Mine Managers Symposium 2008

Hazardous Zone Electrical Equipment – Past, Present & Future

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Context – DPI Corporate Plan

DPI VISION

"Profitable, adaptive and sustainable primary industries building vibrant communities".

Context – Mine Safety Outcomes

Mining industry operates at best practice health, safety and engineering standards

Context – Mine Safety Ops Principles

No increase in risk to the safety of mine workers

Proactive risk management

Get it right at the design stage

Best practice

Hazardous Zone

Defined areas of a mine

Production areas - particularly challenging

Hazardous zone electrical equipment must be Explosion Protected

Hazardous Zone Electrical Key Risk Areas

Explosions

Electrocutions

Unplanned movements

Catastrophic failure of equipment

Fires

Hazardous Zone Electrical Key Risk Controls

Explosion protection

Electrical protection & Earthing

Voltage limits

Gas limits & trips

Special competencies & procedures

TOLERABLE & ALARP?

Hazardous Zone Electrical Key Risk Controls

Changes over the past 25 years

Dealt with known hazards and known controls

Demonstrated continual improvement

Exception – Voltage Limits removed

TOLERABLE & ALARP?

Action by the regulator – Gazette Notice (2008)

Hazardous Zone Electrical Equipment

Verification of Ex Equipment

Verification of Ex Equipment

High risk requires independent credible scrutiny

Approval

A new strategic direction

Provide for a level of risk less than approval

Third part scrutiny essential

Verification - A New Strategic Direction

Support all activities throughout the life cycle.

Support the hierarchy of risk controls

Recognise the harsh mining environment

Be competent

Be credible

Certification schemes could provide this

Certification & Approval - The future

Approvals cull – Initial July 2008 then 2009/2010

2015 – only certified equipment in use

Continuing to participate in Ex scheme MC's

Review & audit of CoC's and ATR's

Supported by a specific mine site program

Inclusion of other types of equipment

Hazardous Zone Electrical Equipment

Repair & Overhaul of Ex Equipment & Cables

Workshop Recognition

Late 1970’ s required to be approved.

1980’s required quality accreditation.

1990’s NATA & JASANZ bodies started accrediting

2002 – 2005 Program to cease approving Ex workshops

2006 legislation required licensing by Dec 2007

2007 scheme of recognition rules published (MP87-2)

The Future – Ex Workshop Recognition

2008 - program of implementing the scheme (MP87-2)

2008 the DPI is commencing to cease Ex licensing

2008 Continue licensing Cable Repair Workshops

2011 all Ex workshops under established schemes

2011+ Cable repair workshops included in established schemes

Hazardous Zone Electrical Equipment

Standards and Competencies

Standards & Competencies

International & Australian Standards:

- Standards of design – Ex techniques and coal mining specific equipment
- Life-cycle site management
- Hazardous area competency requirements

Mine Electrical Engineers Cert of Competency

The Future - Standards & Competencies

Internationalisation

Risk management applied to hazardous areas

Quality requirements for Ex equipment and installations

Equipment protection levels for mining – M_a & M_b

Incorporation of non electrical Ex requirements

Mine Electrical Engineers Cert of Competency

Hazardous Zone Electrical Equipment

Mine Safety Operations – Current Approach

Mine Safety Operations approach

Strategic Plan

Standards & Legislation Program

Industry Infrastructure Support Program

Special Projects

Mine Safety Technology Centre

Communication Program

CONCLUDING REMARKS

Electrical Eng Safety risks to be ALARP

Third party verification at key stages by experts

Standards & Schemes aid duty holders

Changes continuing

Managers of Electrical Engineering have a major role

Voltage limits and establishing ALARP is an issue

CONCLUDING REMARKS

The regulator knows what it wants & how to get it

NO INCREASED RISK TO THE SAFETY OF MINE WORKERS

MINE MANAGERS SYMPOSIUM
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Hazardous Zone Electrical Equipment – Past, Present & Future

J F Waudby, Senior Inspector of Electrical Engineering, Mine Safety Operations, NSW Department of Primary Industries

Information Notes

Slide 1 - OVERVIEW

This presentation looks at hazardous zone electrical equipment.

It looks at the subject in the context of past present and future. As such the future activities will certainly have an impact on your activities.

The mine safety context is first established through the DPI Corporate Plan and some Mine Safety Operations operating principles.

