QEST CONSULTING

Executive Summary

Safety Assessment of Major Mining Hazards

Qest Consulting Pty Ltd
ABN: 41 055 743 345
Level 2, 325 Flinders Lane
Melbourne 3000
T: +61 3 9648 4400
F: +61 3 9648 4499

Job No:	HAZ1M
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Prepared By:	A Deakin
Checked By:	P Herrmann
Approved By:	R Polmear
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Introduction

International Power Hazelwood ("IPRH") commissioned Qest Consulting to assist them in completing a Safety Assessment of the Major Mining Hazards ("MMHs") associated with their coal mining operations. This report is a summary of the methodology and findings of the Safety Assessment process completed. For a more detailed understating of the process, please refer to the supporting reports and risk assessment database.

The assessment was aimed at achieving compliance with the requirements for a Safety Assessment as per the *Occupational Health and Safety (Mines) Regulations 2002*. A Major Mining Hazard is defined under these Regulations as; *"a mining hazard that has the potential to cause an incident that causes, or poses a significant risk of causing, more than one death"*.

IPRH in consultation with the Minerals & Petroleum Regulation Branch, defined the scope of the assessment to include both their existing mining activities as well as any specific MMHs associated with the relocation of infrastructure and mining of the new West Field lease area.

IPRH believe that the Safety Assessment has established a risk-based framework through which they can continue to deliver safety improvements associated with the management of their MMHs. IPRH also recognise that this assessment is a key part of the operations Safety Management System (SMS). The integration of the Safety Assessment and the SMS is also a requirement of the OH&S (Mines) Regulations.

The process followed was developed by Qest Consulting in collaboration with IPRH personnel and mirrors that used in several successful Victorian WorkCover Authority submissions for the licensing of Major Hazard Facilities. The process provides a detailed risk assessment of the MMHs and a method of identifying their Critical Controls. It also provides a framework through which such controls can be tested to confirm that they are "fit for purpose".

The assessment methodology applied is considered to satisfy the specific requirements for a Safety Assessment of MMHs under the OH&S (Mines) Regulations, which requires the process to be; comprehensive and systematic, provide a detailed understanding of hazards, apply an appropriate assessment methodology, assess hazards cumulatively as well as individually, and be adequately documented and available. The assessment was competed through a three-staged approach.

Stage 1	**Identification of Major Mining Hazards**	• Qualitative risk assessment of hazard scenarios • Development of bow-tie diagrams
Stage 2	**Base Case Risk Assessment & Critical Control Selection**	• Semi-Quantitative Risk Assessment (SQRA) considering existing control measures • Identification of Critical and Major Controls
Stage 3	**Critical Control Adequacy Assessment and Reduced Case Risk Assessment**	• Assessment of Critical and Major Controls • MMH Safety Action Plan • SQRA considering improvement actions

A Risk Assessment Team was established at the beginning of the project and engaged throughout each stage of the process. The team was made up of IPRH personnel from; Operations, Maintenance, Engineering and Safety including personnel from shop floor, supervisory and management ranks. Prior to each workshop, a short presentation was provided to the Risk Assessment Team outlining the findings from the previous stage and summarising the next stage of work to be completed. This step promoted ownership of the risk assessment results by IPRH personnel.

Stage 1. Identification of Major Mining Hazards (MMHs)

The first step in the identification of MMHs was to divide the mine up into its major processes and activities and then apply a brainstorming technique using guidewords as prompts. This step generated an initial list of 53 mining hazards for further assessment and consideration as potential MMHs.

The initial list of hazards were then assessed using a Qualitative Risk Assessment approach to identify those hazards that could be considered MMHs in accordance with the definition in the OH&S (Mines) Regulations. This step refined the list to 16 hazards, which were considered to constitute potential MMHs, with 14 identified as having a potential multiple fatality consequence, and two hazards being higher risk potential single fatality events.

These 16 hazards were then analysed to understand the relationships between the potential initiating causes and existing control measures. This information was used to build bow-tie diagrams to graphically represent each hazard scenario. The bow-tie diagrams were then used as a reference throughout the remaining steps in the assessment process.

