berg et al, 2008].

2.2.4 Energy savings through system loss minimization

i. Using ventilation simulation software to optimize system ventilation design [van den Berg et al, 2008].

2.2.5 Energy savings due to system pressure reduction

ii. Optimizing the shaft collar, drift and self closing door designs to reduce system static pressure [Ray 1997]

2.2.6 Energy Savings Strategies by Energy Regulators

Energy Regulators typically use Demand Side Management to regulate energy usage:

1. Load shifting – where energy supply is shifted from one time to another in order to reduce the peak morning and evening demand;

2. Energy efficiency – reducing the amount of energy used in a particular process; and

3. Peak clipping – reducing the peak time usage without shifting the energy supply to another time.

As coal mines are often classified as 'fiery mines' the concept of varying the primary fan station volume over a 24-hour period to achieve load shifting or peak clipping is a high risk approach and is not recommended. It therefore has to be determined if energy efficiency measures can be put in place to reduce main fan energy requirements in a safe, cost effective and sustainable manner.

Based on generic energy management strategies this paper focus on technologies that can be implemented or applied to reduce energy consumption of main fans.

3. Systems approach to energy saving

The U.S. Department of Energy's Motor Challenge Program was launched in 1993, with one of the aims to increase the energy-efficiency of electric motor-driven systems in industry. The Motor Challenge Program identified that such saving potentials exist in the mining industry.

The Motor Challenge program promotes a "Systems Approach" rather than a "Component Approach" when evaluating projects for energy efficiency and these savings can be realized by using mature, proven, and cost-effective technologies [Papar et al, 1999].

A systems approach takes into account all the elements from the point where the power is distributed into the motor to the actual process work done. Depending on the application, the systems approach offers a methodical solution to increasing the energy efficiency.

4. Systems approach to energy savings

The main system components of a typical noncooled underground coal mine is shown in Figure 1 which consists of three main components namely air entry, air distribution and air exit.

4.1 Air Entry

The only applicable potential energy savings strategy at air entries is entry loss pressure reduction. As all mine entries

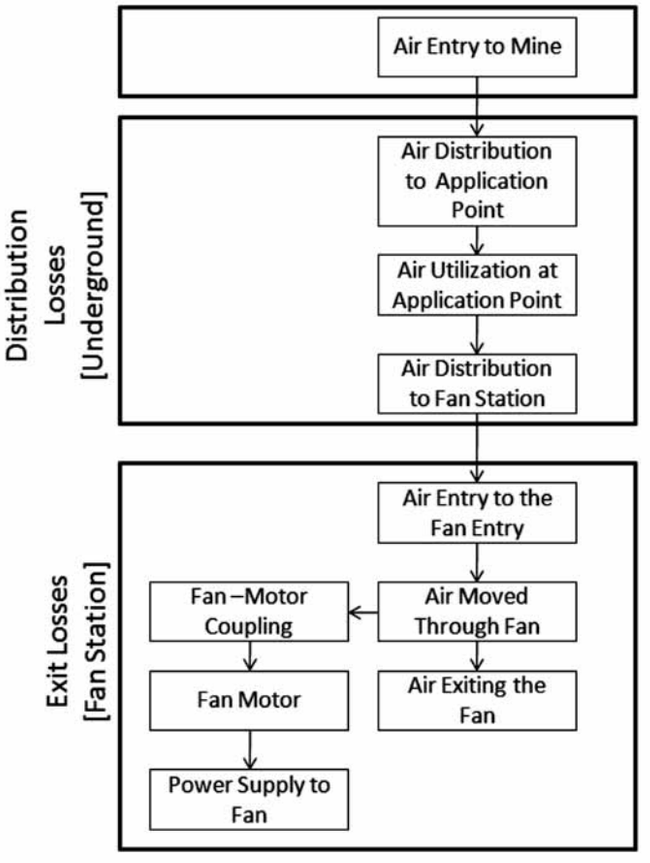

Figure 1. Mine primary ventilation system main components

are designed to economical standards and form a small part of the overall system pressure it was not considered for this high level study.

4.2 Air Distribution

There are typically two issues related to air distribution underground namely to supply the correct air volume and to minimize leakage. This is critical as the absorbed power is directly proportional to volume flow to the power of three [i.e. 10% reduction in flow = 27% reduction in absorbed power].

In bord-and-pillar mining the position of production sections change relatively quickly relative to the mine main infrastructure. This alters the distance the production sections are from the main infrastructure which impacts on the system resistance and ultimately on the system static air pressure. If the system static air pressure drops the fan will over-supply the mine, which if not corrected results in energy wastage.

Mining activities in an underground bord-and-pillar coal mine are reached via multiple roadway developments. A number of these roadways are used as air intakes and the remaining roads used as return airways. The intake and return airways are separated by ventilation walls. These walls are not airtight resulting in air leaking from the intakes

to the returns which can be classified as nonproductive air. Once the fresh air reaches the point of application it is routed to the production points using temporary brattices. These brattices are moved frequently and men and material move through them, resulting in 'in-section' air losses adding to the non-productive total. If these losses can be minimized, the system static pressure can be reduced resulting in energy savings.

Furthermore a reduction in fan volumetric flow rate can typically be achieved relatively easily by the following methods:

- Changing the fan impeller blade pitch angle in axial fans
- Fan inlet guide vanes for centrifugal fans
- Changing fan speed [Use of variable speed

drives, gearboxes or belt pulley sizing]

These methods are either already present on the fan stations or can be retrofitted easily if economically feasible.

4.3 Air Exit

The mines investigated in this study are exhaust ventilation systems resulting in the air exiting the mine via a fan station. Therefore two main energy absorbing components at the exit were investigated namely the fanset and the shaft top bend.

The fan-set was treated as a single unit to identify if the fan-set and its components require more detailed studies. Fan-set efficiency comprises the following components:

- Fan efficiency – rotating assembly
- Transmission efficiency – gearbox
- Electrical efficiency – related to the electrical motor
- Downstream energy recovering devices efficiency – such as the use of an evasee and discharge direction.

Of these, the fan rotating assembly and energy recovery devices have the biggest impact on overall fan-set efficiency [efficiencies of transmissions and electric motors are typically high and have a minimal impact on the overall fan-set efficiency].

The most effective method of improving fan–set efficiency is to ensure that the fan itself operates at its optimal design point [peak efficiency]. Devices that can be considered to achieve this are fan speed varying devices that will allow the new operating point to be achieved while maintaining efficiency using typically VSDs, gearboxes and belt drive pulleys. Impeller replacement can be considered if fan speed varying devices cannot be used. Regarding energy recovery devices poorly designed exit evasees can be replaced with correctly designed devices.

Typically coal mines in Anglo Thermal Coal can be characterized as large volume-low pressure operations. For this type of ventilation system poorly designed fan drifts can lead to large pressure drops being developed between the shaft collar and the fan inlet, contributing significantly to overall system pressure. If the overall system pressure can be reduced, the overall absorbed power of the system will reduce. Improvements can either be effected by retrofitting drifts with for example, turning vanes, or by replacing the existing drift with an aerodynamically efficient design.

4.4 Summary of Study Focus Areas

From the above, four main primary ventilation system components were identified for field studies to quantify the energy savings potential. The results from the study will be used as input for future detail studies:

1. Potential for reducing the circulating air volume [typically achieved by ensuring that air velocities in last through roads do not 'excessively' exceed minimum design requirement]
2. Improve air utilisation by reducing leakage into mined-out areas
3. Optimise efficiency of fan-sets
4. Potential fan drift design optimisation

Finally, taking all four the above components into consideration a long term [life-of-mine] view of the mining operations were taken to determine the potential for system loss reduction in life-of mine ventilation infrastructure such as new ventilation raises and shafts to optimise energy consumption.

Note: because this strategy will require capital investment it is referred to as 'strategic CAPEX improvements' in the study.

5. Identification of test site

For each of the primary ventilation system, a site visit was conducted to review the following aspects:

- Inspect, capture operating/design information, and obtain at least drift static pressure, air temperature, barometric pressure and motor current and voltage.
- Obtain fan OEM data and curves.
- Obtain broad understanding of life-of-mine ventilation requirements.

Based on the data gathered the following analysis was conducted:

- Estimate potentially achievable savings based on initial assumptions.
- Determine required controls to realize potential savings.
- Summarize high level findings for specific primary ventilation systems.

Table 1 summarises both the "recommended" and

Table 1. Summary of Potential Reduction in Absorbed Power [kW]

Colliery		Overall Flow Reduction	Fan-Set Efficiency Improve	U/Ground Utilization Improve	Drift Pressure Drop Reduction	Drift Pressure Drop Reduction	Strategic CAPEX Improve
Total kW Saving Recommended		395	203	489	162	485	1 330
Total kW Saving Recommended + Feasible		750	986	1815	275	825	1 330
Colliery A	Shaft A			609	80	241	580
Colliery B	Shaft A			718	88	265	750
	Shaft B	136			25	75	
Colliery C	Shaft A	203		34	101		
Colliery D	Shaft A	259	157	390	48	143	
	Shaft B			99			
	Shaft C	218	505				
	Shaft D	55	121				
	Shaft E	82					

"potentially feasible" energy savings strategies identified following the systems approach and considering the four identified focus areas. By following the recommended strategies in the short term potentially up to 15% of the total primary fan absorbed power can be saved.

From the study Colliery D, Shaft A shows potential in four of the five identified energy savings strategies. Based on this Colliery D, Shaft A was identified as the test site for energy savings of between 390 kW and 650 kW.

6 Detail shaft study

6.1 Air distribution optimization

It is critical to optimize the underground air utilisation and remove high pressure points. To assess the utilisation at the test site the following process was followed:

- Critically identify leakages, through underground visits and ventilation simulation modeling
- Critically assess commitment ventilation, through underground visits and ventilation simulation modeling
- Indentify sealing improvement strategies
- Assess optimization of airflow regulators to achieve desired air distribution, through ventilation simulation modeling
- Measure in-section airflow to ensure compliance with standards
- Predict power saving potential.

This information was assessed and compared to current best practice. Ventilation simulation was then conducted to assess the impact of the application of current best practice. In the ventilation simulation process it is critical that system leakage be determined accurately to be able to make recommendations on potential sealing programmes.

The number of vent walls [leakage paths] increases as mining advances away from vent shafts with a resulting increase in overall leakage. However, the overall vent system static pressure also increases with distance. These two factors cause the relationship between leakage and distance from vent shafts not to be linear but follow an almost quadratic relationship.

Figure 2 illustrates the increase in ratio of total air required to air required at the section, with increase in-mine distance. The graph is based on two mines with the similar quality and number of walls per unit length, however with different system pressures.

Figure 2 also illustrates that for example, increasing the number of sections in a mine, and thereby increasing the overall required air quantity and system pressure, would require different design air ratios. It is clear that a mine with lower system pressure would reach a greater distance than a mine with higher pressure difference for the same airflow quantity. Therefore, it is obvious that two collieries with the same wall standard/quality can have significantly different leakage characteristics depending on the mine system pressure.