Key risk areas and risk controls are briefly introduced and how changes to the risk controls have occurred with particular emphasis on voltage limits.

Verification of Ex properties is discussed – looking at how we have moved from approval to certification for both equipment and service facilities.

An update on standards and competencies and what we are going to be doing.

I will finish with some concluding remarks.

Slide 2 – CONTEXT – DPI CORPORATE PLAN

DPI VISION

"Profitable, adaptive and sustainable primary industries building vibrant communities".

Mine Safety Operations supports the mining industry, and is willing to assist the industry in anyway it can within the framework of good governance. How does this apply to Mine Safety – we believe safe mines will be profitable mines, safe mines have systems that promote adaptivity, safe mines are sustainable and a safe mining industry is sustainable, however any mine that increases the risk to the safety of mine workers will not be sustainable and will also adversely impact on the industry has a whole.

The DPI Corporate Plan expands the vision in the key result area of - **Safe, healthy and biosecure industries.** "We will support the development of healthy products and safe primary industries by proactively managing risks presented by pests, weeds, diseases, chemicals and natural disasters, and by regulating health and safety in the mining industry".

There are two key points in this statement for mine safety – proactive risk management and regulating health and safety.

Slide 3 – CONTEXT – MINE SAFETY OUTCOMES

Corporate Plan Outcomes for Mine Safety are: "Mining industry operates at best practice health, safety and engineering standards"

What does this mean?

Best practice in:

- Application of OHS legislation,
- Risk management,
- OHS Management Systems,

- Engineering.

It is certainly within Mine Safety Operations ambit to promote best practice and expect best practice, or at the very least authoritative good practice.

Slide 4 – CONTEXT - MINE SAFETY OPERATIONS PRINCIPLES

In implementing the corporate plan, Mine Safety Operations continues to apply well established principles

- No increase in risk to the safety of mine workers
- Proactive risk management
  Get it right at the design stage
- Best practice

Everything I say from now on needs to be placed in this contextual framework.

Slide 5 - HAZARDOUS ZONE

Hazardous zones are defined areas of a mine (defined in the CMHS Reg 2006), or where the gas concentration is 1.25%. Australian Standards and International Standards give guidance on how to classify hazardous areas – it could be argued that the current Standards methodology is risk based as it utilises the likelihood of having an explosive atmosphere – the consequence is inferred as catastrophic.

In mines hazardous zones that are production areas the challenges go beyond explosions. The mining equipment, including the electrical equipment is operating in a harsh environment – wet, dusty, dynamic, physically demanding, people in continuous contact & interaction with the mining environment and the equipment.

There is one given for the electrical equipment. If it is used in a defined hazardous zone it must be explosion protected. Similarly in surface applications, if a location is defined as a hazardous area, it has to be explosion protected suitable for the classification of the area. Typical explosion protection techniques used in mining are Flameproof, Intrinsically Safe, Increased safety, Encapsulated and Special Protection.

"hazardous zone means:
(a) a return airway in a mine, or
(b) that part of an intake airway in a ventilation district in a mine that is on the return side of such points as are:
(i) 100 metres outbye the most inbye completed line of cutthroughs, or
(ii) 100 metres from, and on the intake side of, a longwall or shortwall face, or
(c) a part of a mine in which there is a methane concentration of 1.25 per cent or greater in the general body of air, or
(d) a part of a mine Gazetted as a hazardous zone."

Slide 6 - HAZARDOUS ZONE ELECTRICAL KEY RISK AREAS

1. Explosions, where electrical equipment is an ignition source – we could expect multiple fatalities in a single event

The key risk areas associated with using electrical equipment in hazardous zones are not just associated with explosions, the other key risk areas are:

2. Electrocutions, the electrical equipment is operating in a harsh environment – wet, dusty, dynamic, physically demanding, and people in continuous contact with the electrical equipment – ordinary risk controls found in day to day electrical equipment are insufficient.

3. Unplanned movements take on more significance because of the large powers involved and people in close proximity to the machines used in these areas, remembering that these machines are electrically controlled.
4. Catastrophic failure of electrical equipment takes on more significance because of people constantly in close proximity to the equipment; explosive levels of gas may be relatively close (goafs), and the potential to generate dust clouds and a coal dust explosion.
5. Fires

Slide 7 - HAZARDOUS ZONE ELECTRICAL KEY RISK CONTROLS

Explosion protection, along with special requirements for the harsh mining environment – IP rated, robust, fire resistance, anti-static, user friendly, error tolerant and so on.