In addition to the MMHs identified, there were 14 hazards assessed as having the potential to result in a single fatality consequence but considered a lower risk because they were deemed 'unlikely' to occur in the mine life. Although not considered MMHs, these hazards are of significance and have been referred for assessment at a later stage.

Stage 2. Base Case Risk Assessment

The 16 potential MMHs identified were then further assessed using a Semi-Quantitative Risk Assessment ("SQRA") process. The SQRA approach was selected as it enables an annualised risk value to be generated, allowing the MMHs to be ranked and providing IPRH with an increased understanding of the MMH risk profile[1]. The SQRA process also provides an effective method of selecting the Critical and Major Controls for each MMH scenario.

Based on the current site controls and procedures, the Risk Assessment Team estimated that the overall 'Base Case' risk for the MMHs was 4.72E-02 fatalities per year, equivalent to a single fatality every 21.2 years (refer Table 1). This estimate is consistent with the results gained from applying the SQRA process at other mining operations.

The Base Case risk assessment identified that the overall risk from the MMHs is relatively concentrated, with 81% of the site risk attributable to the top 5 hazards assessed. Furthermore that the three top hazards in the Base Case estimate relate to collisions involving mobile vehicles, placing the operation of mobile equipment as the dominant hazard in the risk profile.

The list of 16 hazards was then reviewed to determine which of these hazards would be considered MMHs, and therefore subject to further analysis through the Safety Assessment process. This was achieved through applying two criteria:

[1] The numerical risk values estimated are expressed in terms of Potential Loss of Life (PLL). PLL is the risk to all individuals who spend time on the site over a year. It is the same as the statistically predicted annual fatality rate for the operation. The SQRA process generates a PLL that is an indicative assessment of the risk using a 'team based' approach and as such relies on the collective knowledge of the risk assessment team and availability of relevant statistical information. The strength of the SQRA approach is that it provides an assessment of the hazards relative to each other and as such enables a risk-based framework for safety management to be established. This framework enables risk priorities to be focussed and reduction efforts to be measured.

1. Comparison of the estimated risk levels against an adopted site defined risk criteria of 1E-03 (1 in 1,000yrs). This step resulted in an initial 10 hazards being identified as MMHs.
2. A team-based review of the remaining six hazards to confirm their relevance for inclusion as MMHs. The objective of this review was to understand the relationships between each hazard, its existing level of control, and the estimated level of risk and/or potential consequences. From this review three additional hazards were identified as constituting MMHs, requiring further control analysis.

As such, 13 hazards were identified as MMHs and taken forward for control analysis. These hazards are shown in Table 1.

Table 1 - Major Mining Hazards and Risk Values

Rank	MMH No.	Hazard Title	PLL value	% Risk	Sum % Risk
1	NO1	Vehicle incident while accessing worksite	1.15E-02	24%	24.3%
2	IW32	Public vehicle incident during road alterations	1.00E-02	21%	45.5%
3	NO24	Heavy Mobile equipment interactions on mine roads	6.67E-03	14%	59.7%
4	NO4	Dropped objects from major mining plant	6.00E-03	13%	72.4%
5	NO37	Failure whilst field jacking of major mining plant	4.40E-03	9%	81.7%
6	IW28	220KV tower incident, including construction activities	2.50E-03	5%	87.0%
7	NO5	Uncontrolled movement of major mining plant	1.65E-03	4%	90.5%
8	NO38	Unplanned movement of equipment	1.37E-03	3%	93.4%
9	NO42	Fall from or tipping of EWP	1.10E-03	2%	95.8%
10	NO26	Batter failure	1.00E-03	2%	97.9%
11	NO39	Confined spaces	3.00E-04	<1%	98.5%
12	NO8	Explosion of electrical components on major mining plant	2.20E-04	<1%	99.0%
13	NO43	Building fire	2.20E-04	<1%	99.5%
14	IW30	Cable incident on public road	1.40E-04	<1%	99.8%
15	NO7	Major mining plant fire	1.00E-04	<1%	99.9%
16	NO36	Inrush of water into mine	1.60E-05	<1%	100.0%
Total Estimated Site Major Mining Hazard PLL			**4.72E-02**		

Identified hazards for Critical Control Adequacy Assessment (Stage 3).