VUMA-3D-coal, which incorporates wall leakage in the model construction, was used to for the simulation of the ventilation networks, see Figure 3.

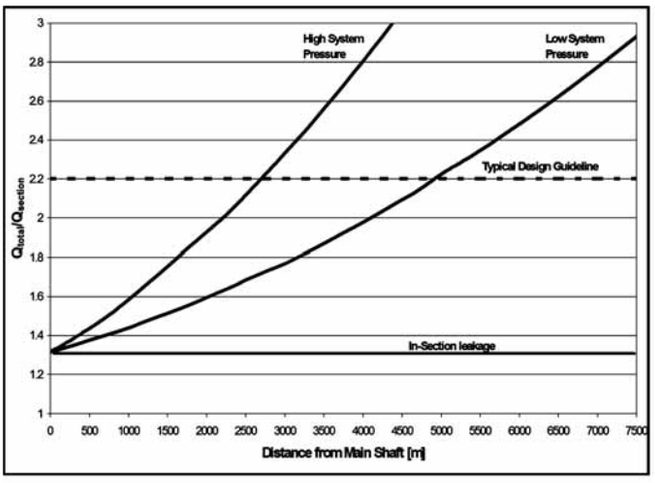

Figure 2. Air requirements as mining distance increase

VUMA-3D-coal was specifically designed and developed to assist underground coal mine managers and ventilation engineers and practitioners to effectively plan, design and operate coal mine ventilation systems.

VUMA-3D-coal is an interactive network simulation programme that allows for the simultaneous simulation of airflow, gas and dust emissions in an underground coal mine. It is used for long term strategic planning, current ventilation system optimisation, or to conduct what-if studies to assess the impact of ventilation changes at an operational level.

Ventilation simulation was also used to identify high pressure areas in the mine that could be addressed.

6.2 Air Exit Losses

To assess the air exit losses the following process was followed:

- Inspect fan drift, including shaft top bend, self-closing doors, inlet guide vane cone and expansion joints
- Inspect fan impeller, drive and motor set to determine inefficiencies
- Conduct pressure and velocity measurements and determine fan operating point
- Estimate overall fan station improvement potential
- Predict power saving potential.

Empirical equations were used to assess if pressure losses could be improved over the drift intake and exit. Secondly the fan efficiency was determined to assess if there was any potential for improvement.

6.3 Findings

The detail study showed that the total air volume could be reduced by 20% by improving in-section air utilisation and implementing a wall sealing programme.

It was also found that that the fan efficiency was 59%. This needs to be improved to at least 65%. The implementation of the finding will result in a 475 kW saving [47%].

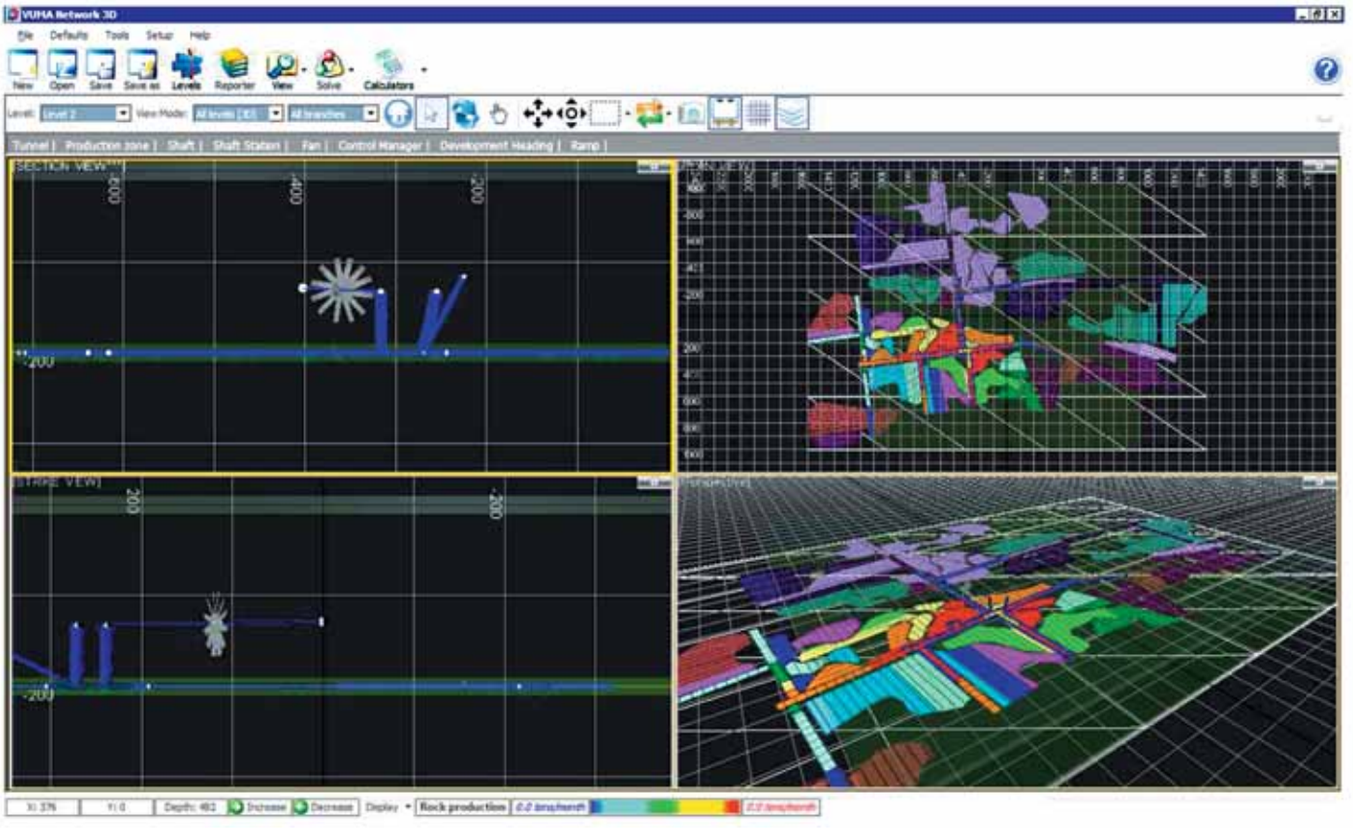

Figure 3 Example of VUMA-coal 3D model

7. Implementation

The implementation consisted of improving the insection ventilation to standard and verify that the sections were 'over' ventilated. The inlet guide vanes of the centrifugal fan were then turned back to the new volume required. A Measurement and Verification Audit indicated that this change resulted in a power reduction of 275 kW.

The reduction in volume flow and resulting drop in system static pressure reduced the efficiency of the fan to 39 %. Two options were considered to improve the fan efficiency, namely a new impeller or reduction in fan speed.

Based on the capital required and improvement in fan efficiency achieved it was found that the reduction in speed option is the most cost effective and will result in a fan efficiency of 68 %. The reduction in speed will be achieved by installing a gearbox.

This will be done in the near future and it is estimated a further 200 kW can be saved.

8. Conclusion

Following a systematic approach to optimise an underground collieries' ventilation system, starting at the face and ending at the exhaust fan station, has great potential to achieve electrical energy savings.

Safety, especially in fiery mines is paramount and it is therefore critical that any proposed changes to the ventilation system is fully supported by accurate network simulations and measured data.

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A BCom OSH Degree curriculum for mining and other manufacturers

- *an exploratory study*

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Background to the problem

Every day, workplace injuries, illnesses and fatalities cause immeasurable pain and suffering to employees and their families as well as to the business itself. Workplace injuries and illnesses cost companies huge amounts in wasteful and often preventable expenses. Effective management of employee safety and health protection is a decisive factor in reducing the extent and severity of work-related injuries and illnesses.

The need for a professional degree programme (qualification) is becoming more and more important. The complexity of OSH and the limited resources (and capacity) at public universities indicates that the problem will remain unless unconventional creative solutions are sought. Private "universities" (private higher education institutions) have the same limitations, although they may offer other possibilities/advantages. Recent discussions between academics and practitioners of Anglo Platinum and other mine groups led to further research on the matter.

The complexity and diversity of the profession of safety and health practitioners is fundamental to the problem. Different disciplines need to be integrated such as (1) business management, (2) occupational hygiene and (3) health and safety. OSH is generally defined as the science of anticipation, recognition, evaluation and control of hazards arising in or from the workplace that could impair the health and well-being of workers, taking into account the possible impact on the surrounding communities and the general environment (ILO 2009:2). To design an appropriate curriculum will therefore be challenging. Many of the subjects (modules) may be provided as electives (such as dust and noise control), but the academic knowledge and experience may not be found in public universities. This challenge (of many) to find and retain the expertise must therefore be found elsewhere.

The current qualifications offered in South Africa are limited in scope. Many BTech qualifications are being phased out and the Bachelor in Technologiae in Safety Management (BTech) (BTSM) offered by Unisa is also being phased out. This was the highest qualification in safety management. Currently, no post graduate training for such professionals exists and the current qualifications are not adequately catering for the need for health and safety professionals. In order to provide industry (such as mining) with academically qualified professional OSH practitioners, we engaged in developing a new curriculum for an academic Bachelor of Commerce (BCom) degree in OSH through distance education. The benefit of such a degree is its articulation possibilities after completing the BCom OSH degree. Some students may be able to articulate to an honours degree, followed by a master's degree and finally a doctorate degree. To summarise: the research problem therefore has two main dimensions: (1) curricula development and (2) obtaining the ideal provider (higher education institution).

The need for professional OSH education and qualifications

Occupational hygienists, nurses, occupational health doctors, mine ventilation officers and SHE managers all agrees that some tertiary organisation in South Africa must be able to provide sufficient OSH related programmes (qualifications). The large need for trained and educated professional safety and health practitioners is not only a South African phenomenon. The ILO (International Labour Organisation) revealed that, despite global efforts to address occupational safety and health (OSH) concerns, an estimated 2 million work-related fatalities and 330 million work-related accidents still occur each year (ILO 2009:xi). Productivity is at stake apart from the human suffering that results from work-related injuries and deaths. The direct and indirect costs at national and global levels are huge, taking into account compensation, lost working time, interruption of production, training and retraining, medical expenses and social assistance. A strong national OSH culture should enforce efforts and government assistance to address this challenge once and for all.

Each manufacturing industry has its own challenges. Dust and noise may be some of the primary hazards in mining. The Mine Health and Safety Council (MHSC) (South Africa)

has set targets for the mining industry of no PLH (Percentage Loss of Hearing) greater than 10% by 2008 and no machinery emitting noise of higher than 110 dBA by 2013. The targets are an attempt to improve the prevention of NIHL in the mining industry and are bas ed on current statistics that 67% (or 209 666 people) of South African mineworkers are exposed to noise levels of 85 – 105 dBA (TWA8h).