Electrical protection and earthing arrangements from the surface power supply all the way to the equipment at the coal face – the electrical energy will, at some point in time, become "out of control", when it does the power supply needs removing ASAP.

Voltage limits for hazardous zone electrical equipment.

Ventilation is obviously the primary control for preventing explosions, but when this fails we aim to detect its total failure and trip off the power, or a partial or localised failure where we detect gas and trip off the power locally.

The electrical equipment is generally specialised, its integration into the mine infrastructure is also highly specialised, as such special competencies are required – The Manager of Electrical Engineering has a pivotal role in all of this. Hazardous area equipment competency for each life-cycle phase is also very important.

Supporting these competencies are special procedures.

Of course they must be supported throughout the life-cycle by OHS Management systems with an expectation of continuous improvement.

These risk controls can not be taken in isolation, in isolation they are insufficient. Hazardous zone electrical installations must be fully integrated with the mine infrastructure, especially the electricity supply arrangements. This is not a simple task – that is why the legislation requires mines to have Managers of Electrical Engineering and review by Qualified Electrical Engineers.

If applied continuously and with certainty, these risk controls can bring the risk level to tolerable and ALARP (note this list is by no means detailed or exhaustive).

How effective?

Explosions gas ignitions:

8 January 1979, West Wallsend

24 July 1979, Appin Colliery - 14 men killed. Fault finding on a flameproof starter panel.

28 June 1995 Endeavour Colliery

12 December 1997 at Munmorah Colliery

In general the NSW industry has done a pretty good job in the area of EES – however these explosions give us a reminder that it can go awfully wrong and we can not afford to take our eye off the ball.

Last electrocution underground over 25 years ago.

We have had two fatalities from unplanned movements in hazardous zones in the 1990's

Catastrophic failures are rare in the hazardous zone.

Fires are rare

Generally the risk controls have been very effective except in the area of unplanned movements. However the explosions give us a reminder that it can go awfully wrong and we can not afford to take our eye off the ball.

Note: Refer to Appendix A for information on risk tolerability and ALARP

Slide 8 - HAZARDOUS ZONE ELECTRICAL KEY RISK CONTROLS

Over the past 25 years there has been an incremental improvement in our understanding of the nature of the risks and an incremental improvement in the application of risk controls for most of the key risk controls. Changes were made because we understood the hazards and how they manifested; we understood and had a great deal of certainty in the risk controls. Any changes were based on good engineering practice and technology was embraced to improve the risk controls.

The exception has been voltage limits, although initial changes were based on the above. Between 1984 – 1999 legislation limited the voltage to 1200 Volts. We understood the risks and we knew what risk controls were required to achieve safety (a tolerable and ALARP risk). In the early 1980's 3300 Volts longwalls were introduced successfully and safely, additional risk controls were introduced (some of them adapted from other industries, some adapted from non-hazardous zone practices). In 1999 legislation changed and hazardous zone voltage limits were raised to reflect what had become industry practice, that is, wide spread use of 3300 Volts on longwalls, this decision reflected over 15 years experience with such equipment in this application. We did not foresee any desire to go above this limit.

The major change in approach to the risk control of voltage limits occurred in 2003, voltage limit removed and arc fault control required this continued in the 2006 legislation, there was an implicit assumption that credible risk management practices and a cooperative approach between industry and Government would ensure any further increase in voltage levels would be demonstrably compliant with legislation and demonstrably NOT INCREASE RISK to the safety of mine workers. In 2007 rumours emerged of the potential use of 11000 Volts on longwalls and the use of 3300 Volts continuous miners. Mine Safety Operations thoughts turned to how it could be demonstrated that the use of 11000 Volts on longwalls and 3300V in continuous miner sections could be tolerable and ALARP, and how we would expect mine operators to fulfil their obligations, especially applying the hierarchy of risk controls. Are thoughts rapidly turned to the nature of the problem. Hazardous zones are by their very nature dynamic and have an element of uncertainty in the risk profile. Where voltage levels are raised beyond our experience level, the uncertainty of risk increases, this is compounded when the increase in voltage levels is made in conjunction with significant changes to other industry standard practices. It became apparent that any decision to increase voltage levels should be preceded by significant R&D. The uncertainty of risk necessitates a precautionary approach by duty holders and an extremely rigorous and transparent decision making process that has a significant component of risk management that compares to authoritative good practice.