It is important to note that three of the hazards in the risk profile solely relate to interim activities associated with the relocation of infrastructure for mining activities in the West Field lease area. It is estimated that following completion of the relocation activities, the risk from MMHs would reduce by approximately 40%, to a single fatality every 35.9 yrs. Furthermore, these hazards relate principally to activities to be completed by contractors under IPRH management. Therefore the controls for the selection and management of these contractors is critical to managing this risk.

Stage 3. Critical Control Adequacy Assessment & Reduced Case Risk Assessment

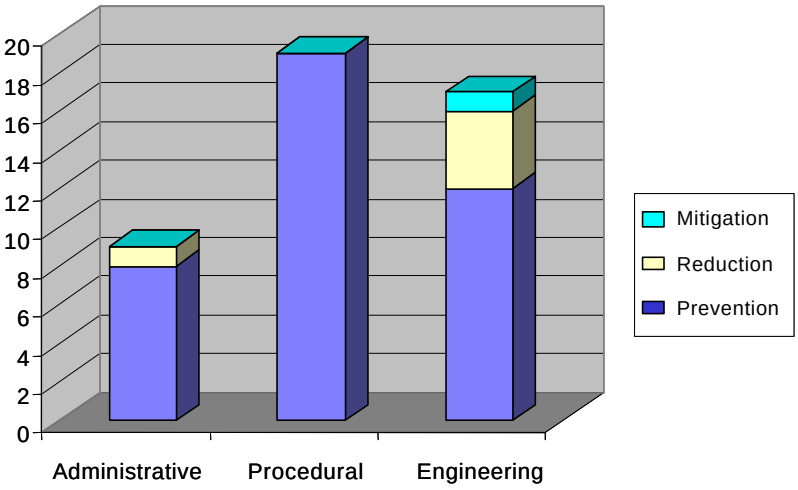
The final stage of the Safety Assessment was to review the adequacy of the Critical and Major Controls selected to confirm that they are ”fit for purpose”.

As discussed, a total of 13 MMHs were identified in Stage 2, for review through the control adequacy assessment process. Two of these hazards were not reviewed, as they related to infrastructure works associated with the relocation to the West Field lease area. As these activities are to be completed by specialist sub-contractors and at a later stage, it was considered more practical to delay the assessment process until the processes for engaging and managing the contactors has been established. This will ensure a more realistic and rigorous assessment is completed.

A total of 45 controls were assessed through the adequacy assessment processes. This included 15 Critical Controls and 30 Major Controls. The controls were also categorised to identify the types of controls being relied upon (refer Figure 1).

