GDF-SUEZ Hazelwood

Hazelwood Mine Fire Preparedness Support

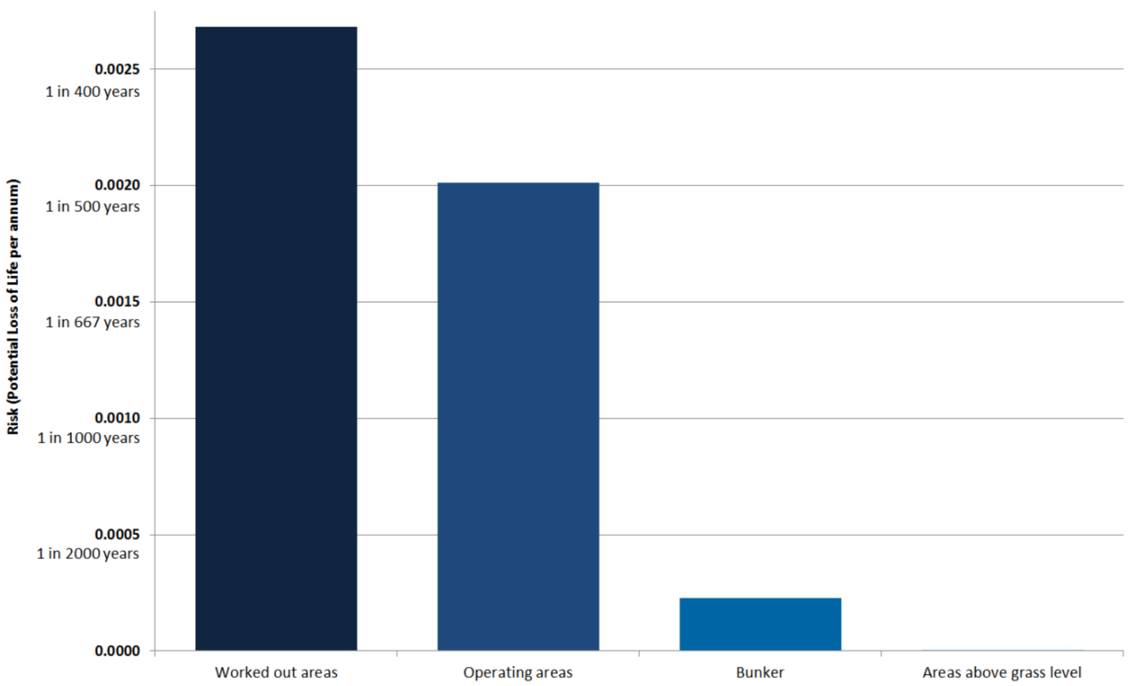
Risk Assessment

April 2015

Executive summary

A risk assessment was undertaken for the GDF SUEZ Hazelwood mine looking at the risk of a coal fire leading to a fatality. A Semi Quantitative Risk Assessment (SQRA^{TM}) methodology was used to complete the risk assessment. Each step of the SQRA process was completed through facilitated workshops using a multidisciplinary team. The workshops were facilitated by an independent consultant and involved engineers, operators and maintenance personnel. This ensured the assessment drew on the experience and knowledge of site personnel to deliver site-specific results.

The results of the risk assessment are summarised in the table below.

	Results Summary	
Current Risk	Risk scenario analysed	Coal fire
Current Risk	Current risk	0.005 fatalities per year (one fatality every 203 years)
Current Risk	Coal fire assessed across the mine lease, split up into four areas for the analysis:	
Current Risk	1. Worked out areas; 2. Operating areas; 3. Bunker; and 4. Areas of site above the grass level.	
Current Risk	Critical Controls Identified	6
Current Risk	Critical Controls currently with a High adequacy rating	0 (0%)
Actions	Risk reduction actions identified	78 (including 35 potential controls)
Predicted Risk	Predicted reduction in risk if all actions are implemented	34%
Predicted Risk	Predicted risk	0.003 fatalities per year (one fatality every 308 years)
Predicted Risk	Critical Controls predicted to achieve a High adequacy rating	1 (17%)
Risk Scenario Profile		

Recommendations

The recommendations arising from the risk assessment are described below.

- It is recommended that GDF SUEZ complete the update the Mine Fire Service Policy & Code of Practice and use this document as the system design and operational standards for use by GDF SUEZ and other design parties. Also the design and operational standards should include any changes in the expectations of the fire system to be a current standard for 2015.
- One of the six identified critical controls is predicted to achieve a high level of adequacy after implementation of the risk reduction actions (when using the SQRA process). It is recommended that GDF SUEZ undertake further work to develop additional improvement actions to raise the predicted adequacy level of the critical controls (so far as is reasonably practicable). As part of this, it is recommended that the site generate actions to put in place more rigorous and formal (documented) processes to support the daily plant cleaning routine and the major mining equipment inspection controls, as currently there appears to be a reliance on informal practices for some key aspects of these controls.
- Risk assessment alone does not manage risk. Reducing and managing the risk of coal fire leading to a fatality at Hazelwood requires thorough implementation of identified risk reduction actions and maintenance of the critical controls:
  - Management should review the proposed risk reduction actions to develop a final implementation plan that includes accountabilities, resources and timeframes, and carry out the plan.
  - It is recommended that GDF-SUEZ audit activities be focused on the critical controls to ensure their effectiveness and robustness. It is also recommended that critical control performance standards and monitoring program be developed and rolled out to track the performance of critical controls. A suitable monitoring program will identify any gaps in critical control performance, resolve identified problems and maintain focus on the controls so that their effectiveness does not diminish through time. Conducting an initial in field critical control performance verification would be a beneficial step in performance standard development, allowing draft performance standards to be tested and providing initial performance data to aid setting performance targets.
- In completing the risk assessment work, the SQRA team selected the fire protection controls that they believe are the most realistic and practical options for protecting the exposed coal surfaces. Consideration should be given to undertaking additional analysis to support the case for these being the most effective options for the worked out area.
- Not all personnel were able to attend the workshops due to operational constraints. It is recommended that a post risk assessment review be carried out by appropriate specialists to review the risk reduction items to ensure no items were missed due to availability of personnel.
- Documentation relating to each Critical Control was not always available in the workshops (for example the daily checklists prompting cleaning and the relevant training packages when assessing the daily plant cleaning routine). It is recommended that this be reviewed post risk assessment to inform the adequacy assessment and also that the documentation can be referenced.

