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Subject: Ampcontrol submission - Independent review of NSW WHS (MPS) Laws
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Ampcontrol Submission – Independent review of NSW WHS (MPS) Laws

23rd March 2020

The following Regulatory Reform Notes are submitted for consideration under the Statutory Review of WHS (MPS) Laws. The notes are submitted by the Ampcontrol group of companies as an Australian manufacturer of underground electrical equipment.

Due to a number of immediate operating pressures, our staff are unable to attend the scheduled video conferences for public consultation and feedback. Please confirm via return email that this written submission will be provided to the Independent Reviewer for consideration.

If you require additional information or clarification, please contact either:

- Tim Wylie (Chief Technology Officer) [redacted] or
- Ian Webster (Group Engineering Manager) [redacted]

Regards,
Ampcontrol

Regulatory Reform Notes

WHS(M&P)R:2014 Clause 3, 78, 79 and multiple related: Hazardous zone assignment

WHS (MPS) Regulations do not support the concept of zoning as per Australian and International Standards to characterise explosion risk in an underground coal mine. Standards adopt a risk based approach to hazardous area (zone) assignment, whereas WHS (MPS) Regulations prescribe a hazardous area (zone).

WHS(M&P)R:2014 clause 3: hazardous zone, at an underground coal mine, means each of the following—

(a) any part at the mine in which the concentration of methane in the general body of the air is 1.25% by volume or greater,

(b) a return airway,

(c) any part of an intake airway that is on the return side of such points that are within 100 metres outbye of—

(i) the most inbye completed line of cut-throughs, or

(ii) any longwall or shortwall face, but only to the extent that the intake airway is on the intake side of that face (but not if the longwall face is an

installation face at which the development of the face, and mining for development coal, have been completed and at which longwall mining has yet to commence).

Best practice considers a hazardous area (on account of an explosive atmosphere) as a combination of flammable substances in the form of gas, vapour, dust and fibres. Combustible flyings, and gas make (not just CH_4) are essential considerations in assignment of hazardous areas or zones, whereas the Regulation simply considers the concentration of methane or a mine precinct. Perhaps more importantly, best practice assigns zones based on the frequency of occurrence and duration of a hazardous atmosphere. These concepts (frequency of occurrence and duration) are absent in WHS (MPS) Regulations.

AS/NZS 60079.10.1:2009 Classification of Areas - Explosive Gas Atmospheres

3.6 Zone 0: an area in which an explosive gas atmosphere is present continuously or for long periods or frequently.

3.7 Zone 1: an area in which an explosive gas atmosphere is likely to occur in normal operation occasionally.

3.8 Zone 2: an area in which an explosive gas atmosphere is not likely to occur in normal operation, but if it does occur, it will exist for a short period only.

AS/NZS60079 Series of Standards and the assignment of equipment protection levels are fundamentally based on the concept of zones. While the WHS (MPS) Regulations attempt to (generally) follow the intent of AS/NZS60079 Series, because the definition of a hazardous area is inconsistent with the Standards, there are multiple ambiguities and interpretation difficulties (particularly in edge cases or unusual circumstances) with the WHS (MPS) Regulations.

As an example:

WHS(M&P)R:2014 clause 78 describes the requirements for equipment that is (either continuously or transiently) exposed to a hazardous area. The required protection does not include Exd (general flameproof equipment) or IP rated equipment.

- Exd equipment in Zone 1 transiently exposed to > 1.25% CH_4 continues to operate until the exceedance is detected and power removed. This is likely to occur in normal operation.
- IP rated equipment in Zone 2 transiently exposed to > 1.25% CH_4 continues to operate until the exceedance is detected and power removed. While unlikely to occur in normal operation, there are exceptional circumstances where this event is possible.

Both of these equipment types are common in underground NSW mines, and transient events are known to occur. During the period of detection these applications are not compliant to WHS(M&P)R:2014 clause 78.