Efforts to gain meaningful information on this were unsuccessful. This raised serious concerns with the regulator, when this occurs there is doubt about compliance with legislation and the application of hierarchy of risk controls in a competent and diligent manner as such the regulator takes action – January 2008 the gazette notice was changed to require the CI to be given 12 months notice of any intention to use voltages above set limits – this is certainly consistent with DPI policy. Any notification will be followed by a request for information and if necessary enforcement actions.

Slide 10 - VERIFICATION OF EX EQUIPMENT

The explosion risk is recognised as probably the highest consequence events for underground coal mining. Explosion protected electrical equipment (Ex) is the most critical risk control. We need to have a high degree of confidence in the risk controls. It has long been recognised that the criticality and need for confidence in Ex is such that additional scrutiny is required at key points in the life-cycle, which is design verification and overhaul/repair.

From the early 1970's through to 2006 this additional scrutiny was vested in the approval process and a variety of electrical equipment was required to be approved before use in both underground and open cut coal mines. Approval was given by the Chief Inspector of Coal Mines, based on a test report from a recognised test lab & reviewed by an Inspector of Electrical Engineering. Documents and approval number issued, approval had an infinite life unless revoked for safety reasons. Database of approvals kept - approvals from the early 1970's still exist. Approval was given to use the equipment – this inferred that it was fit for purpose and that "pit worthiness" - that is suitability to be used in the harsh underground coal mining environment, issues were considered in the approval. Approval conditions were often used to fill in regulatory holes, ensure there was a proper information flow, cater for the non-compliance to standards, and as time went on, conditions of approval were often used to embrace contemporary OH&S Management – operational risk assessments, life-cycle (overhaul & repair). The scrutiny was independent and credible.

Government rationalisation along with a desire to adopt a more progressive and sustainable approach to mine safety and increased demand for approval placed the Approval scheme under stress. Private organisations and an Australian test house were appointed to approve on behalf of the Chief Inspector, these were known as Accredited Assessing Authorities (AAA's). Competency criteria were established, the approval process was modified to provide a quality type audit of AAA's, which was conducted initially annually and later somewhat ad-hoc and ad-hoc review of AAA work was conducted. The role of the regulator became a quality auditor, database manager with some ad-hoc technical review.

By 1998 the approval scheme had deteriorated – a combination of reduction in technical resources & government department restructuring influenced re-directing technical resources away from monitoring the approval scheme. Reviews and audits had become low priority and somewhat ad-hoc.

A combination of a "stressed" approval scheme and other matters lead to equipment being approved that was not explosion protected. The problem was identified by an Australian test house. On Xmas eve 1998 the regulator took action to have this non Ex equipment withdrawn from service immediately – it impacted on the majority of underground coal mines.

In early 1999 we realised that if we wanted to remain as a credible approver we needed to measure up to organisations like NATA or JAS-ANZ. A strategic decision was made to cease approving electrical equipment (especially Ex equipment) in a managed manner. The new strategic direction would need to provide for NO INCREASE IN RISK, and give a high level of confidence; as such third party scrutiny of Ex design was critical.

Slide 11 - VERIFICATION - A NEW STRATEGIC DIRECTION

The additional scrutiny must:

- Be applied at the proper points of the equipment life cycle,
- support all activities throughout the life cycle, including the end-users activities and management systems,
- support the hierarchy of risk controls (*eliminate the hazard, substitute for a lesser hazard, isolate the hazard from the person, engineering controls administrative procedures & PPE*),

- support the hazard reduction precedence *(Design out the hazard, Safety devices that fail to safety, Warning devices, Special procedures and training,)*
- recognise the harsh mining environment,
- be competent,
- be credible. By credible I mean that end users must have confidence that the testing, assessment and certification has been done:
    - to a set standard,
    - in a consistent and repeatable manner,
    - by competent people,
    - using proper procedures,
    - using fit for purpose equipment,
    - in a managed work environment suitable for detailed technical evaluation,
    - in a work environment where cost does not overly influence the testing approach,
    - reporting and review

Certification schemes could provide all this with respect to Ex properties, well established risk assessment would take care of fit for purpose issues. We started to actively participate in the management of the AUS Ex / ANZ Ex schemes and in the development of the emerging IEC Ex scheme, both of which were type 5 certification scheme (includes assessment of manufacturing – quality aspect).