Additional Recommendations

- The output of the risk process should be communicated to all relevant personnel on site to maximise the benefits of the process.
- It is recommended that the risk assessment be updated at a regular interval as appropriate so it remains a reflection of the current coal fire risk on site and so that risk reduction efforts maintain focus on the most appropriate areas.
- Unless adequately covered by other risk assessment processes, it is recommended that the site expand the SQRA analysis to cover all major mining hazards applicable to the Hazelwood mine, to gain increased confidence that the fatality risks are being managed and that the level of risk has been reduced so far as is reasonably practicable. A hazard identification exercise, to confirm all hazards have been identified, should form part of this process.

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1. Introduction

1.1 Background

Following the Hazelwood mine fires in February 2014, and the resulting Hazelwood Mine Fire Inquiry later in 2014, GDF-SUEZ engaged GHD (an independent consultant) to undertake a coal fire risk assessment for the mine.

Recommendation 15 of the Hazelwood Mine Fire Inquiry[1] advised GDF-SUEZ to:

- Conduct, assisted by an independent consultant, a risk assessment of the likelihood and consequences of fire in the worked out areas of the Hazelwood mine, and an assessment of the most effective fire protection for the exposed coal surfaces;
- Prepare an implementation plan that ensures the most effective and reasonably practicable controls are in place to eliminate or reduce the risk of fire; and
- Implement the plan.

This risk assessment is intended to assist GDF-SUEZ in developing a response to completing these tasks.

1.2 Risk assessment scope

The scope of work was to undertake a risk assessment of a coal fire at the Hazelwood mine, involving:

- A risk assessment workshop, using Semi Quantitative Risk Assessment (SQRA) methodology, attended by knowledgeable and experienced site personnel from a range of disciplines;
- Development of a bow tie diagram for the risk; and
- Identification of actions, both short and longer term, targeted at reducing the level of risk.

During the risk assessment workshop, the workshop team agreed that the most appropriate approach to assessing the risk was to look at all areas of the mine lease, rather than only the worked out areas. The intention of this approach was to gain a holistic understanding of the coal fire risk and to avoid narrowing the focus and potentially missing relevant causes, controls or improvements. As a result, the team divided the mine lease into four areas for the purposes of the analysis:

- Worked out areas;
- Operating areas;
- Bunker; and
- Areas of site above the grass level.

Power station coal fires were excluded from assessment, except as a source of fire that could escalate to other areas of the mine. Similarly, fires not involving coal (e.g. electrical fire, belt fire) were not assessed individually, but were considered as an ignition source where the potential for fire escalation to a coal fire exists.

[1] Hazelwood Mine Fire Inquiry 2014, Hazelwood Mine Fire Inquiry Recommendations August 2014, p. 6, Victorian Government Printer, Victoria.

1.3 Objectives

The objectives of the risk assessment were to:

- Analyse the scenario of a coal fire, including in the worked out areas of the mine, to gain a greater understanding of the potential causes and current control strategies.
- Evaluate the current (pre-fire season) risk level associated with the coal fire risk scenario.
- Identify and assess the critical controls.
- Identify potential risk reduction actions, and areas where additional analysis and/or further work is required, as steps towards achieving a risk level that is reduced so far as is reasonably practicable.
- Engage site personnel in the analysis of the coal fire risk scenario.

1.4 Assumptions and limitations

1.4.1 Assumptions

The risk identification, bow tie analysis, control assessment and SQRA calculations are reliant on the opinions of, and any data supplied by, the site representatives and the risk assessment team. Information and opinions are assumed to be valid and representative for the purposes of the Risk Assessment.

1.4.2 Disclaimer

This report has been prepared by GHD for GDF-SUEZ Hazelwood and may only be used and relied on by GDF-SUEZ Hazelwood for the purpose agreed between GHD and GDF-SUEZ Hazelwood as set out in Section 1.3 of this report.

GHD otherwise disclaims responsibility to any person other than GDF-SUEZ Hazelwood arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in this report. GHD disclaims liability arising from any of the assumptions being incorrect.

The services undertaken by GHD in connection with preparing this report did not include GHD verifying or accrediting the risk identification, risk judgements or control adequacy assessments made by the risk assessment team.

2. Approach

2.1 Risk assessment methodology

GHD's SQRA methodology was selected for the risk assessment. SQRA is a systematic and rigorous risk assessment process, originally developed to assess process safety risks for Major Hazard Facilities. The technique has been used extensively in the mining industry in Australia and internationally to analyse and manage low frequency, high consequence safety incidents, i.e. credible single and multiple fatality incident scenarios. As a result, SQRA is a proven technique for assessing major incident hazards and major mining hazards.

SQRA employs workshops involving a horizontal and vertical cross-section of the workforce personnel with extensive knowledge and experience of the site, and available incident history statistics, to provide site-specific results.

While the SQRA methodology applied only looks at safety consequences (fatality), the work completed is a detailed analysis of the risk. As such, evaluation of additional relevant consequences (e.g. environmental, financial, reputation) can later be readily added, with much of the existing work remaining applicable whatever the consequence under consideration.

2.2 SQRA methodology

The Semi Quantitative Risk Assessment process, as applied to this study, involves seven core steps. The steps are built around a workshop process to maximise the level of engagement of stakeholders in the risk assessment process. The process provides a rigorous method for the identification and evaluation of risks and critical controls. The process enables improvement initiatives aimed at control improvement and risk reduction to be identified and prioritised.