The majority of most underground Australian coal mines are typically assessed as Zone 2. The probability of encountering CH_4 > 1.25% transiently is considered rare,

or more to the point, so low that Ex protection is not required and IP rated equipment may be used. *It would be unsafe to remove power with IP rated equipment that was operating transiently in a gas make at the lower explosive limit.* If this risk is material, the equipment would need to be Ex protected. Either way, transient events and gas exceedances in all zones are acknowledged and possible. As a consequence, non-compliance to WHS(M&P)R:2014 clause 78 is acknowledged and possible.

While the above example may appear trivial, its implications are significant. It is not acceptable to know of a reasonably foreseeable event or circumstance where equipment will be non-compliant with mandatory WHS (MPS) Regulations. Both Exd and IP rated equipment are common in NSW mines, whereas a strict interpretation of Regulations would call use of this equipment into question.

Reform Submission:

Hazardous area classification in WHS (MPS) Regulations is inconsistent with a risk based approach, and does not follow best practice as defined in Australian and International Standards (AS/NZS 60079.10.1:2009 and IEC60079.10.1:2008 Hazardous Area Classification). Difficulties in compliance and interpretation are avoided if WHS (MPS) Regulations are re-written to acknowledge (verbatim) or follow best practice as defined in AS/NZS 60079.10.1:2009 with regard to hazardous area classifications.

WHS(M&P)R:2014 clause 78: Explosion Protection Levels

Many of the Australian & New Zealand Standards (AS/NZS) with regard to explosion protection are based on direct text adoptions of International (IEC) standards. Standards continuously evolve and are deliberately modified to reflect national and (in the case of explosion protection) international best practice, with new revisions regularly released. Australian Standards have included the concept of Explosion Protection Levels (EPLs) since 2009 for hazardous area classification and equipment selection, installation, maintenance and inspection. An EPL requirement is assigned to each hazardous area zone based upon a detailed risk assessment.

The EPL approach breaks the rigid link between zone and explosion protection technique, in acknowledgment that there are alternate solutions that afford the necessary safety and explosion protection for many applications. For example, when using EPLs applications may be able to use Ex n equipment (historically restricted to Zone 2) in areas classified as Zone 1. Similarly, a combination (or layering) of traditional Ex protection techniques when assessed under EPLs can allow a technique traditionally restricted to Zone 1 as suitable and safe for Zone 0 deployment.

WHS (MPS) Regulations presently prohibit application of EPLs as per Australian and International Standards. WHS(M&P)R:2014 clause 78(2) defines the requirements for explosion protection level of electrical equipment for use in a hazardous area. The acceptable techniques do not include EPL Ma (Note: Ex ma is protection by encapsulation, and is distinct from EPL Ma per AS/NZS60079.0:2019). By comparison WHS(M&P)R:2014 clause 78(3) defines the requirements for explosion protection level

of electrical equipment for use where the concentration of methane is less than 1.25%. In this case, EPL Mb is acceptable.

The WHS (MPS) Regulations require development of site specific Principal Hazard Management Plans for fire, explosion and gas outburst, as well as development of Principal Control Plans for Electrical Engineering and Ventilation. PHMPs and PCPs are site specific and risk based. The EPL concept is completely consistent with the existing principles and requirements of the WHS (MPS) Regulations. In addition, WHS (MPS) Regulations include the assignment of competent persons (via formal assessment and issue of practicing certificates) to key statutory roles including the Electrical Engineering Manager and Ventilation Officer. These individuals are assessed (by the Regulator) as competent to assess the risks, write and implement many aspects of the Principle Control Plans but these individuals are prevented from utilising EPLs as per best practice described in both Australian and International explosion protection Standards.

Reform Submission:

WHS (MPS) Regulations remove prescription with regard to explosion protection level and explosion protection technique as a function of methane concentration alone, and adopt (verbatim) best practice as per Australian Standards AS/NZS60079 Series with regard to equipment protection levels and explosion protection techniques.