The provision of OSH-related training at all levels to operate a national OSH system is of paramount importance (ILO 2009:164). Basic management skills are lacking in the manufacturing industry and only academic knowledge and skills acquired through stringent academic training that would prepare a person to enter the professional practice of safety.

OSH Management demands multi-disciplinary skills

An effective SHE or OSH manager will need multiple competencies. They may vary between leadership and management skills, understanding of economics, engineering, ergonomics, mathematical skills, physics, chemistry, biology and medical skills, risk management skills and project management, etc. One of the most important skills is the understanding of industrial hygiene. This science is devoted to the control of environmental factors in the work place that may cause sickness, impaired health or discomfort. They address toxic materials, change work processes, manage ventilation systems, maintain good housekeeping and provide proper PPE. High standards or best practices do not necessarily work in practice. The South African Mine Health and Safety Act (Act No. 29 of 1996 (MHSA)) established legal obligations that include the proper use and care of PPE. This is the theory, but in practice, supervisors must monitor and insist on the proper use of PPE (or face disciplinary action).

Noise is regarded as the "silent disease" due to its insidious nature and need sophisticated management skills to control. Many workers, including supervisors, still prefer not to wear HPDs (hearing protection devices). This could be acceptable, if the potential hearing damage was known to be none, low, medium or high. Statistics shows a "noisy" picture, unfortunately. The World Health Organization (WHO) (www.who.int/mediacentre) has provided the following statistics related to the problem:

- Noise can adversely affect a worker's performance, for example in reading, attentiveness, problem solving and memory.
- Prolonged or excessive exposure to noise, whether in the community or at work, can cause permanent medical conditions such as hypertension and heart disease.

A link between community noise and mental health problems is suggested by the demand for tranquillisers and sleeping pills, the incidence of psychiatric symptoms, and the number of admissions to mental hospitals.

It is clear that the complexity and diversity of the profession of safety and health practitioners is significant. The job has become more complex than ever before owing to advances in technology, new legislation, the potential for costly litigation and a proliferation of standards (Goetsch 2005:628). These facts support the argument for the advanced training of health and safety professionals.

The American Society of Safety Engineers (ASSE), which is the largest and leading professional association of safety practitioners in the world and the Board of Certified Professionals (BCSP), responsible for the registration of safety practitioners in the USA, proclaimed that "As we begin the twenty-first century, the safety profession requires highly educated, competent and motivated practitioners. … To meet future challenges, safety professionals need a strong academic background." (ASSE & BCSP 2007:vii).

The need for professional safety practitioners is further driven by the fact that importers demand 'safe or green" products and regulation through ISO standards and the OHS Amendment Act 181 of 1993 (OHSA) has become stricter and higher demands are placed on the skills of the safety practitioner. The Mine Health and Safety Amendment Act 74 of 2008 (MHSA 2008:10) "requires all mines or groups of mines to prepare and implement a health and safety management system for mines". The Presidential Safety Audit by the Minister of Minerals and Energy was conducted at 355 mines across five mining sectors – gold, platinum, coal, diamonds and smaller mining activities – and focused on the health and safety of mines in South Africa. It highlighted several safety shortcomings and leading practices in the mining industry and the need to accelerate safety improvement in the sector (Mining Africa Yearbook 2009:1). The South African manufacturing industry needs larger numbers OSH practitioners/officers with professional qualifications.

Research problem: BCOM OSH Curriculum Development

The research problem has two main dimensions: (1) curricula development (2) obtaining the ideal programme provider (higher education institution). The dual research objectives are therefore to address these two aspects.

It may be ideal that the curricula developer also be the programme provider. It seems that the know-how does not lie within any public university for the simple reason that none of them offer such an important qualification. It may be time for a large mine house (who invest in all sorts of corporate social responsible projects and BEE ventures) obtain or create an academy for this purpose.

Although the SA mining industry May set the pace for its international competitors, it may not be the benchmark in all respects. Owing to the fact that the curriculums offered in South Africa is in many respects not on par with the

world's best practices, it became necessary to also benchmark against international providers. The safety education in most countries exhibited a fairly similar emphasis on curriculum contents it was evident that the curriculum contents, standards and emphasis of the ASSE (papers presented at ASSE 2010 and 2011) set the pace in safety education and training. It is also clear that a BCom is an ideal qualification to address all the multi-professional dimensions within the basic fundamentals of commerce, economics and business management. Additional "legs" can be included to address safety and occupational hygiene. Certain modules can also be included as electives for those who want to specialise in certain hazards such as noise to be addressed by hearing conservation management.

Research methodology

An exploratory research approach was used to address the research problem. Exploratory research is usually based on a combination of qualitative methods. A combination of personal surveys (and observations), research reports and the proceedings of the 2010 and 2011 international ASSE (American Society of Safety Engineers) have been studied. Qualified occupational hygienists and lecturers (previous and currently employed) at public and private higher education institutions in the discipline were consulted and meetings with a group of safety and risk managers from leading industries in SA provided more insights.

To address the two research objectives regarding a BCom OSH curriculum and the ideal provider of such a programme the following broad measures were used, namely:

A. The core skills needed by an OSH professional – international curriculum benchmarks

B. The core skills needed by an OSH professional – based on studies by academics

C. The core skills needed by an OSH professional – vocational and practical industry specific skills needed by means of elective modules

D. The ideal programme provider (university) within the changing higher education landscape

The status of the research work-in-process but the preliminary results already shows clear indicators. We need more feedback (see questionnaire at the end) from SHE practitioners (eg. on this report) to improve representation and we may update this report in 2012. The results are presented within the above mentioned four broad measures.

Research results

A.The core skills needed by an OSH Professional - International Curriculum Benchmarks

According to the ASSE/BCSP (2007:5-6) the precise roles and responsibilities of safety professionals depend on the nature of the industry and the company where they work, but most of them do at least several of the following:

- *Advising management:* helping managers establish safety objectives, plan programmes to achieve those objectives and integrate safety into the culture of an organisation.
- *Record keeping*: maintaining safety and health information to meet government requirements, as well as to provide data for problem solving and decision making.
- *Evaluating*: judging the effectiveness of existing safety and health related programs and activities.
- *Emergency response*: organizing, training and coordinating skilled employees with regard to auditory and visual communications pertaining to emergencies such as fires, accidents or other disasters.
- *Managing safety programmes*: planning, organizing, budgeting, and tracking completion and effectiveness of activities intended to achieve safety objectives in an organisation or to implement administrative or technical controls that will eliminate or reduce hazards.
- *Product safety*: assessing the probability that exposure to a product during any stage of its lifecycle will lead to an unacceptable impact on human health or the environment and determining the appropriate auditory and visual hazard warnings.
- *Hazard recognition*: identifying conditions or actions that may cause injury, illness or property damage.
- *Inspections/audits*: assessing safety and health risks associated with equipment, materials, processes, facilities or abilities.
- *Fire protection*: reducing fire hazards by inspection, layout of facilities and processes, and design of fire detection and suppression systems.
- *Regulatory compliance*: ensuring that mandatory safety and health standards are satisfied.
- *Accident and incident investigations*: determining the facts related to an accident or incident based on witness interviews, site inspections and collection of other evidence.
- *Security*: identifying and implementing design features and procedures to protect facilities and businesses from threats that introduce hazards.
- *Health hazard control*: controlling hazards such as noise, chemical exposures, radiation, or biological hazards that can create harm.
- *Ergonomics*: improving the workplace based on an understanding of human physiological and psychological characteristics, abilities and limitations.
- *Hazardous materials management*: ensuring that dangerous chemicals and other products are procured,

stored, and disposed of in ways that prevent fires, exposure to or harm from these substances.

- *Environmental protection*: controlling hazards that can lead to undesirable releases of harmful materials into the air, water or soil.
- *Training*: providing employees and managers with the knowledge and skills necessary to recognize hazards and perform their jobs safely and effectively.

International OSH curricula benchmarks

The majority of the programs offered in the USA are undergraduate BS programmes. However, by comparison there are 35 accredited MS industrial hygiene programmes and 6 BS industrial hygiene programs and overall, 2800 accredited programs (www.abet.org). The following universities in the USA can be used as benchmarks: Central Missouri (Occupational Safety and Health, BS); Fairmont State University, (Occupational Safety, BS); University of Houston-Clear Lake (Environmental Science and Safety, BS); Indiana University of Pennsylvania (Safety Sciences, BS); Marshall University (Safety Technology BS); Oakland University (Occupational Safety and Health), Pennsylvania State University (Industrial Health and Safety, BS) and others.

A large majority of South African students will be working adults that would need to study part-time. A distance learning (open distance learning) Bachelor's degree would be appropriate and the popular offerings of the DETC accredited Columbia Southern University was used as a benchmark. Their Bachelor of Science in OSH consists of 17 major modules (besides other general modules required) listed in table 1.

Table1: A BS in OSH curriculum

Group A	Group B
Fundamentals of OSH	Risk management
Legal compliance	Project management
Construction safety	Leadership
Industrial ergonomics	Training and development
Interactions of hazardous materials	
Total SHE	Fleet safety
Introduction to fire protection	Hazardous material management
OSHA standards	Accident investigation
Industrial hygiene	
Toxicology	

This syllabus can be regarded as sufficient for a bachelor's degree with the assumption that the entry-level general modules (not shown in the table) are appropriate and the variety of electives (not listed in the table) is sufficient. This example also shows the inter-disciplinary make-up of such a qualification with three major "legs" such as (1) business management related modules (see examples in group B), (2) safety management (of standards, systems and legislation) and (3) occupational hygiene.

Smit (2011) is an OSH consultant and previous professor at several public universities altered the above qualification to be more in line with a typical BCom qualification. The outcomes of the qualification should be in line with the following:

- Anticipating, identifying, analysing and evaluating hazardous conditions
- Advising in development of control designs, methods, procedures and programs
- Advising in implementation and administration of safety control programs
- Measuring, auditing and assessing the effectiveness of safety management controls
- Analysing incidents to identify deficiencies in occupational safety, health and environmental protection management

Besides the normal accounting and economic subjects at entry-level, Smit (2011) recommends that quality management, operations management and project management must also be included in the business management group and that hearing conservation excellence be considered to be one of several electives. A summary of this suggested curriculum of the OSH related modules (the typical entry-level BCom modules are not listed here) is provided in table 2.