The seven core steps in the SQRA process are:

1. Identify the hazards;
2. Describe hazard dynamics (bow tie diagram);
3. Determine current risk;
4. Identify critical controls;
5. Assess the adequacy of the critical controls;
6. Select risk reduction actions and estimate the predicted risk; and
7. Reporting and implementation planning.

An additional eighth step, critical control monitoring plans, is often undertaken to follow on from the initial seven steps.

Further detail on each step is provided in Appendix B.

2.3 Specific approach for Hazelwood

As GHD was engaged to assess one hazard, already identified by GDF SUEZ, the first SQRA step, hazard identification, was not undertaken.

For the purposes of the risk assessment work, the team defined the "current risk" as the pre 2014/2015 fire season risk level.

3. Results

3.1 Workshop details

The SQRA workshops were held in two stages: an initial two day session on 18 and 19 November 2014; and a three day session, comprising small groups sessions followed by a half day team session, on 20 to 22 January 2015. The time between the sessions provided site with the opportunity to:

- Gather additional information to clarify uncertainties highlighted by the workshop team regarding a small number of controls recorded on the bow tie diagram; and
- Compile documentation for reference during the critical control adequacy assessments.

The bow tie diagram development (see Appendix C), current risk calculations and critical control identification were undertaken with the full workshop team.

The adequacy assessments were completed as small group sessions involving specialists selected based on the critical control being assessed.

The full team then reconvened to confirm the critical control improvement actions generated by the small teams, select potential controls for implementation and complete the predicted risk calculations.

All workshops were held onsite at Hazelwood. The attendance records for each session can be found in Appendix A.

3.2 Hazard definition

The risk was defined as a coal fire on the mine lease, as described in Table 3-1.

Table 3-1 Coal fire risk description

Risk	Description
Coal fire	This analysis looks at the risk of a fatality from a coal fire on the mine lease, including in the worked out area, the operating area, the bunker and areas of site above grass level. Power station coal fires are excluded from the scope of the analysis, except as a source of fire that could escalate to the coal in other areas. For the purposes of the analysis, a coal fire was defined as any coal event generating smoke (i.e. includes smouldering). Fires not involving coal (e.g. electrical fire, belt fire) are excluded from the analysis, except as a source of ignition for a coal fire. The risk of a fatality involving anyone on site is considered, including employees, contractors and external fire response personnel.

3.3 Describe hazard dynamics (bow tie diagram)

A bow tie diagram was generated for the coal fire risk. The diagram provides the site with a comprehensive understanding of the dynamics of the hazard, including the causes and pathways that may lead to an incident, the controls that are in place to prevent and mitigate an incident and potential new controls that could be implemented. In addition, the diagram is a useful communication tool for personnel onsite. The bow tie diagram is provided as an external document with this report.

3.4 Determine current risk

The risk of a coal fire at the Hazelwood mine was calculated by evaluating four scenarios, as listed in Table 3-2, which together cover the areas of the mine lease included in the scope of the analysis.

The overall risk (Potential Loss of Life-PLL) for the coal fire was estimated to be 0.005 fatalities per annum or approximately one fatality every 203 years. The risk for each scenario is shown in Table 3-3 and displayed in Figure 3.1. Figure 3.2 shows the maximum consequence that the team believe could result from each scenario.

Table 3-2 Coal fire scenarios

Scenario	Notes
Worked out areas	The worked out area includes the batters and the floor.
Operating areas	The areas where the excavation of material and material transport occurs currently.
Bunker	The bunker is defined as the raw coal bunker and the drive tower.
Areas above grass level	The team determined that the areas above grass level most likely to suffer a coal fire are: 8TP; 5TP, the coal stockpile above 8TP and the 690 conveyor area.

Table 3-3 Current risk

Current Scenario Ranking	Scenario	Current Risk	1 Fatality Every… (years)	% of Overall Current Risk	Cumulative % Risk
1	Worked out areas	2.68E-03	373	54%	54%
2	Operating areas	2.01E-03	497	41%	95%
3	Bunker	2.28E-04	4,384	5%	99.9%
4	Areas above grass level	5.05E-06	197,961	0.1%	100%
Total		**3.02E-02**	**203**	**100%**	**100%**

The most significant scenario, contributing just over half of the total risk was found to be a coal fire in the worked out areas of the mine, with a fatality predicted once every 373 years. In line with the site's incident history, the team estimated that a coal fire with the potential to cause fatality occurs in the worked out areas of the mine around once every two years. In the past ten years, there have been five fires: four initiated by fire hole breakouts and the February 2014 event attributed to embers from offsite bushfires. While the team felt the chance of a fatality in this scenario is fairly low, and there has never been one at the Hazelwood site from this situation, the potential nonetheless exists as people fighting the fire are in range of smoke and heat and/or could become trapped. Should a fatality incident occur, the team believe a single fatality is the most likely outcome, however there is also a strong change of two fatalities resulting given personnel often work in pairs. Ten or more fatalities from the event are considered possible but unlikely, as personnel are sometimes transported by minibus to reach the fire-fighting location and could be killed if the bus is engulfed by the fire.

A coal fire in the operating areas is the second highest scenario, contributing around 41% of the total risk, with a risk of a fatality around once every five hundred years. While minor coal fires occur relatively frequently in the operating area, these are usually controlled promptly. Coal fires with the potential to cause fatality are rarer and using the incident history as a reference, the team estimated that the frequency of these is around one every two years (the same as the frequency for the worked out areas). It was determined that the chance of a fatality in the operating area was slightly lower than for the worked out areas, as the operating area has more monitoring, resources and equipment to respond. As for the worked out areas, a single fatality was considered the most likely fatality outcome, two fatalities quite possible, and ten or more fatalities again possible but unlikely.