WHS(M&P)R:2014 clause 32: Electrical safety - Implications for Practicing Certificates and the M&P Competence Board

WHS(M&P)R:2014 clause 32 requires an operating site to manage the risks associated with the use of electricity. Clause 32(l) also mandates a particular earthing arrangement (utilising an earth fault limited network) for all underground mines. Protection devices and the control of touch potential in a fault limited network is very different to a surface (or solidly earthed) electrical network. As the vast majority of electrical installations in Australia are in solidly earthed (MEN) applications, protection on an underground fault limited network is a specialised area of expertise and deviates substantially from traditional (familiar) practice for most electrical practitioners.

Even within the mining industry where a fault limited network is mandated, there is a relatively poor understanding of the link between earth continuity settings and protection, the fault limitation itself, and earth leakage clearance times in control of touch potential. In 2013 and 2014 Ampcontrol gave technical presentations at the Queensland Mining Electrical Safety Conference (MESC) and NSW Electrical Engineering Safety Seminars (EESS) in regard to touch (voltage) potentials in typical mine installations. The presentation entitled “Compliant vs Safe: Common practice against AS/NZS4871:2012” demonstrated that traditional protection settings and grading (common operating practice) do not conform to the requirements of AS3000 or AS/NZS4871.

Variable speed drives have been applied for many years in large numbers of surface applications, where protection techniques and suppression of electrical

interference is well understood. Unfortunately, these techniques do not immediately translate to acceptable risk profiles in underground applications. There have been numerous presentations at the NSW Electrical Engineering Safety Seminars run by the NSW Resources Regulator that demonstrate protection difficulties associated with the application of switching power electronics and variable speed drives on fault limited electrical networks. As examples, refer to:

- Ampcontrol presentation "Electrical protection issues with variable speed drives in a mining environment" EESS 2009 and follow up presentations on the same topic in 2010, 2011, 2012 and 2019.

- The Pike River Royal Commission handed down its final report in 2012. That report identified the most likely source of ignition as electrical arcing caused by high frequency currents emanating from one or more variable speed drives deployed in or near hazardous areas.

- NSW Regulator safety bulletin SB11-04 "Electrical hazards associated with variable speed drives and earth fault current limited systems".

- Joy Global Safety Notice GSN0047 (Neutral-Earth Restriction rating, undetected electrical faults, and effect of DC on traditional electrical protection equipment).

Incidents involving electricity (and in particular electric shock) are notifiable events in mining. The Inspectorate records are presented to the industry each year in a number of forums. Reducing the frequency of electric shocks routinely features as a point of focus for the industry and the Inspectorate. Despite identification of emerging difficulties in application of VSDs underground and identification of concerns with the adequacy of electrical protection settings on underground power equipment there appears to be little activity or motivation to ensure the competency of end users (or the inspectors themselves) to properly assess and/or design adequate electrical protection.

Reform Submission:

(1) Major equipment suppliers, certifying bodies and mine operations servicing NSW all maintain professional engineers at the forefront of their technical assessment and decision-making. While this approach is based in sound business strategy, it is also precipitated by the requirements of the Queensland Professional Engineers Act 2002. Similar legislative requirements are in draft for NSW to ensure that all engineering services are provided by a registered professional engineer in a professional and competent way. In practice, this means degree-qualified engineers in relevant disciplines, together with appropriate experience. Electrical protection is a specialist area of electrical engineering. Competence to exercise the statutory function of an Electrical Engineer should require a practicing certificate and a professional qualification in Electrical Engineering. Any change to WHS (MPS) Regulations needs to be consistent with legislation now in draft around professional engineering services.
(2) There should be specific competencies under the general heading of electrical

engineering that must be demonstrated by formal examination with the Mines and Petroleum Competence Board to ensure those individuals tasked with using and maintaining critical electrical systems at an operating mine have the necessary expertise in electrical protection as applied to fault limited networks. Fault limited networks deviate substantially from traditional (familiar) practice for most Professional Electrical Engineers.