Table 2: A proposed BCom OSH curriculum

Group A (level 6)	Group B (level 7 and electives)
Introduction to occupational safety management	Safety management in world context
Introduction to occupational health management	Safety auditing
Introduction to occupational hygiene management	Electives to be decided, such as:
OSH law (level 6)	OSH law (level 7)
Safety risk assessment	Hearing conservation excellence
Managing safety in the workplace	Dust control
Introduction to environmental management	BBS (behaviour-based safety)
SHEQ system standards	(Elective)
Safety incident analysis	(Elective)
Safety leadership and culture	(Elective)

Popular topics to be considered in the BCom OSH syllabus

From the many papers presented at the recent ASSE conferences (2010 and 2011) the topics did not provide many new insights and therefore confirms the primary contents of the suggested BCom OSH syllabus. The following 7 topics (and related topics) are examples:

1. *Key strategic issues influencing global workplace safety and health*

- Corporate sustainability
- Chemicals and hazardous materials management
- The Global Harmonization Standard
- ISO 26000 SR and ISO 31000 RM

2. *Milestones toward a zero-incident safety culture*

Large companies like DuPont and Dow have invested significantly in developing work standards, processes and engineered solutions to workplace conditions that protect employees. BBS (behavior-based safety) concepts began engaging employees across, as well as up and down, the organization in improving awareness and resolving observable workplace issues. Computer database advances also contributed to focus on repetition and leading/lagging indicators.

3. *Safety leadership*

OSH excellence resides in corporate leadership. Visible leadership in the workplace is supported and the "Twenty Foot Rule" is an example of a process-driven concept that allows organizations to improve employee communications and increase their participation in the success of an organization. The principle of "Point of Action is inherent to this where management efforts are most effective when they focus at the point where the work is actually done. Employees are more comfortable "on their turf." It is unimaginable to have excellent OSH leadership without a strong safety culture based on certain behaviours, norms and values.

4. *Improve human safety behaviour*

With reference to BBS the interventions to address the human dynamics of injury prevention have improved dramatically since the early 1900s. Focus and distraction are human factors that impact both performance and the risk of error. Unlike observable conditions, such as human behaviour, the conditions that give rise to human error are largely unobservable and un-measurable. Addressing these factors requires the application of psychological principles to the manger's toolbox. An understanding of these human factors is crucial to achieving improved performance as well as mitigating their negative effects.

5. *Continuous development of an effective OSH management system*

Most experts agree that an effective OSH program will be based on the following four elements:

- Leadership, management commitment and all employee involvement;
- Workplace analysis;
- Hazard prevention and control; and
- Safety and health training of all employees to eliminate or avoid hazards.

6. *Risk management*

In the face of ever-present uncertainty, risk management is fundamentally about how well an organization can consistently understand / manage associated threats. Risk management needs to be embedded into every aspect of core "modern" management. The following new international standards were popular topics: (1) ISO 31000, Risk Management- Principles and guidelines on implementation; (2) ISO/IEC 31010, Risk management-Risk assessment guidelines.

7. *Combustible dust is an insidious hazard*

Many manufacturing environments fraught with hazards have slow but steady accumulation of fine "dust" particles in often unseen areas such as ceilings. Machinery can seem innocuous compared with more immediately obvious dangers of bodily injury posed to workers. Several factors contribute to the interplay of an explosion. As a rule, these five elements interact in order for an explosion to occur:

- Combustible dust (fuel)
- Ignition source (heat)
- Oxygen (oxidizer)
- Dispersion of dust particles in sufficient quantity and concentration
- Confinement of the dust cloud

B.The core skills needed by an OSH Professional - based on studies by academics

An established assessment centre for safety practitioners in SA identified competencies that serve as assessment criteria within the context of industrial practice. Van Loggerenberg (2011) and a group of safety practitioners, which included senior safety practitioners and safety managers, utilized this centere to select a set of competencies that safety practitioners must master in order to be professionally successful using an inductive Delphi approach. The question that needed answering was: what critical content should be included in the curriculum to ensure adequate and appropriate skills development for professional recognition of health and safety professionals, taking into consideration that modern safety practitioners operate in work environments that are undergoing constant technological, legislative, social, economic and cultural changes? A summary of this study will be given in terms of (1) safety responsibilities, (2) the type of qualification needed and (3) the module content of a proposed BCom OSH degree.

1. Safety responsibilities

The six core responsibilities were taken from the ASSE and BCSP Career guide to the safety profession (2000:3-4). All six responsibilities were identified by an overwhelming majority as being suitable as a function of a safety practitioner/officer, but the responsibility to anticipate, identify, analyse and evaluate hazardous conditions was

Table 3: Responsibilities that suite the functions of a safety practitioner

Responsibility	Number of respondents	Percentage of respondents
Anticipate, identify, analyse and evaluate hazardous conditions	292	93.0
Analyse incidents to identify deficiencies in SHE-systems	285	90.8
Advise in developing of control designs, methods, procedures and programmes	282	89.8
Measure, audit and evaluate effectiveness of controls	281	89.4
Advise in implementation and administration of control programs	274	87.3
Advise on maintaining the process of continual improvement	272	86.6

the highest (93%). The summary of this results are shown in Table 3.

2. Suitable qualifications for the training of safety practitioners/officer

Although participants are acquainted with particular OSH qualifications being offered, a large percentage is in favour of a change in terms of a BCom degree. Participants in the study find a BCom (OSH) degree (64%) more suitable than the BTech (Safety Management) degree. This concept qualification was also tested and for each of the subjects, a concise description of the typical content for that subject was given in the questionnaire. The modules (subjects) are discussed in the next section.

3. Modules (subjects) to be considered in a proposed BCom (OSH) degree

Respondents had to rate a predetermined proposed list of subjects in terms of their importance of inclusion in a proposed B Com (OSH) degree on a four-point Likert scale. From table 4, it follows that the subjects can be grouped into four clusters with regard to importance. The most important subjects were safety management, SHE legislation and safety risk management, all three considered "very important" (90.1%, 89.8% and 88.9% respectively) for inclusion. A summary is given in table 4.

Respondents could also indicate on a predetermined list of topics which modules they think should be included in the curriculum. A summary of the 15 most important topics are:

- Incident analysis and analysis techniques (92.0%)
- Hazard analysis, risk assessment and evaluation (90.4%)
- Safety systems (89.8%)
- Developing SHE culture (89.8%)
- Emergency preparedness (88.5%)
- Task process safety (86.6%)

Table 4: Possible subjects for inclusion in a proposed BCom (OSH) degree

Subjects	No response %	Irrelevant %	Not so important %	Important %	Very Important %
Safety management	5,1	0,3	0,3	4,1	90,1
SHE legislation	5,1	0,6	0,3	4,1	89,8
Safety risk management	6.1	0,3	0,3	4,5	88,9
Environmental management	5,7	0,3	1,6	24,8	67,5
Occupational hygiene	6,4	0,3	2,5	24,2	66,6
Quality management	5,4	0,3	1,3	26,8	66,2
Ergonomics	6,4	0,3	3,8	27,4	62,1
Industrial and organisational psychology	5,7	0,6	4,1	34,1	55,4
Financial risk management	5,4	1,6	14,6	41,4	36,9
Organisational development	5,4	1,3	11,5	49,0	32,8
Management of production and operations	5,7	2,9	13,7	47,1	30,6
Business management	5,7	1,6	10,5	55,1	27,1
National, corporate and enterprise economics	7,0	11,1	38,5	33,8	9,6
Accountancy	5,7	15,3	40,4	29,0	9,6

- Behaviour based safety (86.6%)
- Auditing (86.6%)
- Safety training (85.4%)
- Handing hazardous substances (85.0%)
- Service provider (contractor) management (84.7%)
- Report writing (84.1%)
- Philosophy of safety management (84.1%)
- Fire safety (83.1%)
- Task analysis (83.1%)

C. The core skills needed by an OSH Professional - vocational and practical industry specific skills needed by means of elective modules

1**. Internship** - the majority of the respondents (76.4%: 240 out of 314) said that a student should perform a mandatory internship. Out of these 240 respondents, most of them (77%) indicated that the duration of the internship should be three months. Fender and Watson (2005: 36) identified

three stakeholders that can benefit from OHS internships, namely the students, employers and universities, provided that the clear goals are set for the internship and that all stakeholders comply with the goals. Work integrated learning (WIL) involves "periods of required work that integrate with classroom study" (DoE 2007:9) to contribute to training of a professional standard.

2. Specialised modules for mining officials – some specialised modules may be to be included as electives for certain industries. Hearing conservation and dust control may be more important in mining. Construction safety is another example and other industries may need to focus more on fire protection, fleet safety, toxicology, etc.

3. Third level strategic electives - strategic issues influencing global workplace safety and health are corporate sustainability, chemicals and hazardous materials management and the Global Harmonization Standard. OSH culture management, BBS (behavior-based safety) and safety leadership are other possibilities. Integrated OSH management system, total SHE and risk management standards are other examples for consideration.

The ideal programme provider (University) within the changing education landscape

After many years of teaching and learning experience at tertiary institutions it became evident that the skills to teach such a qualification may never reside in one single public (subsidised) university. Qualified SHE and OSH managers do not teach or consider such a career as financially viable. This is the reason that only basic qualifications (eg. certificate programmes) are offered in South Africa. The conventional university Bachelor's degree in OSH will have to be found in unconventional ways.

With the "business academy" concept in mind it may therefore be necessary to think creative to resource, develop, offer and sustain such a qualification. A mine house may for instance create or extend their own training academy. The ideal programme provider may therefore be found outside (or semi-outside) the public university. This may be in partnership configuration with a variety of education institutions, experienced consultants (as lecturers) and OSH managers.

Private higher education institutions (PHEIs) accredited at the DOE seems to be the recommended possibility. These institutions also have limited capacity (lecturing staff) but they are more flexible. The IIE is JSE listed and offer a wide variety of qualifications. Some smaller "private universities" specialize in certain disciplines and OSH may fit some of these institutions. The following are examples of PHEIs that specialise:

- Cranefield College is a PHEI specializing in project management
- Da Vinci institute is known for innovation and technology management
- FPD (Foundation for Professional Development) is known for health and medical related training.

Should a large mine company want to extend their "training academy" capabilities and credibility, it could consider a strategy to engage with a suitable PHEI to offer certain OSH related offerings (eg. BCom OSH degree). Hereby the mine can sponsor a few core skills (professors / leather chairs) and obtain its "own" accredited established PHEI through such a long term partnership. It could thus be possible for Anglo American (or Anglo Platinum) to engage with FPD to offer a BCom OSH degree. The other advantage is the agility obtained and the possibility of some mine managers to become involved as course developers/providers (lecturers) of specialised modules. Another example of this win-win strategy is that Anglo can hereby obtain their "own university" and the PHEI (such as FPD who have trained 10 000 medical doctors) obtain the benefit of cross-branding by its association with a large international company such as Anglo.

Brief discussion of the results

The exploratory study approached the research problem to obtain more insights regarding (1) curricula development (2) obtaining the ideal programme provider (higher education institution). The study is work-in-process and the dual research objectives are not fully reached.

In developing the curriculum for the BCom (OSH) the benchmarks discussed in this paper (and other industry specific insights) should all be revised again in collaboration with industry (eg. members of the MVS). In spite of the fact that survey respondents showed an aversion to accounting and economics being included in a BCom (Safety management), these subjects and business management, general management and strategic management are necessary requirements for safety professionals. A survey of certified safety professionals (CSPs), Ferguson (1994:79-81) found that baccalaureate course work in risk management and in areas associated with business, such as total quality management and the financial aspects of safety was needed. Blair (1997:127-131) surveyed a different group of CSPs and identified that their most challenging problem is the lack of commitment and support of upper management. He recommended that knowledge of business, accounting and even marketing be included in safety management programmes.