A bunker coal fire was third in the list, and a much lower contributor to the overall risk, providing only 5% of the total. Small fires in the bunker, mainly initiated by maintenance activities, occur relatively often, however fires in the bunker with the potential to cause fatality occur infrequently, around once every ten years. The chance of someone being injured by the fire is considered lower than for the previous scenarios, as the team believe in most cases personnel will be able to activate the bunker fire water sprays and evacuate safely. Should a fatality occur, a single fatality is considered the likely outcome, although six to nine fatalities would be possible if a maintenance crew becomes trapped.

The final scenario of a coal fire in the areas above grass level is insignificant to the total risk, contributing less than 1%. Coal fires in this area are infrequent, as there is a limited amount of fuel available. Even if the fire does occur, the team feel it is improbable that a fatality will result due to the lack of fuel and as there are few areas where personnel could be trapped while fighting the fire. Three to five fatalities, was considered theoretically possible, but the team believe a single fatality is the most realistic fatality outcome for this area.

The risk calculations show that risk reduction efforts are best focused on the worked out areas and the operating areas, as these two scenarios contribute 95% of the total coal fire risk for the site. On a consequence basis, these are also the two scenarios of most significance, having greater multiple fatality potential than the bunker or areas above grass level.

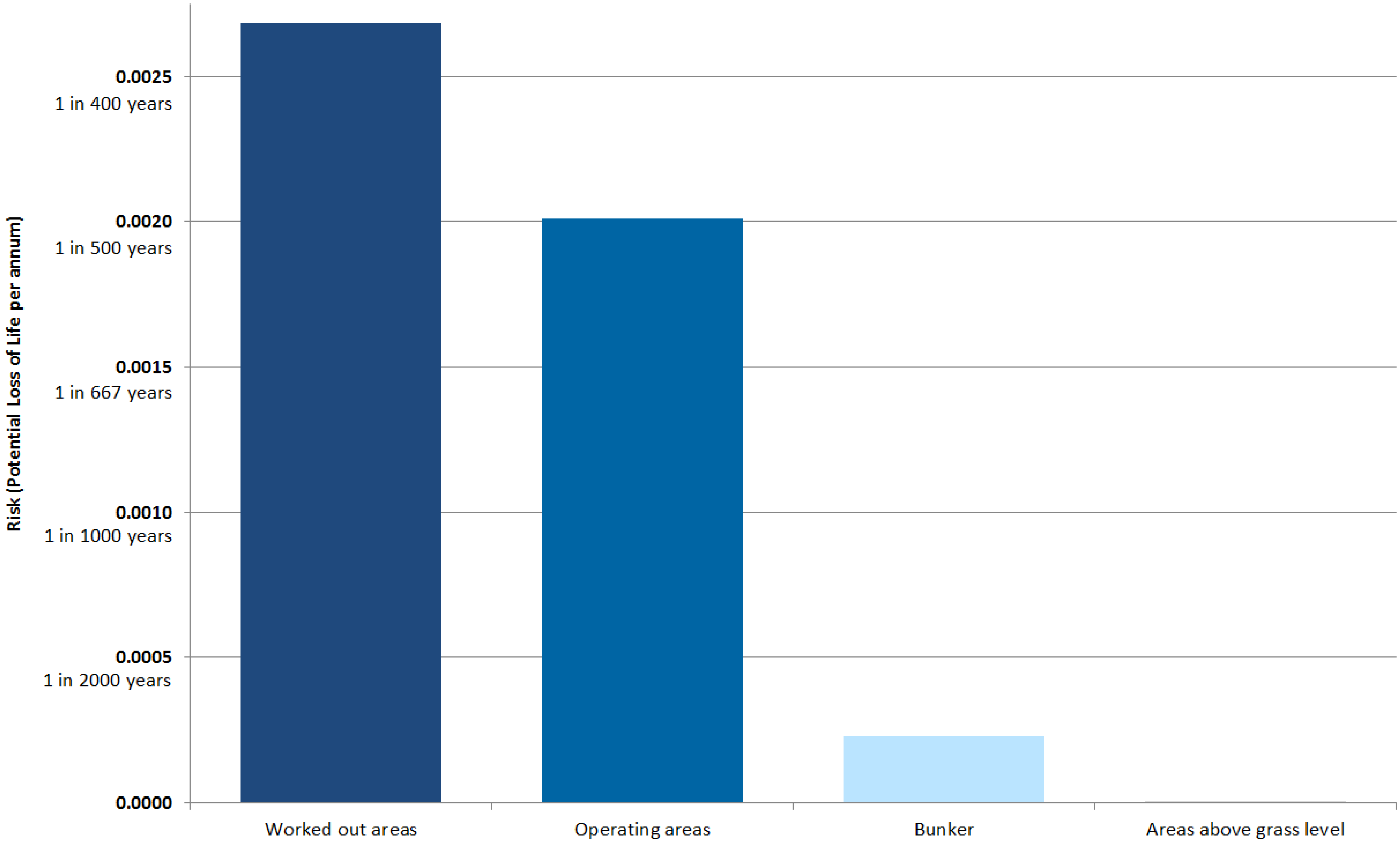


Figure 3.1 Current Risk Profile by Scenario

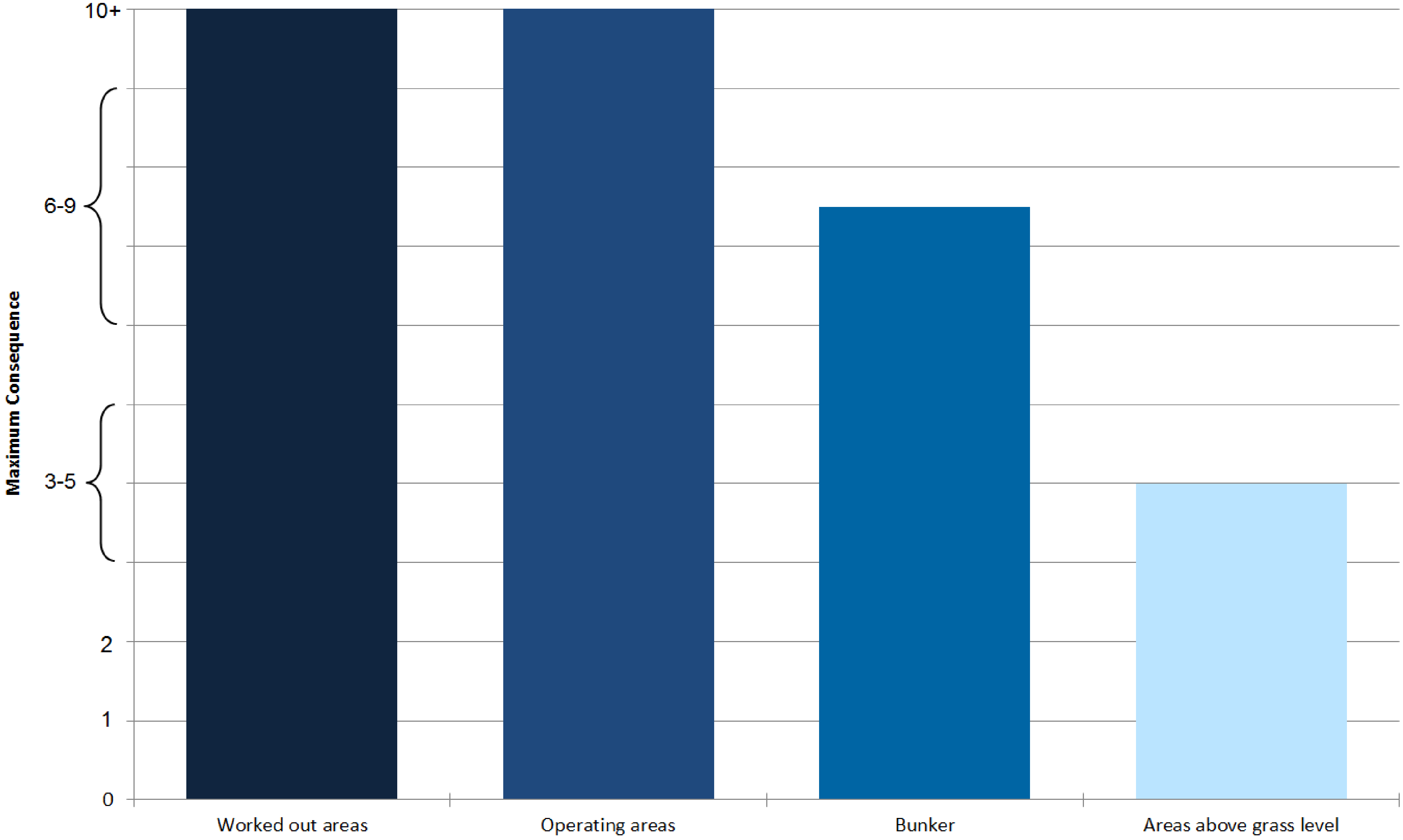


Figure 3.2 Maximum Reasonable Consequence Profile

3.5 Identify critical controls

Six controls were identified as critical on the bow tie diagram for the coal fire risk, as listed in Table 3-4. In line with the risk calculation results, these critical controls focus on the worked out areas and the operating areas of the mine.

Table 3-4 Critical control list

Control No.	Control Hierarchy	Control
0041	Administrative	**Operational cleaning** – daily plant cleaning routine
0118	Administrative	**Plan** – daily fire readiness (includes patrols, equipment, manning levels, wetting down)
0136	Engineering	**Clay capping or crushed rock** – exposed coal in worked out & operating areas
0250	Administrative	**Inspection** – major mining equipment (shiftly checklist)
0290	Administrative	**Procedure** – management of hot spots (identification, monitoring, notification to responders) – Potential Control
0383	Engineering	**Fire water system** – mine