(3) Under the WHS Act 2011 Part 9 Division 2 Section 160, Inspectors are required to provide information and advice with regard to compliance. Given this requires the ability to assess risk in regard to electrical protection, and confirm touch potential (amongst other parameters) is as low as reasonably practicable, the same qualification and competency requirements to exercise the statutory function of an Electrical Engineer must extend to the Electrical Inspectors within the Regulator itself. This is not consistent with the WHS Act 2011 Part 9 Division 1 section 156 where the Regulator itself may determine the necessary qualifications for an inspector, that may or may not include a professional electrical engineering qualification.

(4) WHS(M&P)R:2014 Schedule 2 clause (3) (3) (h) & (j) Electrical Engineering Control Plan requires the consideration (or account) of earthing arrangement and management of touch potential. The actual control of touch potential and other risks associated with electricity is completely dependent on protection settings and clearance time. To both demonstrate and maintain control of risk associated with electricity, the mine must be able to justify all protection settings via engineering calculations and system design. Protection settings need to be part of the mine record, and engineering justification for those settings to demonstrate control of touch potential (and other risks associated with electricity) needs to be continuously maintained and up to date as the mine electrical system is altered as mining progresses. This needs to be added to the requirements of the Electrical Engineering Control Plan.

Direct reference to Australian Standards – Multiple WHS (MPS) Regulation Clauses

Australian Standards are invariably prescriptive because they describe best practice at the time of publication. Standards are regularly updated as new technology and techniques are found to reduce risk, or ways are found to provide improved outcomes with an equivalent level of risk. Unfortunately, a standardised set of products or application solutions cannot encompass all possible applications and there is a need to also accommodate engineered to order, non-standard solutions. On their own, Standards are voluntary and there is no requirement to comply. Where a design, product or application does not follow a Standard, it is a requirement that the residual risk in that application is demonstrated to be equivalent or better than following the applicable Standard. This requirement is already formally enshrined in QLD mining legislation, namely:

> Section 37(3) of the Queensland Coal Mining Safety and Health Act 1999
>
> PART 3- SAFETY AND HEALTH OBLIGATION
> 37. How obligation can be discharged if regulation or recognised standard made

> 37(3) …. if a recognised standard states a way or ways of achieving an acceptable level of risk, a person discharges the person's safety and health obligation in relation to the risk only by—
>
> (a) adopting and following a stated way; or
>
> (b) adopting and following another way that achieves a level of risk that is equal to or better than the acceptable level.

Electrical Engineering and electrical protection is a rapidly evolving space. The rate of technology advance makes it impossible for Standards to prescribe how all electrical applications must be implemented in order to be deemed acceptably protected or with an acceptable level of residual risk. Where Standards are referred to in legislation, they become mandatory. Relatively few Australian Standards were written in a manner consistent with legislative referral. AS/NZS3000 is an exception, and was written specifically to enable it to be referenced directly in legislation. Its format has been tested as applicable to any Australian electrical application (including mining) without exception – there are no exemptions to AS/NZS3000 requirements. It has been tested in prosecutions, and does not limit/styfle innovation or adoption of new technology. The Standard is enduring – while there are regular revisions to its content, no Australian electrical installation or application has had to wait for the Standard to be revised to allow a new technique or technology to be applied.

This is because the risks around use of electricity are well known. These primary risks do not change with time and are independent of the application or indeed technology advances as they are a consequence of fundamental physical principles. AS/NZS3000 is written in two parts. Part 1 is the mandatory section that describes clearly what must be achieved, that is, the primary risks that must be controlled and mitigated in any electrical application. Part 2 is not mandatory but if you choose to follow it, your solution is deemed to comply with the mandatory elements of part 1. You do not need to follow part 2 if you can otherwise demonstrate your solution meets the requirements of part 1.