The inclusion of subjects such as psychological process in work context; personality in work context, organisational psychology and organisational development and change is in line with the role of the safety professional as advisor, communicator, facilitator, trainer/coach, relationship builder, mentor and change agent. These skills are all also fundamental to BBS (behaviour-based safety). This is supported by Swuste and Arnoldi (2003:15-27) who pointed out that the role of a OHSE professionalis such that it requires "attention to organisational theory, company structure and function, budgeting, planning, etc.

QUESTIONNAIRE - please provide your comments/feedback to email steenrj@unisa.ac.za

Please use the following section to respond. Van Loggerenberg (2011) suggests the following proposed (concept) qualification composition:

Level and main themes	Modules	Credits
First level (NQF 5) – BCom subjects related to economics, accounting and business management	7	84
Second level (NQF 6) – OSH modules	13	156
Third level (NQF 7) – OSH modules and electives	10	120
Total:	**30**	**360**

***Please provide your feedback** – use the following information as An open-ended questionnaire to assist us with the curriculum design. Please respond freely on any aspect. We urgently need your response to finalize the curricula. Use the background in the report and the broad measures discussed under A, B, C and D to improve/adapt the following conceptual BCom (OSH) curriculum with 30 modules for a total of 360 credits. Please try to limit the modules accordingly and indicate your comments / improvements / changes/new modules regarding the suggested subjects/ modules. Also indicate or add three modules as electives on the third level.

First-level modules (NQF level 5): business management; economics; accounting concepts and principles; psychological process in work context; personality in work context; introduction to safety management; safety management in industry (other possibilities: statistics and OSH costing; safety behaviour)

YOUR COMMENTS:

Second-level modules (NQF level 6): business management; economics; accounting reporting; general management; production and operations management; organisational psychology; enterprise risk management; safety management precautionary measures; safety risk assessment; occupational health theory; occupational health and safety law; ergonomics (other possibilities: product safety; behaviour-based safety)

YOUR COMMENTS:

Third-level modules (NQF level 7): strategic management; organisational development and change; incident assessment and analysis, managing organisational safety culture; systems in safety management; quality management systems; safety management auditing; safety management in world context; occupational health and safety law (other possibilities: safety leadership; project management; corporate social responsibility; hearing conservation excellence; emergency responsiveness; fleet safety; toxicology; dust control)

YOUR COMMENTS:

The offering of a professional degree in safety management at a higher education institute (or PHEI) would contribute substantially to recognising the professional status of OSH managers. Safety practitioners need to be recognised and treated as professional people, and respected for the qualitative safety advice they deliver as professional people, to the same degree as the occupational health nurse, doctor, human resource person, hygienist, ergonomist, environmental management person and the engineer are respected.

In conclusion – industry begs for a proper qualification and it is unthinkable to wait another decade for a proper OSH degree qualification. Appropriately qualified safety and health practitioners will be able to contribute to curbing the high level of occupational incidents, injuries and fatalities.

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The role of the ventilation function in compliance

- a practical perspective

Warren Beech, Leppan Beech Attorneys

Editorial note: *The promulgation of new regulations regarding ventilation and occupational hygiene may have surpassed the accuracy of some of the aspects presented in this paper However, there are a larger number of other issues that are of value to our readers.*

Introduction

In order to understand the role of the ventilation function within the context of the Mine Health and Safety Act No. 29 of 1996 ("MHSA), it is essential to understand the impact of the appointment structures, and the primary responsibilities placed on the employer, as defined.

This document will explore these responsibilities, and the way in which the ventilation function can assist in the search for compliance.

Summary of primary responsibilities

The primary responsibilities in terms of the MHSA, are placed on the employer, as defined. In addition, specific responsibilities are placed on the Chief Executive Officer, or nominee, the Manager (as defined), and certain specified functionaries.

These functionaries include a person appointed to comply with the ventilation requirements in terms of the MHSA, and more specifically the Regulations.

Appointments

In most cases, the person responsible for carry out the ventilation requirements, is appointed in terms of section 7(4) of the MHSA, read with together with the applicable Regulation, namely Regulation 2.16.1.

The appointment in terms of section 7(4) of the MHSA means that the person is appointed to assist the Manager in complying with the Manager's responsibilities in terms of the MHSA.

The Manager's responsibilities in terms of the MHSA, are to:

- Be in charge of the day to day operations and Management of the Mine; and
- Comply with the specific Regulations.

In addition, the Manager is often appointed in terms of section 7(2) of the MHSA, which means that the Manager is appointed to assist the employer in carrying out its responsibilities.

It is therefore essential for each person appointed in terms of section 7(4) of the MHSA to know and understand the primary responsibilities placed on the employer.

Primary responsibilities

In summary, the primary responsibilities placed on the employer are as follows:

To conduct Hazard Identification and Risk Assessments (HIRAs). In accordance with the SIMRAC Guidelines, HIRAs must include a baseline HIRA, continuous HIRA, and issue based HIRA.

- This requirement is set out section 11 of the MHSA which provides

"11. (1) Every employer must -

a. identify the hazards to health or safety to which employees may be exposed while they are at work;

b. assess the risks to health or safety to which employees may be exposed while they are at work;

c. record the significant hazards identified and risks assessed; and

d. make those records available for inspection by employees.

2. Every employer, after consulting the health and safety committee at the mine, must determine all measures, including changing the organisation of work and the design of safe systems of work, necessary to -

a. eliminate any recorded risk;

b. control the risk at source;

c. minimise the risk; and

d. in so far as the risk remains -

i. provide for personal protective equipment; and

ii. institute a programme to monitor the risk to

which employees may be exposed.

3. Every employer must, as far as reasonably practicable, implement the measures determined necessary in terms of subsection (2) in the order in which the measures are listed in the paragraphs of that subsection.

4. Every employer must -

a. periodically review the hazards identified and risks assessed, including the results of occupational hygiene measurements and medical surveillance, to determine whether further elimination, control and minimisation of risk is possible; and

b. consult with the health and safety committee on the review.

5. Every employer must -

a. conduct an investigation into every -

i. accident that must be reported in terms of this Act;

ii. serious illness; and

iii. health-threatening occurrence;

b. consult the health and safety committee on investigations in terms of this section;

c. conduct an investigation in co-operation with the health and safety representative responsible for the working place in which the investigation takes place; and

d. on completion of each investigation, prepare a report that -

i. whenever possible, identifies the causes and the underlying causes of the accident, serious illness or health threatening occurrence;

ii. identifies any unsafe conditions, acts, or procedures that contributed in any manner to the accident, serious illness or health-threatening occurrence; and

iii. makes a recommendations to prevent a similar accident, serious illness or health-threatening occurrence; and

e. deliver a copy of the report referred to in paragraph (d) to the health and safety committee. If there is no health and safety committee the employer must deliver a copy of the report to the health and safety representative responsible for the work ing place.

6. An investigation referred to in subsection (5) may be held jointly with an investigation conducted by an inspector in terms of section 60.

7. If there is no health and safety committee at a mine, the consultations required in this section must be held with -

a. the health and safety representatives; or

b. if there is no health and safety representative at the mine, with the employees."

- **The appointment of appropriate, competent and trained supervisors.** The MHSA requires certain compulsory appointments, and provides for certain discretionary appointments. With specific reference to the ventilation requirements, the appointment in terms of section 7(4) of the MHSA, would be a discretionary appointment..

- Any person appointed in terms of section 7(4) must be competent.

Section 7(4) provides:

- A manager may appoint any person with qualifications as may be prescribed to perform any function of the manager in terms of this Act."

Training and education. This is regulated by section 1 0, which provides:

"10(1) As far as reasonably practicable, every employer must -

a. provide employees with any information, instruction, training or supervision that is necessary to enable them to perform their work safely and without risk to health; and

b. ensure that every employee becomes familiar with work-related hazards and risks and the measures that must be taken to eliminate, control and minimise those hazards and risks.

2. As far as reasonably practicable, every employer must ensure that every employee is properly trained -

a. to deal with every risk to the employee's health or safety that -

i. is associated with any work that the employee has to perform; and

ii. has been recorded in terms of section 1 1;

b. in the measures necessary to eliminate, control and minimise those risks to health or safety;

c. in the procedures to be followed to perform that employee's work; and

d. in relevant emergency procedures.

3. In respect of every employee, the provisions of subsection (2) must be complied with -

a. before employee first starts work;

b. at intervals determined by the employer after consulting the health and safety committee;

c. before significant changes are introduced to procedures, mining and ventilation layouts, mining methods, plant or equipment and material; and

d. before significant changes are made to the nature of that employee's occupation or work."

- Appropriate training, communication and information sharing can only take place provided that relevant information is communicated to the persons, for

example human resources development / training and development centre. relating to aspects which arise in the workplace, and in this context, which arise as a result of ventilation practices, procedures and requirements. In a number of inquiries, where ventilation was an issue, it became apparent that there was a misunderstanding between the ventilation department, and the production personnel on the interpretation of Codes of Practice, Standard Instructions etc, as they applied in the workplace. This miscommunication generally started in the training centre or during the training process, where inadequate information was communicated. This misunderstanding is reproduced in the workplace, and where on the job training is relied upon, the misunderstandings are simply communicated to the trainees.

- **Systems.** The mine is required to design, implement, and maintain various systems including Codes of Practice, Standard Instructions, Planned Task Observations, training manuals etc.
- With regard to the ventilation function, it is essential to ensure that the various standards, Codes of Practice etc, are drafted in such a manner that they apply in the workplace, and can be communicated in a form that is understood by all relevant persons. The failure to do this, has in the past, led, to fatal accidents (will be discussed further below).
- **Enforcement.** In order to ensure that the requirements are complied with, there must be enforcement mechanisms in place. The enforcement mechanisms could include overinspection, audits, reviews, counselling, and discipline, where appropriate. The ventilation department should play a crucial role in the enforcement process.
  - In the event that the ventilation officer / functionary carries an appointment in terms of section 7(4) of the MHSA, such person will have a direct responsibility to assist the Manager, and ultimately the employer, in achieving compliance with these requirements.

In addition to these primary responsibilities, there are also secondary responsibilities which are contained in the Regulations.

The Regulations, add content to the general obligation on the employer, to provide a healthy and safe environment. The Regulations therefore deal with all aspects, including not allowing workmen to enter into areas where there is dust, or a dangerous accumulation of noxious gases. Ventilation plays a key role, in compliance with these requirements.