From 1999 when the coal mining regulations changed, up to the current time we have ceased approvals and require certification of Ex equipment, this was done in a planned and consultative manner.

The gazette notice is the legal instrument for specifying certification and the conditions are designed to "fill in the gaps" that the certification schemes don't adequately provide for. A typical example is the provision of information to end users and the ability to relate CoC's to equipment. IEC 60079.0: 2005 now sets a standard that is suitable, however CoC's can be issued to the previous version of the standard – there is a gap. Also, CB review of this information is the subject to development of an IEC Ex Operational Document (OD) – there is a gap. Also the gazette notice allowed the continued use of previously approved equipment.

A guiding principle is not to disrupt or disadvantage the industry by our actions in the transition to certification.

Slide 12 - CERTIFICATION AND APPROVAL – THE FUTURE

We have completed a survey of approved Ex equipment in use in NSW mines. Approximately 67% of the approved equipment on our database is not in use. These will be removed from the approvals database, and it will be illegal to then use this equipment in a NSW hazardous zone. A modified database is on our website for your use, it would be prudent for mines to review their approved equipment against the modified database, if you have something in use in a hazardous zone and it is not on the modified database let us know and we will re-instate it. We have recently received a very late submission which required us re-instating 14 items of approved equipment onto the database. Most mines have responded, however some mines have either not responded or responded in a format that makes it unacceptably difficult for us to use the information.

After this cull, we will then consider our next steps, typical actions may be:

- is it approved and is it certified? If yes, remove the approval from the database and rely on the certification,
- is it only approved? If yes, modify conditions in the gazette to require QAR's as per a type 5 certification scheme for newly manufactured equipment,
- let natural attrition take its course.

We have a target of 2015 for only certified equipment to be in use in NSW coal mine hazardous zones.

We will continue to participate in ANZ Ex scheme and IEC Ex scheme through Australian National Committees.

We are, continuing to review CoC's and test reports (ATR's) through the requirements that gas detectors still have to be registered (DPI does the performance testing) with Ex properties established by a CoC, ATR's and CoC have to be submitted as part of the registration process, we review these.

We are planned random audits of ATR's and CoC's from ALL types of certification bodies.

All of this is to be supported by a mine site program where we audit how mines life-cycle manage Ex equipment – verification dossiers / safety files are an important component.

Longer term, expect to see gas detecting (both flammable and toxic) and non-electrical equipment included within certification schemes.

Slide 14 - RECOGNITION OF WORKSHOPS

The equipment has had a hard life at the mine. At some stage the equipment needs overhaul and repair. This is the opportunity to ensure the equipment is in its approved / certified condition – it has some analogy with manufacture, as such it is a critical point for extensive independent scrutiny.

I the late 1970's workshops (Ex repair and cable repair) were required to be approved. As part of the approval a competent persons (Ex repair and cable repair) program was conducted by the regulator. Mid – Late 1980's approved workshops required quality accreditation; NSW was the sole Australian Regulator approving workshops, Non mining industry requesting approval

1990's NATA & JASANZ bodies started accrediting Ex workshops

2002 DPI commenced a program to stop approving Ex workshops and accept national recognition. The DPI continues to approve Cable Repair Workshops.

2004 Ex workshops accredited by NATA & JASANZ bodies deemed to be approved.

2005 DPI ceased approving Ex workshops and all previously approved workshops had national recognition.

The competent person program for Ex repairs was ceased in 2005 when we ceased approving Ex workshops, it was ceased because national competencies had been established and organisations that recognise workshops had a key component of establishing competency. We also commenced work on establishing common rules and procedures for national recognition – so that uniformity of recognition is achieved in a consistent manner.

2006 DPI maintained approval of cable repair workshops and the cable repair competent person program.

2006 legislation required licensing by Dec 2007; the DPI is now licensing Cable Repair & Ex workshops – almost like approving again.

2007 scheme of recognition rules and procedures published (MP87-2)

Slide 15 - THE FUTURE – EX WORKSHOP RECOGNITION

2007 IEC Ex scheme of Ex workshop recognition commences – DPI is monitoring its progress.

2008 a program of implementing the scheme of recognition (MP87-2) commences.