The breakdown by control hierarchy for selected critical controls is shown in Figure 3.3. Typically it is preferred to select a higher proportion of engineering controls than administrative controls, as administrative controls have a high reliance on people and their correct application of the control. However it is not unusual for a mine site to have a higher percentage of administrative controls compared with a process plant, given the constantly moving operating area, the high involvement of personnel in key tasks (e.g. mobile equipment operation) and the more limited ability to use instrumented systems for control.

The team attributed over half of the coal fire risk to causes of escalation from offsite fires. The site has little control over preventing offsite fires, so controls were selected aiming to prevent these fires from escalating to site and to mitigate onsite fires that could not be prevented:

- **Plan** – daily fire readiness (includes patrols, equipment, manning levels, wetting down);
- **Clay capping or crushed rock** – exposed coal in worked out & operating areas; and
- **Fire water system** – mine.

Two out of these three are engineering controls. The remaining three controls, selected for other causes of fire, were all administrative and in each case the team felt they were the best available option to prevent a fire:

- **Procedure** – management of hot spots (identification, monitoring, notification to responders):
  - Fires caused by hot spots were a cause of concern for the team, given a number of the more recent coal fire incidents in the worked out areas arose from this source. The team believe that a proposed robust procedure covers identifying, monitoring and responding to hot spots, and using engineering controls such as thermal imaging cameras to assist, is the best method to prevent significant hot spot coal fires. This is preferable to the use of thermal imaging cameras alone, as hot spots are often detected by sight or smell rather than thermal imaging, and the size of the mine lease means it would be impractical to provide coverage of all areas.
- **Operational cleaning** – daily plant cleaning routine:
  - This was selected to prevent fires due to coal build up in proximity to heat sources (such as conveyors, stackers and dredgers). The team believe spillage and coal build are an inevitable part of coal mining and therefore regular removal of the coal by cleaning is the best available control to prevent a fire. Thought was given to redesign of the plant, however the team did not believe this was a practical solution or that it would eliminate build up.
- **Inspection** – major mining equipment (shiftly checklist):
  - Inspection was selected to prevent major mining equipment fire (e.g. dredger, slew conveyor, stacker). Again, the team feel that some build up of coal on major mining equipment is inevitable, and were unable to identify a realistic engineering control to select as critical. The group believe that the inspection is the most important control, as if correctly completed it will provide fire preparedness, and therefore prevent significant coal fires with the potential to cause fatality.