Practical compliance

In a recent accident, the circumstances were as follows:

- A Code of Practice, with various subsections had been drafted for the ventilation, surveying, and stripping of a boxhole on reef;
- The Code of Practice had been drafted by different functionaries. The ventilation department had input on each of the separate sections of the Code of Practice;
- As a result of the drafting by different functionaries, there were discrepancies in the sections of the Code of Practice relating to:
  - Distance from the face that the compressed air hose had to be;
  - Whether a plastic pipe or hose had to be used;
  - Whether a 25mm compressed air hose constituted ventilation.
- The boxhole had been stripped, before a survey Deg had been installed when the boxhole was on reef;
- The compressed air pipe had a hole, near the entrance to the boxhole, and therefore little or no air was being pumped in the top of the boxhole;
- An employee entered the boxhole in order to measure the boxhole, slipped and fell;
- Subsequent to the accident, it was ascertained that there was a build up of methane in excess Of the permissible quantities, and there was an oxygen deficiency. This may have contributed to the fatality.

The investigation into the accident revealed the following:

- The compartmentalisation of the sections in the Code of Practice resulted in the discrepancies;
- The understanding of the ventilation department, as opposed to the mining department who implemented the Code of Practice was different;
- The ventilation department did not participate in any reviews / audits conducted;
- The ventilation department had not participated in the HIRA in respect of boxholes;
- The requirements of the Code of Practice, with regard to notification between the mining department and the ventilation department for the purpose of compliance with the Regulations, was not strictly complied with.

In another accident, the following circumstances were present:

- Employees of a contractor were called out to lag a tailend pulley in an incline shaft;
- A dust extraction system had been installed, which was interlinked to the conveyor system;
- When the conveyor was not working, the dust extraction system did not work;
- Ventilation was provided through natural movement of air, in circumstances where the dust extraction system was not operational;

- Employees were exposed to fumes from the chemicals being used;
- The employees of the contractor were overcome by the fumes and one employee fell with his face into the water and drowned.

The investigation revealed that the ventilation would, under normal circumstances, be sufficient. However, the exposure to the fumes, together with prolonged previous exposure before carrying out this job, resulted in the employees being overcome by the fumes. This was not taken into account in the HIRA carried out by the particular mine. In addition, the ventilation department had not participated in any HIRA relating to this. The ventilation department was called to the 'nquiry, and the Chief Ventilation Officer was required to explain the circumstances.

Practical compliance guidelines

The following aspects should be taken into account by ventilation departments:

- Ventilation departments should participate, fully, in the drafting, design, and implementation of Codes of Practice addressing ventilation standards;
- The drafting team should be multi-disciplinary i.e. should include operational, technical and ventilation personnel;
- Training and education, in compliance with section 10, should be undertaken with the participation of the ventilation department;
- Hazard identification and risk assessments, as required in terms of section 11, should be undertaken with the participation of the ventilation department;
- The ventilation department should participate in the review, overinspection and auditing of compliance with the Codes of Practice.

Conclusion

The ventilation function flows throughout the compliance requirements. The ventilation department often does not participate in the various processes, and as a result, there are often shortcomings in the standards / Codes of Practice which are drafted, and their enforcement.

Ventilation departments should be encouraged to be participative. Where representatives from the ventilation department carry statutory appointments, in particular, in terms of section 7(4) of the MHSA, they must take into account the specific responsibilities placed on the employer and manager in terms of the MHSA, and assist in compliance.

MSA introduces pioneering gas and flame detection technology

MSA has launched new products that provide innovative options for detecting hazardous atmospheric conditions. The range of advanced MOS semi-conductor, Infrared / Ultraviolet flame and Ultrasonic gas and leak detection systems enhances MSA's range of robust fixed gas detection products. These include the Ultima® MOS-5 Gas Detector, Ultrasonic EX5/IS5 Gas Leak Detectors and the FlameGard®5 series of instruments.

These new detection systems continuously monitor for abnormal situations, such as fire, toxic or combustible gas leaks. Detection of these hazards provides early warnings and the opportunity to prevent the escalation of incidents.

Ultima® MOS-5 Gas Detector and the Ultima MOS-5E Gas Transmitter

These highly reliable, self-contained intelligent sensors are micro-processor-based designed to measure and display concentrations of hydrogen sulphide in three ranges: 0-20ppm, 0-50ppm or 0-100ppm.

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The Ultima® MOS-5 and Ultima MOS-5E units allow one-person calibration and virtually self-calibrate through the activation of a magnetic switch and the application of test gas, simplifying operation and maintenance requirements. The MSA units also include warning, alarm and fault relay contacts that provide local alarm capability.

The Ultima® MOS-5 Gas Detector and Ultima MOS-5E Gas Transmitter is SIL2 (Safety Integrity Level) and SIL3 suitable, and meet or exceed various safety standards, including ATEX, CE Marking, CSA and IP 66/67. These features make the units suitable for a wide variety of indoor and outdoor applications including refineries, chemical and petrochemical facilities, mining, and general industry.

The Ultrasonic EX 5 and Ultrasonic IS 5 Gas Leak Detectors

These units detect the airborne ultrasonic noise emitted by gas leaks at high pressure. Using sound makes it possible to detect gas leaks, regardless of weather conditions, at the speed of sound before they turn into explosive gas clouds, thus providing a preventative measure that lasts up to 40% longer than conventional gas and leak detection systems and transmitters. These detectors are SIL3/SIL2 suitable and are ATEX, IECEx, CSA and FM certified.

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Mine Ventilation Services, Inc. Is pleased to announce an alliance with Bluhm Burton Engineering (Pty) Ltd

VnetPC Pro

VUMA

BBE and MVS are pleased to announce an alliance in the field of mine ventilation, heat load examination and refrigeration. This alliance represents a pooling of the expertise of two major mine ventilation engineering firms, in an effort to develop and produce a superior line of mine ventilation and refrigeration software and provide complete mine ventilation engineering services.

MVS is the producer of the widely-used VnetPC software package, which has broad usage in North and South America. MVS has over 27 years in the field of mine ventilation engineering design with project work around the world.

BBE specialises in ventilation and refrigeration consulting and is the producer of the VUMA software package. This compressible flow programme allows users to predict not only ventilation network simulations, but is used for heat load analysis and refrigeration design. It is a widely used programme in Africa and around the world. BBE has a staff of well-recognised mine ventilation engineers, most renowned for their work in consulting and large turn-key mine refrigeration systems. BBE has over 22 years experience in software development and engineering services.

The companies now announce an agreement to make the VnetPC and VUMA software packages compatible and to mutually support development of even further enhanced software. In addition, the companies would have the capabilities to combine engineering services to better support the mining industry.

Further enquiries regarding this announcement can be directed to Keith Wallace at MVS or Steven Bluhm at BBE tel: 011-706-9800.

15800 Roxy 40 units will be deployed at Goldfields Shared Services

After careful studies Goldfields Shared Services (Pty)Ltd on 7/03/2012 issued Letter of Intent to deploy over 15800 SCSR ROXY-40 at Goldfields KDC operations.

The process of coming to this decision took over 6 months and included technical comparisons, human live tests and a revision of production facilities and service support for ROXY-40 in South Africa.

SCSR ROXY-40 was certified in 2010 in SA according to SANS 1737/2008 and introduced to the SA Mining community by Shauenburg Flexadux (exclusive distributor, service and support for Roxy-40) and AME SA (Technical representation office of OEM- DZGA, Ukraine).

“We believe that the synergy between Shauenburg, well known for their excellent service to the mining industry, and the biggest European manufacturer of SCSR sets DZGA Ukraine, represented in SA by our Technical support branch AME SA will create new level of service to the mines,” said Marketing Director of DZGA Mr Yuri Spivak.

“ROXY”-40 stands for “Rescue Oxygen” which is simple but important and vital in emergencies. “40” stands for 40 minutes duration rating of protection - so far the longest protection performance in industry.
The combination of performance, guarantees and a wide ranges of services offered by Schauenburg, ROXY-40 is so far the best value for money.”

Other products such as SCSR Long Duration Units and Oxygen Booster pumps from DZGA have already been widely used by MRS SA and mines since 2003.

“We believe, our widening range of products combined with the great services offered by Shauenburg, will benefit all our customers in Southern Africa”

For more information about DZGA range of product please contact AME SA, Boris Iskra (Pr.Eng) at 0116725581/+0826528113 and Schauenburg Flexadux , Christo Grobler at 0145929069 / 0836661561

What's happening out there?

Preliminary Mine Safety and Health Administration data reveal that 37 miners died in work-related accidents at US mines in 2011. There were 21 coal mining and 16 metal/nonmetal mining fatalities last year. That compares with 48 and 23 fatalities in 2010, making 2011 the year with the second-lowest number of deaths since statistics were first recorded in 1910. Kentucky had the most mining deaths (8), followed by West Virginia (6) and Ohio (3). All but one of those occurred in coal mines. Several of the largest coal-producing states experienced no mine fatalities last year.

MSHA points to a number of measures it says are helping prevent mining deaths. Among these are increased surveillance and enforcement through impact inspections, enhanced "pattern of violations" actions, special initiatives, and outreach efforts. Agency head Joseph A. Main reiterated that mining deaths are preventable. The key, he said, is effective safety and health management programs that are constantly evaluated, plus training and programs to identify and eliminate hazards. *(Sourced from safety.blr.com)*

USA: 29 W.Va. families settle in Upper Big Branch deaths

Extract from USA Today, USA

MORGANTOWN, W.Va. – A mining company has settled wrongful death lawsuits with families of all 29 victims of West Virginia's Upper Big Branch disaster, an attorney for the estates of two miners said Tuesday.

In April 2010, Michelle McKinney talks to the media in Naoma, W.Va. McKinney's father, Benny Willingham, 61, was killed in an explosion at Massey Energy's Upper Big Branch Coal Mine. Virginia-based Alpha Natural Resources did not confirm the agreement or otherwise comment, but attorney Mark Moreland said the final deals were cut Tuesday afternoon after a marathon mediation session. He said Alpha also settled lawsuits by at least seven miners who were injured in the April 2010 blast, the worst U.S. mine disaster in four decades. Although some lawsuits had long since been settled, mediation of the final 13 began last week and continued through Tuesday. Moreland, who represented the estates of miners Ronald Lee Maynor and William Griffith, would not disclose the terms of the agreements, which will still require court approval.

"It's some compensation for a loss that can never be fully compensated," he said. "At this point, we await the action of the U.S. attorney. I think some people behind bars might bring complete closure to the matter."

Just weeks after the blast, Massey offered $3 million to each family, the daughter of one victim told The Associated Press at the time. Some accepted, but most refused, saying the lives of their loved ones had no price tags.

Because the latest settlements are confidential, some relatives on Tuesday told The Associated Press they cannot comment. Alpha spokesman Ted Pile said the company has been in discussions for several days with families and their attorneys to reach a settlement.

"We respect the confidential nature of those discussions and consequently we're not able to comment at this time," Pile said in a statement.