Unfortunately, AS/NZS3000 is unique. Mining standards have not been written in this manner, and where WHS (MPS) Regulations refer directly to mining Standards they become mandatory. This effectively means the methods described in Standards become the only way an application may be constructed, even though new technologies and techniques may have become available.

As an example:

> AS/NZS1802:2018 and AS/NZS1972:2006 are prescriptive Standards that explicitly define acceptable materials and construction attributes for cables classed as suitable for use in underground coal applications. The preface of both Standards acknowledges that other cables may be required as applications and technology change over time, but contain no provision (other than by revision of the Standard itself) to allow alternate cables to be considered compliant. AS/NZS1972 was last updated 14 years ago.
>
> Both of these Standards are explicitly referenced in NSW mining legislation WHS(M&P)R:2014 section 80 (3) (b) & (c). These references, together with the

prescriptive nature of the standards, preclude competent engineers from exercising the obligatory technical discretion by deviating from the cabling nominated in the Standard.

As a result, only cables compliant with AS/NZS1802 are able to be used in a reeling or trailing cable application in a hazardous zone in NSW. Similarly, only a cable compliant to AS/NZS1972 can be used in a machine application. This situation means that:

- New technologies that offer a higher degree of electrical safety are precluded because the optimal cable is not described in AS/NZS1802 or AS/NZS1972.
- Cable applications routinely proceed with a higher than necessary residual risk when superior technical solutions are available, and;
- Practicing engineers are prevented from achieving a level of risk as low as reasonably practicable, because the optimal cable is not compliant.

These scenarios have already occurred in both NSW and QLD. Compliant cables have been used in VSD applications where it can be demonstrated that a readily available and technically superior non-compliant screened cable would achieve a substantially reduced touch potential under both normal running and fault conditions.

In response to the above example, the NSW Resources Regulator published an exemption (NSW Government Gazette No 27 dated 29th March 2019) that allows use of a non-standard cable on the proviso it is part of an engineered system and results in a level of safety that is at least equivalent to the standard that would be achieved by compliance with WHS(M&P)R:2014 section 80 (3) (b) & (c).

There are a number of issues with WHS (MPS) Regulations directly referencing prescriptive Standards:

- Standards are revised independently either by adoption of International Standards or locally by Standards Australia. The Resources Regulator does not have control of this process or the content of the revised Standard. A revision to the Standard has the immediate effect of altering Regulatory requirements.
- Where an alternative is available, it cannot be adopted without the Regulator generating an exemption. This requires the Regulator (not the end user) to assess the resultant risk and determine it is acceptable. This is not the function of the Regulator.
- The process limits innovation or adoption of new technology without direct Regulatory intervention in (proactive) provision of an exemption. It is not the function of the Regulator to evaluate alternate methods or technologies that could lead to reduced application risk. In all cases, residual risk being as low as reasonably practicable is not the responsibility of the Regulator.

Reform Submission:

It is impossible for Australian Standards to comprehensively address all application scenarios; Standards are generally prescriptive as they embody best practice for

representative applications defined in the scope of the relevant Standard at the time of publication. Standards do not, and cannot, replace the sound engineering assessment or technical discretion expected of competent professional engineers in achieving a residual risk as low as reasonably practicable. Where a given application diverges from an applicable Standard, it is mandatory to achieve a level of residual risk that is equivalent to or less than that achieved by simply following the relevant Standard.

WHS (MPS) Regulations must either:

1. avoid solution or application prescription by direct referral of an Australian Standard, instead defining the outcome that must be achieved or the level of performance that must be met, or;
2. allow the existing Standards references to remain, but provide a formal mechanism (as per QLD mining Regulations) that require an independent engineering assessment completed by competent professional engineers to demonstrate an alternate method results in a level of risk equivalent or better than following the prescribed Standards.

The latter is in essence identical to the exemption already published in NSW Government Gazette No 27 dated 29th March 2019 for WHS(M&P)R:2014 section 80 (3) (b) & (c).

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