Figure 3.3 Critical Controls by Hierarchy

3.6 Assess the adequacy of the critical controls

Detailed control adequacy assessments were completed for the six critical controls identified. Table 3-5 provides a summary of the current rating of the critical controls as well as the rating that the workshop team predict will be achieved once the risk reduction actions are completed. The potential control selected as critical was not assessed for current adequacy, given it does not yet exist.

Detailed assessment criteria and the methodology used are outlined in Appendix E.

Table 3-5 Current adequacy assessment summary

Control	Planning / Design Adequacy	Implementation Adequacy	Workforce Involvement Adequacy	Monitoring Adequacy	Current Adequacy	Predicted Adequacy
Operational cleaning – daily plant cleaning routine	Adequate	Adequate	Adequate	Adequate	Satisfactory	Satisfactory
Plan – daily fire readiness (includes patrols, equipment, manning levels, wetting down)	Adequate	Adequate	Fair	Poor	Unsatisfactory	Satisfactory
Clay capping or crushed rock – exposed coal in worked out & operating areas	Fair	Adequate	Adequate	Poor	Unsatisfactory	Satisfactory
Inspection – major mining equipment (shiftly checklist)	Fair	Fair	Adequate	Fair	Unsatisfactory	Satisfactory
Procedure – management of hot spots (identification, monitoring, notification to responders)	Potential control – no current adequacy	Potential control – no current adequacy	Potential control – no current adequacy	Potential control – no current adequacy	Potential control – no current adequacy	High
Fire water system – mine	Fair	Fair	Fair	Fair	Unsatisfactory	Satisfactory

While the table shows that the actions generated during the adequacy assessments are expected to improve the performance of the critical controls, only one of the six controls is predicted to achieve a high level of adequacy.

Factors contributing to these controls only achieving a satisfactory predicted adequacy rating include the following.

- **Clay capping or crushed rock** – exposed coal in worked out & operating areas:
  - Once the exposed coal has been capped, vegetation often grows on the capping providing a source of fuel for a fire, and thereby undermining the effectiveness of the capping in preventing fire. The team recorded an action to develop and implement a regular vegetation inspection, monitoring and maintenance program for the capped areas. When this action is fully implemented the extent of annual regrowth can be assessed to determine if any additional actions are required. In particular the group were concerned about exposed coal and plant growth on the overburden dump being difficult to manage.
  - The capping, including after the implementation of the actions, will not cover operational areas of exposed coal which are subject to other protection measures.
  - Ultimately full rehabilitation as far as practicable of specific areas of the worked out portion of the mine will diminish the risk in these areas.
- **Plan** – daily fire readiness:
  - Even if well executed, the team does not believe the plan can ever be entirely effective in stopping severe ember attacks from airborne embers travelling long distances and landing in the mine. Exposed areas of coal although contained within water spay bounded areas can still ignite causing a coal fire. (e.g. in the operating areas or on the overburden dump). In these instances the focus needs to be on preparedness to attack the fire when it is small.
- **Fire water system** – mine:
  - The overall philosophy of the fire water system was found to be not well documented and not well understood by some team members, so this requires clarification then subsequent reassessment in light of the additional information. This will be aided by the completion of the update of the revised design and operations standards (code of practice).
  - The team identified that the Mine Fire Service Policy and Code of Practice requires review with respect to the specified required number of days of firefighting expected from the fire water system to determine if the current policy is still appropriate, given the duration of the 2014 fire.
  - The mine fire water system provides wetting for key strategic locations by creating wetted corridors breaking the coal surfaces into limited areas which can ignite and limit the growth of an ignited area. Full coverage is not seen to be reasonably practicable.
- **Operational cleaning** – daily plant cleaning routine:
  - The team noted that some areas are difficult to access to complete cleaning, and there are some areas where the coal builds up quickly which makes it difficult to keep on top of the cleaning.
  - Personnel responsible for undertaking the cleaning have competing priorities, as their role includes multiple additional tasks. Some team members felt that people don’t have sufficient time to complete all these tasks during their shift, which can then compromise the operational cleaning.

  - The group were not confident that the actions recorded will resolve the identified issues. It was felt that these issues have been known for some time, yet still exist, and the current site culture and/or business practices may be contributing to the limitation of this control.
- **Inspection** – major mining equipment (shiftly checklist):
  - It was identified that there are a number of issues relating to the completion and signing of the checklist forms, particularly with people failing to sign the forms. While improvement actions were recorded to address some aspects of the issue, the team were unable to identify actions to solve the problem. Further work is required to develop a solution, which is likely to required management level input.

One out the six selected critical controls are predicted to meet a high level of adequacy. Given these are the controls which are being relied upon to prevent fatalities from occurring due to a coal fire and are considered essential to safe operation of the site, it is recommended that GDF SUEZ undertake further work to develop additional improvement actions to raise the predicted adequacy level of the critical controls, where practicable. As part of this, it is recommended that the site generate actions to put in place more rigorous and formal (documented) processes to support the daily plant cleaning routine and the major mining equipment inspection controls. For example, based on the adequacy assessment discussions, it appears that:

- The delivery and the content of the training for these tasks is quite informal, thereby leaving room for gaps and inconsistencies to arise, which will undermine the effectiveness of these controls.
- There is little or no documentation defining the daily plant cleaning routine (how to undertake the task, required standard of cleaning, equipment requirements, access methods, etc.), which similarly has the potential to lead to inconsistencies and poor control performance.

3.7 Select risk reduction actions & estimate the predicted risk

3.7.1 Risk reduction actions

A total of 78 risk reduction actions (see Appendix D) were identified during the SQRA and it is predicted that completion of all actions will achieve approximately 34% risk reduction. The risk reduction actions consist of:

- Critical control improvement actions; and
- Potential controls identified on the bow tie diagrams that were selected for implementation.