Alpha inherited the mine and the lawsuits when it bought Massey Energy last summer. It has since settled several unrelated lawsuits against other Massey operations. A company spokesman said last month Alpha was eager to shed the legacy problems and move forward.

In December, Alpha reached a $210 million settlement with the U.S. Department of Justice that spares the corporation criminal prosecution. Individuals, however, can still be prosecuted — as many families have publicly demanded.

So far, one person has been held accountable in criminal court: Former security chief Hughie Elbert Stover was convicted in November of lying to investigators and trying to destroy mine records. He is awaiting sentencing. The DOJ settlement included $46.5 million in restitution to the victims' families, guaranteeing them and two survivors of the blast $1.5 million apiece. That $1.5 million will be deducted from the wrongful death settlements.

Separate investigations by the Mine Safety and Health Administration, the United Mine Workers of America and an independent panel appointed by former Gov. Joe Manchin have all agreed on what caused the blast. They determined that Massey allowed highly explosive methane gas and coal dust to accumulate at Upper Big Branch, and that worn and broken cutting equipment created the spark that ignited the fuel. Broken and clogged water sprayers allowed a mere flare-up to turn into an inferno that ripped through miles of underground tunnels and killed men instantly. In its final report, MSHA said the root cause of the explosion was Massey's "systematic, intentional and aggressive efforts" to conceal life-threatening problems. MSHA said mine managers went so far as to maintain two sets of pre-shift inspection books — an accurate one for itself, and a fake one to throw off regulators.

Three killed, two trapped in E China gold mine accident

Extract from Xinhua

Three people have been killed and two others remain trapped after entering a gold mine in east China's Shandong province, local authorities said Thursday. The accident occurred on Wednesday night, when five workers were lowered into a desolate gold mine belonging to the Rushan Jinhua Mining Company in the city of Rushan, according to a statement from the Rushan municipal government. The workers drained water out of the shaft for 10 days before entering it to look into the possibility of discovering more gold there. Three workers were lifted out of the shaft early Thursday morning but died after they were sent to a local hospital.

An initial investigation indicated that all three choked to death. But an autopsy is still needed to determine whether they were poisoned or suffocated from lack of oxygen, sources with the hospital said.

Rescuers are searching for the two workers who remain trapped. An investigation into the accident is under way.

NZ: Pike River probe set to examine blast's cause

Extract from nzherald.co.nz

The Pike River Royal Commission of Inquiry will hear from former mine managers and Australian experts next month, when it finally asks 'what happened?'

Fifteen months after 29 men lost their lives in an underground explosion, the commission has so far spent weeks probing the search and rescue effort and the Pike River Coal Company's set up, and is now ready to look into what caused the fatal blast.

Some evidence has been temporarily suppressed, but early hints have emerged:

- Pike River logs books in the month before the disaster recorded soaring gas levels, and a leaking gas drainage line.
- Miners had been repeatedly caught taking contraband underground, including cigarette lighters, and some gas sensors had been tampered with.
- There were problems with the new underground fan.
- When Mines Rescue reviewed footage of the portal, they noticed a rag used to indicate airflow was behaving oddly in the minutes before the explosion.
- The commission itself has identified hydro mining as a 'prime suspect', although there may not have been an ignition source there. However, it was the gassiest part of the mine and there had been one roof collapse there.

One of the most intriguing pieces of information is a recording between the control room on the surface and the coal face 2.4km underground, in the lead up to the explosion. The water pumps to the coal-cutting machine were turned on only a minute or two before the blast.

Control room operator Dan Duggan initially made contact after turning the water on, when someone replied: "Hello Dan, who you looking for?" followed by an unidentified, muffled noise. All further contact was lost.

Mr Duggan's brother Chris was among the 29 dead.

The commission resumes on February 8 with evidence from Department of Labour services and support general manager Brett Murray, followed by Australian David Reece, who provided the department's investigative team with expert advice on mine design and ventilation.

In week two, another Australian mining expert, Tony Reczek, will discuss electrical issues.

Former Pike River mine manager Doug White and technical services manager Pieter van Rooyan will also appear.

Appearing late last year, expert witness Dr Kathleen Callaghan, from the University of Auckland, when describing the disaster said the cause was probably like Swiss cheese - all the holes lined up on that fateful November day. The hearings are held at the Greymouth District Court and are open to the public.

NZ: Police near decision on Pike charges

Extract from nzherald.co.nz

Police are on the verge of a decision on criminal charges over the Pike River mine disaster.

A royal commission of inquiry into the mine explosions that killed 29 workers resumes next month and police investigators are closing in on a finding that will dictate which people or groups, if any, are prosecuted.

"We should be at a point within the next week or so where we will have a recommendation," officer in charge Detective Superintendent Peter Read told the Herald yesterday.

The Department of Labour has already laid 25 health and safety charges against Pike River Coal, its former chief executive Peter Whittall and VLI Drilling.

The royal commission is required to report its findings no later than March 31. Mr Read said police had been following what came out of the commission hearings, but had largely relied on their own work - producing over 25,000 pages of transcripts from interviews.

"It makes it a little bit harder with the fact you can't actually get into the mine. The opinion the experts are giving us is based on information without a scene examination."

February 2012

Two dead, six injured in explosion at coal mine

Extract from Yonhap News

TAEBAEK, South Korea, Feb. 4 (Yonhap) -- A gas explosion at a coal mine has killed two people and injured six others, police said Saturday.

The blast occurred at around 8 p.m. on Friday when nine miners were working at a site about 970 meters deep or 3,400 meters from the entrance, police officer Chang Jae-koo said.

He said the wounded are being treated for carbon monoxide poisoning at nearby hospitals in Taebaek, some 250 kilometers southeast of Seoul. Two of them were transferred to a special hospital in Seoul for treatment of burns, according to hospital officials.

Chang said police investigators questioned the ninth miner who was not injured and walked out of the mine by himself.

An investigation is under way to determine the exact cause of the accident, Chang added, but they could not access to the site as toxic gas still remains inside the pit.

Taebaek was once the largest mining city in South Korea with 44 mines, though the number has now dwindled to just two, as the country has shifted toward imported oil as an energy source, according to Kim Dae-jin, an official of Taebaek Coal Museum.

China coal mine explosion kills 13

Extract from www.hispantv.com - 05 February:

A methane gas explosion at a coal mine has claimed the lives of 13 workers and injured eight others in China's south western province of Sichuan.

The explosion ripped through the Diaoyutai mine outside Yibin city, situated 1,020 miles (1,641 kilometres) southwest of the Chinese capital Beijing, on Friday afternoon. Thirteen miners were killed and eight others injured as a result of the blast.

The provincial work safety administration said the injured workers are being treated at a local hospital, where four are in a critical condition. The fate of one missing miner remains unknown.

A thorough investigation into the cause of the accident is underway.

China's mining industry is the most dangerous in the world. According to official figures, 2,433 people died in coal mine accidents in China in 2010.

But independent labour groups say the figure could be much higher, as accidents are covered up to prevent mine closures.

The Chinese government has shut down hundreds of mines over the past year as part of its efforts to improve safety standards.

However, mining safety rules are often ignored in favour of profit as the economy has boomed.

S.Africa mines minister targets CEOs on fatalities

Extract from Reuters - 07 February

South Africa's mines minister said on Tuesday that industry chief executives should be held liable for avoidable fatalities, also raising the possibility of court action.

Targeting chief executives would take her safety drive to new levels as the government tries to stem the death toll in the country's mines, the world's deepest and among the most dangerous.

"Fatalities which could have been avoided, we feel that CEOs must be held liable for those accidents, because they are responsible for the operations. As they show interest in how they grow the profits they must also show interest in safety," Susan Shabangu told Reuters in an interview.

Asked if this meant possible court action, she said: "These are some of the issues that we must look at. For me the courts are the last option. But legislation provides for us to go to courts."

Earlier she told the annual African mining conference in Cape Town that the platinum industry's contribution to fatalities in the mining sector remained a "serious concern" and defended safety stoppages which she said had contributed to a drop in accident rates.

South Africa's platinum sector has been battered by oversupply, squeezed margins and an uncertain economic outlook, making producers increasingly vocal about regulatory pressures, particularly the impact of inspections and stoppages as part of the government's zero-harm target.

"The department has been greatly concerned about lack of improvement in compliance and fatalities in the major platinum mines," Shabangu said.

"The platinum sector alone contributes about 30 percent of all fatalities which remains a serious concern."

The gold sector has also been subject to increased scrutiny and Graham Briggs, chief executive of Harmony Gold, South Africa's third largest gold producer, described the government's campaign on Monday as punitive.

Harmony cut its full-year output target by 13 percent because of the stoppages.

Shabangu said that there was a slight drop in mining fatalities to 123 in 2011 from 127 in 2010 and that 13 miners have been killed so far this year in South Africa.

She also said in her speech that the governing African National Congress (ANC) had reinforced in a key policy document that nationalisation, long feared by the country's mining industry, was not a viable option.

"I must indicate that we welcome the fact that the report of the ANC task team on nationalisation has reinforced the ANC's earlier decision that nationalisation is not a viable policy for South Africa," she said.

NZ: Pike River inquiry delivers answers

Extract from nzherald.co.nz - 09 February

The white flash reported by Pike River Mine survivor Daniel Rockhouse as he staggered from the tunnel just after it exploded, helped convince experts the disaster may been caused when gases unleashed by a roof fall met sparking electrical equipment.

The Royal Commission of Inquiry resumed in Greymouth today, and finally delivered some answers about the deadly November 2010 explosion that killed 29 men underground.

The commission is leaning heavily on the Department of Labour's own investigation report, with a panel of five experts, to explain what happened on the afternoon of November 19, 2010.

Australian expert David Reece went through many different scenarios - an auxiliary fan was one possible ignition source, and something could have hit a pipeline.

But Mr Rockhouse, the survivor closest to the seat of the blast, saw a white flash, that indicated an electrical problem. It probably originated in a part of the known as Spaghetti Junction.

Chemical analysis and the size of the blast pointed to a gas - not a coaldust - explosion.

Commission chairman Justice Graham Panckhurst said the preferred expert theory was that a large collapse in the 'goaf', the void left behind by mining, had occurred.

This sent methane rushing through the mine, diluting as it went, until it reached the explosive range.

About the same time, the surface control room operator Daniel Duggan had turned on the water pumps into the mine, although not to the hydro monitor coal-cutting machine at the coalface.

This in turn re-powered the electrical system. The Department of Labour's experts believe this caused the variable speed drive - which had components throughout

the mine and moderated the supply of current - to spark. Problems with variable speed drives have been reported in Australia.

There was also possible arcing.

"Nothing Daniel did was wrong," said Commissioner David Henry.

Mr Duggan's brother Chris, also a coal miner, died in the blast.

The department has written to mining companies and Australian regulators expressing concerns about variable speed drives.

Under cross-examination, the department's lead investigator Brett Murray said they had relied heavily on circumstantial evidence and there were still a number of unknowns because no one had made it back underground to conduct a scene examination.