2008 the DPI is commencing a program to effectively cease licensing Ex workshops.

2008 the DPI is continuing to license Cable Repair Workshops. To complement this licensing, a competency assessment process has been established for cable repairers and the DPI issues a Cable Repairer Signatory Certificate.

2011 all Ex workshops to be accredited under the MP87-2 scheme or the IEC Ex scheme if it is deemed suitable.

2011+ Recognition of Cable Repair Workshops is done under the established National and International schemes and the DPI ceases licensing.

Details of licensed workshops are on our website.

Slide 17 - STANDARDS AND COMPETENCIES

Underpinning approvals and certification were standards and competencies.

Throughout the 1980's & 1990's to the current time significant effort has been put into developing Australian Standards initially, and now International Standards for Ex equipment and coal mining specific equipment. (We are also actively engaged in the area of more general electrical standards that can be used for mining applications – Functional safety, Wiring of Machines, AS/NZS3000 etc.).

International & Australian Standards provide for:

- Standards of design – Ex techniques and coal mining specific equipment - IEC 60079 series, AS/NZS4871, 1299, 1300, 2081
- Selection, installation, commission, inspect maintenance & overhaul standards - IEC 60079 series, AS/NZS3800, 2381
- Hazardous area competency requirements AS/NZS 4761 – an IEC Ex personnel certification scheme is being developed

At the same time, the importance of the mine electrical engineer has not been lost and plenty of work has gone into the development of competency requirements and examinations. This role has transformed into the Manager of Electrical Engineering, this is a key role at a mine in coordinating electrical engineering safety, throughout the life-cycle of the electrical equipment, infrastructure and the mine.

Slide 18 - THE FUTURE - STANDARDS AND COMPETENCIES

Internationalisation & continuing review of current standards.

Standards Australia is developing a new business plan, which is due to be rolled out in October 2008 – this could have a major impact on the DPI and the industry in general from a strategic perspective – if coal mining standards are no longer supported or developed by Standards Australia who will do it?

Development of risk management applied to hazardous areas – expect to see a closer alignment with Functional Safety (especially wrt machinery and safety instrumented systems).

Development of quality requirements for Ex equipment and installations.

Equipment protection levels for mining equipment.

"EPL Ma - Equipment for installation in a coal mine, having a "very high" level of protection, which has sufficient security that it is unlikely to become an ignition source, even when left energized in the presence of an outbreak of gas. Typically communications circuits and gas detection equipment will be constructed to meet the Ma requirements, for example an Ex ia telephone circuit".

“EPL Mb - Equipment for installation in a coal mine, having a "high" level of protection, which has sufficient security that it is unlikely to become a source of ignition in the time span between there being an outbreak of gas and the equipment being de-energized. Typically all the coal winning equipment will be constructed to meet the Mb requirements, for example Ex d motors and switchgear”.

Incorporation of non electrical Ex requirements.

Mine Electrical Engineers Cert of Competency – Engineering practice reports, national registers?

Slide 20 - MINE SAFETY OPERATIONS APPROACH

Our life's experience with Ex equipment has not occurred in isolation. A multitude of changes have occurred that have, and are continuing to influence what and how we need to manage the risks from hazardous zone electrical equipment. The equipment approval scheme and workshop approval scheme and competency assessment evolved in response to changing demands on Government. Legislation changed and embraced contemporary OH&S Management and industry has implemented this approach – with risk assessment at the core. National and international certification schemes for equipment and workshops started to take on a greater significance. A sound enforcement policy and appropriate regulatory powers to intervene where risks may increase have been put in place.

What we do as Mine Safety Operations in the area of Electrical engineering safety is reflected in:

A Strategic Plan – based on a risk assessment

Standards, Guidelines and Legislation Program
- **Ex life-cycle and competency standards**
- **Ex techniques, coal mining specific equipment**
- **Electrical Engineering Management Plans (Legislation)**

Industry Infrastructure Support Program
- **Ex certification schemes – equipment and workshops**
- **Ex competency schemes**
- **Mine EE competency**

Special Projects Program
- High Risk plant
  - **Management of Ex at mines**
  - Mine winders
  - Remote controlled equipment
- Electrical installations at small quarries and opal mines

Mine Safety Technology Centre
- **IS testing capabilities**
- **Gas performance testing**
- Breathing apparatus testing
- Static electricity assessment capabilities

Communication Program

Slide 21 – CONCLUDING REMARKS

Risks from electrical equipment in hazardous zones are high, managing those risks to a tolerable and ALARP level requires multiple, sophisticated controls and a high degree of confidence in those controls especially explosion protection which is a critical risk control.