The Risk Reduction Spreadsheet (provided as an external document) outlines each of the risk reduction actions and can be used as an action tracking tool.

It is recommended that the site management review the proposed risk reduction actions to develop a final risk reduction plan that includes accountabilities, resources and timeframes.

3.7.2 Predicted risk

The predicted risk takes into account the successful implementation of identified risk reduction actions, noting the estimated effect these would have on risk reduction. The overall predicted risk was estimated to be 0.003 fatalities per annum or approximately one fatality every 308 years. This represents around 34% reduction in the risk level as highlighted in Figure 3.4.

A summary of the current risk and predicted risk results for each risk scenario is shown in Table 3-6, which includes an estimate of the percentage risk reduction expected. The overall risk comparison is shown in Figure 3.4.

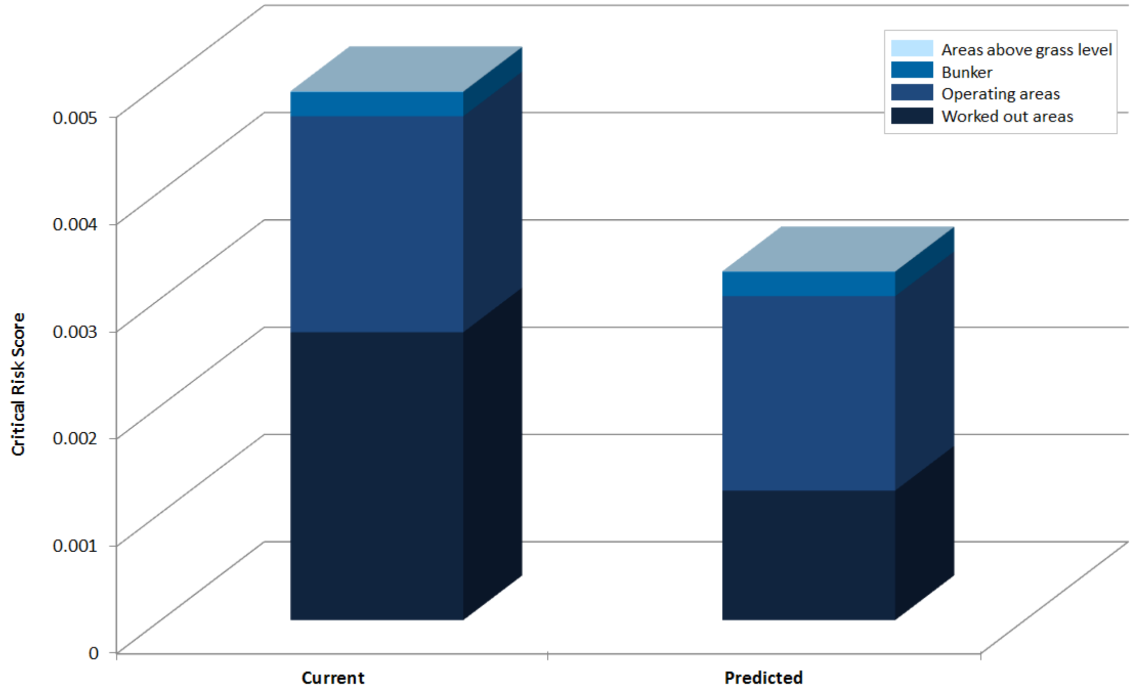


Figure 3.4 Current Risk vs. Predicted Risk

Table 3-6 SQRA results summary (current and predicted)

Current Scenario Rank	Scenario	Current Risk	1 Fatality Every… (years)	% of Overall Current Risk	Predicted Risk	1 Fatality Every… (years)	% of Overall Predicted Risk	% Risk Reduction
1	Worked out areas	2.68E-03	373	54%	1.21E-03	828	37%	55%
2	Operating areas	2.01E-03	497	41%	1.81E-03	552	56%	10%
3	Bunker	2.28E-04	4,384	5%	2.28E-04	4,384	7%	0%
4	Areas above grass level	5.05E-06	197,961	0.1%	4.37E-06	228,645	0.1%	13%
Total		**4.93E-03**	**203**	**100%**	**3.25E-03**	**308**	**100%**	**34%**