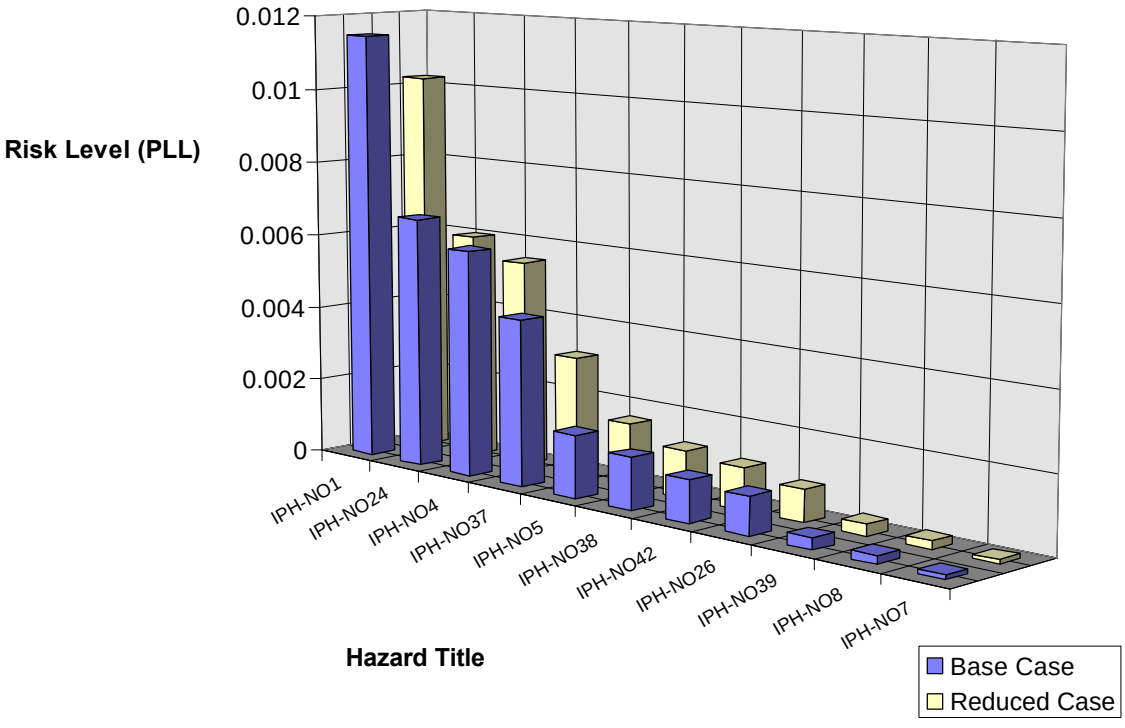
The results shown in Figure 1, illustrate that there was a good spread between the Procedural and Engineering controls selected. It also shows that a vast majority of the controls selected were Preventative in nature.

Figure 1- Critical & Major Control Categories



The adequacy assessment process generated 51 improvement actions that targeted different aspects of the risk profile. These improvement actions were prioritised, according to their affect on improving the adequacy of the controls, and form the Safety Action Plan for Major Mining Hazard. This Plan represents the culmination of the Safety Assessment Process and presents the context in which the Reduced Case risk assessment was completed. It therefore acts as a list of what needs to be done to reach the reduced risk level. The implementation of these actions was estimated to reduce the risk, from the hazards assessed, from 1 fatality every 29 years to 1 fatality every 33 years, constituting an 11.5% risk reduction (refer Figure 2).

Figure 2 - Base Case and Reduced Case Risk Profile Comparison



Key Conclusions

1. This Safety Assessment has been completed in line with the requirements of the *Occupational, Health & Safety (Mine) Regulations 2002*.
2. This Safety Assessment has been successful in developing a risk-based framework through which IPRH has and can continue to review the MMHs associated with its coal mining operations.
3. The process has been successful in gaining input and ownership of the results from a relevant cross section of IPRH personnel.
4. A total of 53 mining hazards were identified with 13 classified as Major Mining Hazards.
5. The Risk Assessment Team estimates the cumulative risk from the MMHs to be 4.72E-02 fatalities per year, equivalent to a single fatality every 21.2 years.
6. It is estimated that 40% of the MMH risk profile is associated with the establishment of infrastructure to the West Field Area. The controls associated with engaging and managing the construction contractors is therefore critical to managing this risk.
7. The Critical and Major Controls for the MMHs have been assessed enabling 51 improvement actions to be generated and prioritised. These actions form the Safety Action Plan for MMHs.
8. The Safety Assessment outcomes are to be integrated with the operations Safety Management System.
9. The Safety Assessment needs to be continually built upon, expanded and reviewed to maximise its benefits to IPRH.

Recommendations

1. Prior to the commencement of the West Field infrastructure works, a review of the adequacy of the processes for engaging and managing the contractors should be completed.

2. A systematic review of the operations MMHs should be undertaken at least every 3 years or if significant changes that affect the mines risk profile are planned. The review process should use this or a similar semi-quantitative process with the outputs being incorporated into the Safety Management System to facilitate implementation.

   The safety review processes provide an opportunity to systematically review each hazard scenario and confirm the adequacy of the controls, or identify any areas in which additional improvement actions or new control measures can be implemented. Ensuring the update and review processes are completed is a critical step in driving risk reduction and continuous improvement.