The use of voltages above current industry practice is a significant issue – risk profiles have high uncertainty, significant changes in the risk profiles can occur, hazards from new sources and non-electrical matters all have an impact. Determining ALARP requires authoritative good practice risk management, significant R&D, application of engineering good practice, system integration and a diligent fulfilment of legislative obligations. If voltage limits are to be increased, there is an expectation that duty holders can demonstrate:

- No increase in risk
- Tolerable and ALARP risk
- Compliance with legislation

Third party verification at the design & overhaul / repair phase is critical to give a high degree of confidence in the Ex as a risk control. Third party verification is moving from the regulator to expert organisations both on a national level and an international level. This has assisted us in doing things differently, releasing resources for mine site activities, whilst not increasing the level of risk to the safety of mine workers. If we didn't have these schemes – mine operators and the regulator would need to do the equivalent. Mine Operators & regulators can be very confident that certified Ex equipment is Ex when it arrives at the installation site and that proper life-cycle information accompanies the equipment.

Ex standards & schemes can aid:

- Establishing the right risk control and having confidence in it.
- Life cycle management of Ex equipment – including information transfer.
- Competency requirements.
- The regulator's aims for electrical engineering safety.
- A mine operator's fulfilment of OH&S obligations.
- An equipment supplier's fulfilment of OH&S obligations.

There is significant infrastructure out there to support the application of contemporary OHS management and good engineering practice – it provides for the application of the hierarchy of risk controls & hazard reduction precedence – get it right at the design stage with a high degree of confidence. Applying each element of the Nertney Wheel – FFP equipment, competent people, and proper processes within a managed framework.

From a strategic perspective, the industry should be active in standards development and scheme management.

Changes are continuing in certification schemes, standards development and competency development, these changes will present opportunities to integrate contemporary risk management and good engineering practice to deliver safer work places with a high degree of confidence.

Managers of Electrical Engineering have a pivotal role in integrating hazardous zone electrical equipment into the whole mine, and coal winning process.

Slide 22 – CONCLUDING REMARKS

As a regulator we are involved in these activities, and they are central to our achieving our goals of zero death and injuries from electrically powered and controlled equipment, we know what we want and we have a plan to achieve it.

NO INCREASE IN RISK TO SAFETY OF MINE WORKERS

Appendix A

ALARP & TOLERABILITY

Introduction:

In reality there is no zero risk for the hazards found in mining. Although legislation puts an absolute duty of care on the duty holders. A duty holder needs to be able to establish that the risks to the safety of mine workers are ALARP (As low as reasonably practicable).
The challenge to both duty holders and Mine Safety Operations is to determine if day to day risks are ALARP and at the same time reduce the risk and move it towards the broadly acceptable region. Of course, this effort to continually drive the risk towards the broadly acceptable region is analogous to continual improvement, fortunately the very nature of mining (mining is dynamic in that production areas regularly move to new areas and the need to regularly thoroughly overhaul plant) gives plenty of opportunities to improve. The opportunities to improve encompass the application of new technology, improved safety management practices and recognising that our knowledge of hazards and understanding of risk increases with time.

Assumptions: Duty holders have in place a functioning Occupational Health and Safety Management System.

Intolerable risk is basically the risk we won't accept if risk controls can not bring it into the ALARP region. This results in the practice or process being prohibited.