He told former Pike River Coal chief executive Peter Whittall's lawyer Stacey Shortall that former mine managers Mick Lerch and Kobus Louw had not been interviewed for the report.

The department had been unable to rule out that someone carrying contraband underground had caused the explosion.

Ms Shortall said "one piece of the puzzle" was missing from the report, because the department had not looked at whether its own inspectors made mistakes.

Those inspectors came under fire at the commission last year for failing to spot ongoing safety issues at the mine.

Ms Shortall also said that after the disaster one inspector sat in on up to 18 official interviews with other mine employees.

Some equipment was not inspected until many months after the blast.

Mr Whittall, Valley Longwall Drilling and Pike River Coal Ltd (in receivership) have all been charged by the department in connection with the deaths.

This third phase of the inquiry is scheduled to continue until Friday next week.

Meanwhile, the Royal Commission's request for a six-month extension has been granted.

Its final report will now be made to the Government at the end of September.

The report was due back by the end of this month.

But the commissioners said their timelines and management of evidence and hearings were being complicated by the parallel inquiries being conducted by the police and the Department of Labour.

Pike River body showed no sign of explosive force

Extract from stuff.co.nz

Images of a body inside Pike River coalmine after November 2010's fatal blast have been closely analysed by experts for clues on what happened.

Australian mine safety consultant David Reece has begun his third day today giving evidence at the royal commission into the deaths of 29 men at the underground West Coast mine.

Reece, one of a panel of five experts employed by the Labour Department to investigate what caused the explosion, said the panel closely examined the body's position in scans taken down borehole 47, which was near the hydro-mining area.

It appeared to have collapsed or "relaxed" and showed no sign of a violent force from an explosion, he said.

On Wednesday, he told the inquiry at Greymouth District Court the blast's most likely cause was a roof collapse in the hydro-mining goaf, a void left after coal was extracted, which pushed out a large volume of highly concentrated methane accumulated there.

The gas would then become diluted by air to within the explosive range before being ignited by an electric spark elsewhere in the mine.

He said the ignition was most likely a result of the electric supply being switched on to the mine's underground water pumps, which happened shortly before the explosion.

Pike families lawyer Richard Raymond told the inquiry the department this week had raised its desire to explore "pit bottom and stone" in the mine's tunnel to assess electrical equipment that might have caused the explosion.

That area was about 1900m along the 2.4km tunnel, where blast survivor Daniel Rockhouse was when the mine exploded on November 19, 2010.

Reece agreed it would be beneficial for the department's ongoing investigation to inspect the pit bottom area to check variable speed drives, which powered the mine.

"That is potentially a key point as far as ignition goes."

Pike River Coal Mine

Work was underway to create a remote seal about 2.1km down the tunnel, in front of a rockfall blocking access to the main working part of the mine, which would allow the tunnel to be re-ventilation with air.

It was currently full of methane.

Raymond said the tunnel would be re-ventilated hopefully next month, which would allow department staff to enter.

He questioned whether the department was working on its plan to re-enter the mine to check out electrical equipment.

While Reece was unaware of its planning, he agreed early planning would allow a prompt reconnaissance and avoid further delays.

He also agreed to recommend to the department that drilling a borehole at the front of the hydro-mining goaf would be useful to see if the roof had collapsed there, which might confirm the panel's most likely scenario for the explosion.

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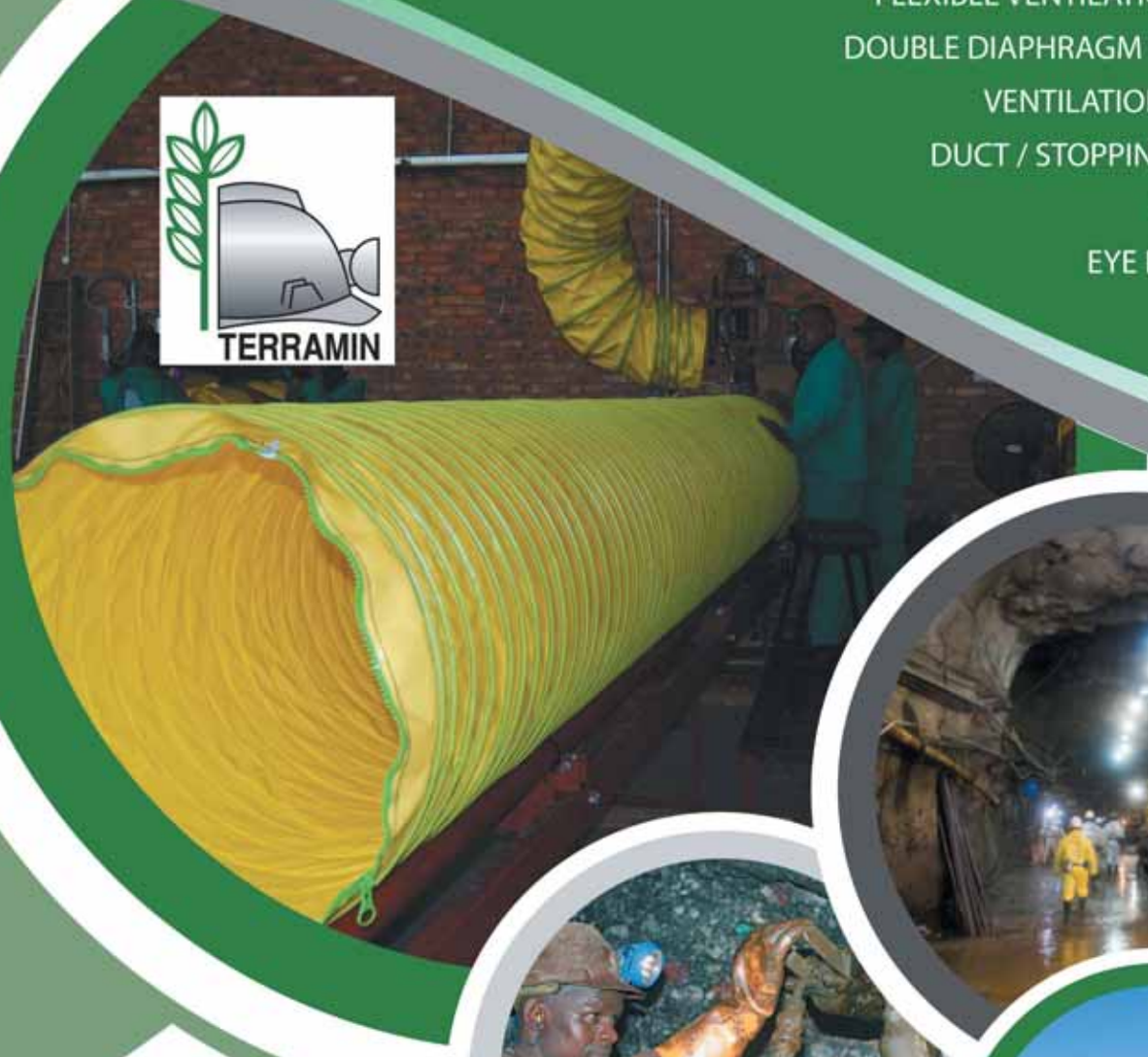

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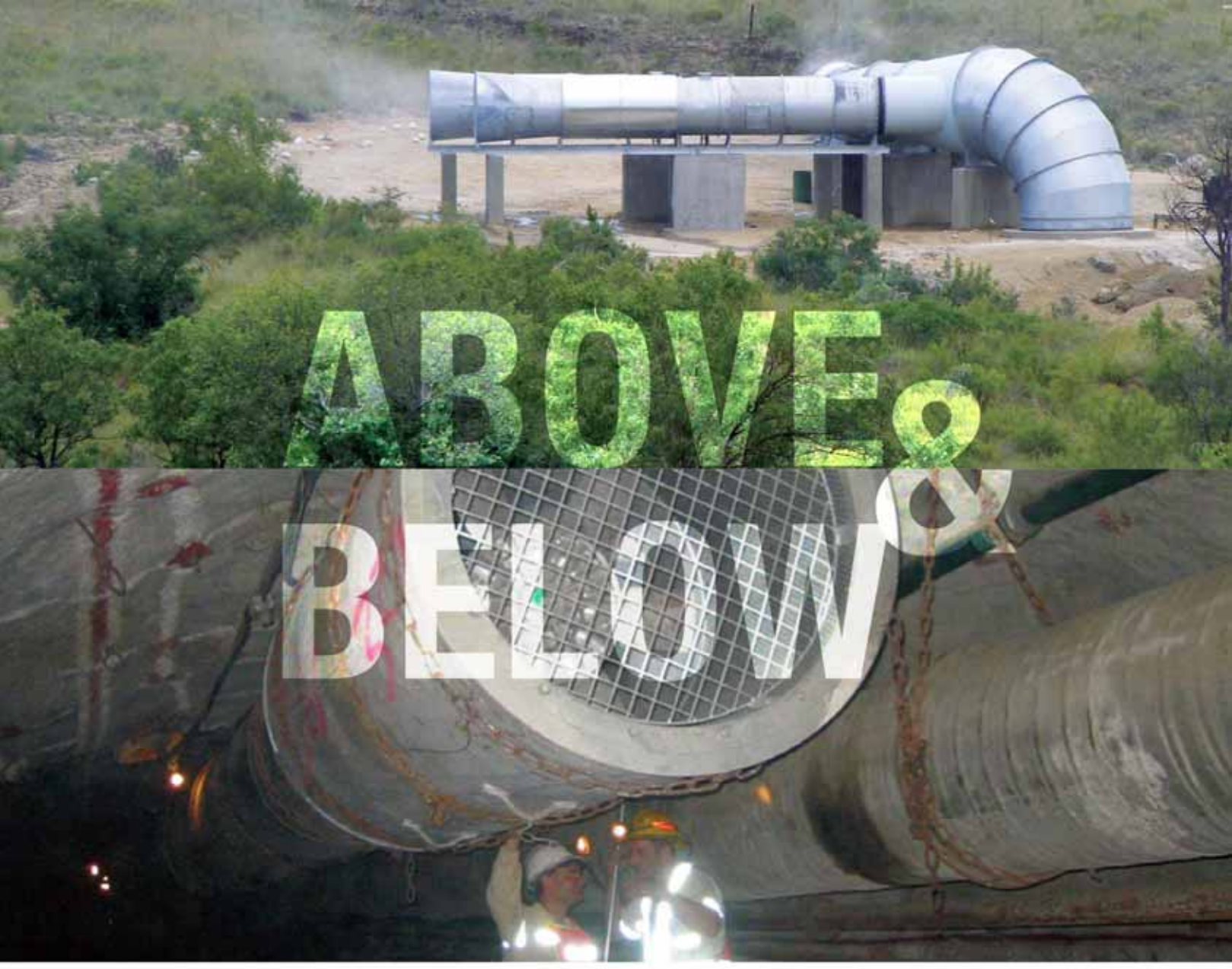

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