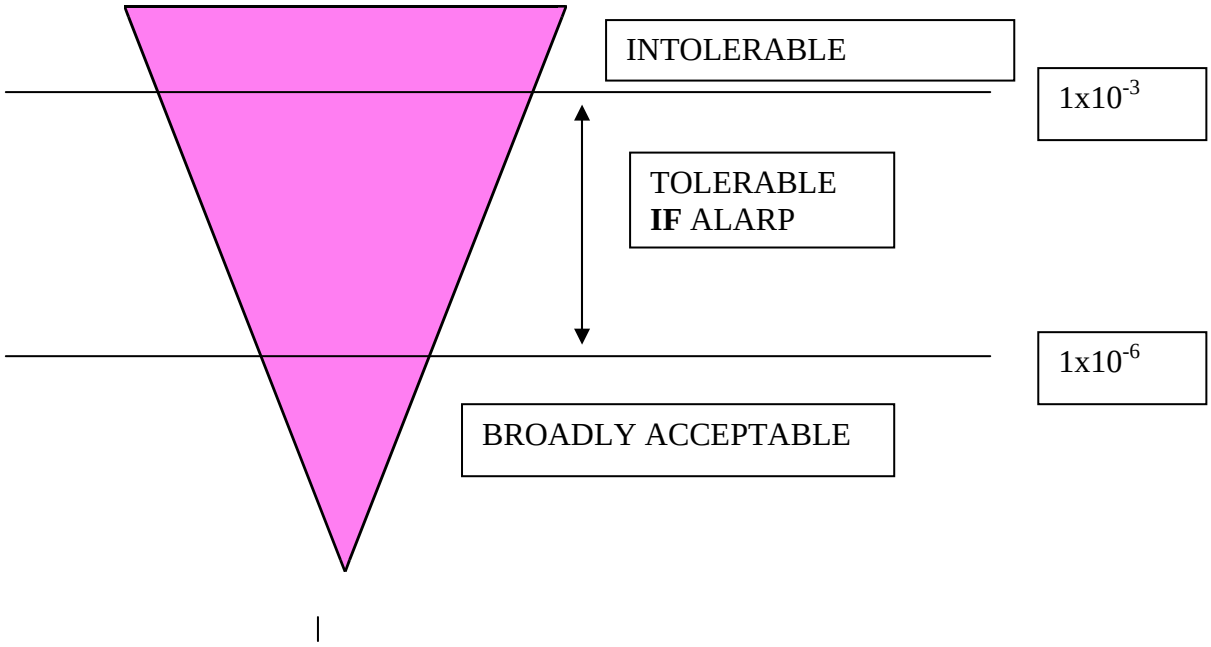
Tolerable does not mean 'acceptable'. It refers instead to a willingness by society as a whole to live with a risk so as to secure certain benefits in the confidence that the risk is one that is worth taking and that it is being properly controlled. However, it does not imply that the risk will be acceptable to everyone, i.e. that everyone would agree without reservation to take the risk or have it imposed on them.[1]

Broadly acceptable.

Risks falling into this region are generally regarded as insignificant and adequately controlled. We, as regulators, would not usually require further action to reduce risks unless reasonably practicable measures are available. The levels of risk characterising this region are comparable to those that people regard as insignificant or trivial in their daily lives. They are typical of the risk from activities that are inherently not very hazardous or from hazardous activities that can be, and are, readily controlled to produce very low risks. Nonetheless, we would take into account that duty holders must reduce risks wherever it is reasonably practicable to do so or where the law so requires it.[2]
The Health and Safety Executive has published boundaries of tolerability for individual risk as shown below[3]
Intolerable risk is defined as greater than $1x10^{-3}$ for a worker, $1x10^{-4}$ for the public. Broadly acceptable are less than $1x10^{-6}$ for workers and the public.[4].
Risk levels in between the intolerable and broadly acceptable are TOLERABLE **IF** ALARP.

[1] HSE, UK. "Reducing Risk, protecting people HSE's decision-making process", p3
[2] HSE, UK. "Reducing Risk, protecting people HSE's decision-making process", p43
[3] HSE, UK. "Reducing Risk, protecting people HSE's decision-making process", p42
[4] HSE, UK. "Guidance on "as low as reasonably practicable' (ALARP) decisions in control of major hazards (COMAH), p5.

ALARP risk:[5]



The risk of death to an individual mine worker:
The probability of being fatally injured in the NSW coal mining industry (based on figures from 1993 to 2007 is approximately $160x10^{-6}$. Although if one takes the past five years this figures drops to $70x10^{-6}$ At this particular point in time the risk of death to a mine worker is within the TOLERABLE IF ALARP region. But is it ALARP? And if so how do we determine it is ALARP?

[5] HSE, UK. "Guidance on "as low as reasonably practicable' (ALARP) decisions in control of major hazards (COMAH), p5.