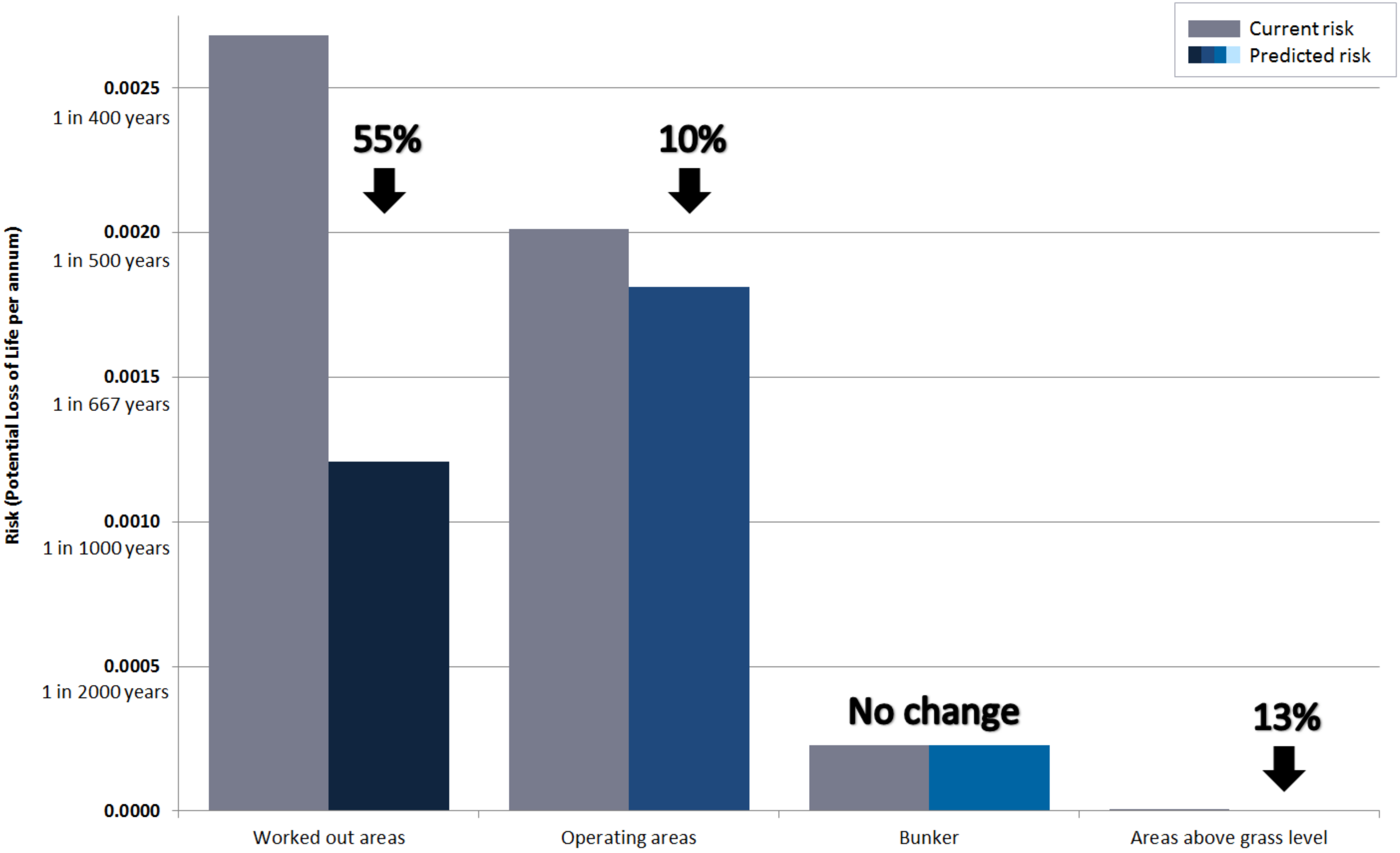


Figure 3.5 Predicted Risk Profile by Scenario

3.8 Reporting and implementation planning

As noted in Section 3.7.1, a 34% reduction in risk is predicted if the identified risk reduction actions are fully completed. The listed control measures should be implemented throughout the Mine where reasonably practicable in order to achieve the greatest fire risk reduction. Key actions that are predicted to achieve the greatest risk reduction are as follows:

- Improvements targeting weak spots in the critical control clay capping or crushed rock - exposed coal in worked out & operating areas, in particular:
  - Develop and implement a dump management procedure to prevent coal (including coal mixed with the overburden material) being placed on the surface of the overburden dump (where it could be ignited by embers from a nearby fire); and
  - Finalise and roll out the updated Mine Fire Service Policy & Code of Practice (which has recently been in development) as the new document includes a number of improvements in the clay capping sections.
- An action to resolve a gap identified in another critical control, the mine fire water system:
  - A number of areas on site do not currently meet the requirements of the fire policy with respect to access to the fire water system and/or tanker filling capability being within five minutes away. Compile a list of these discrepancies and rectify.
- Covering the worked out batters and floor with non-combustible material, which is expected to provide considerable risk reduction by preventing coal fires from occurring in these locations.
- Implementation of a vegetation management plan, which will provide significant risk reduction by reducing the quantity of material available to fuel a fire starting or escalating.
- Putting in place multiple fire breaks within the site, to reduce the ability of any fire to escalate to additional areas of the mine lease.
- Providing specific PPE (in line with the CFA PPE) to site personnel engaged in firefighting, which is predicted to considerably reduce the chance of injury and fatality during firefighting.

Achieving the 34% risk reduction evaluated during the predicted Risk step is dependent upon successful completion of the implementation plan.

4. Recommendations

The recommendations arising from the risk assessment are described below.

- It is recommended that GDF SUEZ complete the update the Mine Fire Service Policy & Code of Practice and use this document as the system design and operational standards for use by GDF SUEZ and other design parties. Also the design and operational standards should include any changes in the expectations of the fire system to be a current standard for 2015.
- One of the six identified critical controls is predicted to achieve a high level of adequacy after implementation of the risk reduction actions (when using the SQRA process). It is recommended that GDF SUEZ undertake further work to develop additional improvement actions to raise the predicted adequacy level of the critical controls (so far as is reasonably practicable). As part of this, it is recommended that the site generate actions to put in place more rigorous and formal (documented) processes to support the daily plant cleaning routine and the major mining equipment inspection controls, as currently there appears to be a reliance on informal practices for some key aspects of these controls.
- Risk assessment alone does not manage risk. Reducing and managing the risk of coal fire leading to a fatality at Hazelwood requires thorough implementation of identified risk reduction actions and maintenance of the critical controls:
    - Management should review the proposed risk reduction actions to develop a final implementation plan that includes accountabilities, resources and timeframes, and carry out the plan.
    - It is recommended that GDF-SUEZ audit activities be focused on the critical controls to ensure their effectiveness and robustness. It is also recommended that critical control performance standards and monitoring program be developed and rolled out to track the performance of critical controls. A suitable monitoring program will identify any gaps in critical control performance, resolve identified problems and maintain focus on the controls so that their effectiveness does not diminish through time. Conducting an initial in field critical control performance verification would be a beneficial step in performance standard development, allowing draft performance standards to be tested and providing initial performance data to aid setting performance targets.
- In completing the risk assessment work, the SQRA team selected the fire protection controls that they believe are the most realistic and practical options for protecting the exposed coal surfaces. Consideration should be given to undertaking additional analysis to support the case for these being the most effective options for the worked out area.
- Not all personnel were able to attend the workshops due to operational constraints. It is recommended that a post risk assessment review be carried out by appropriate specialists to review the risk reduction items to ensure no items were missed due to availability of personnel.
- Documentation relating to each Critical Control was not always available in the workshops (for example the daily checklists prompting cleaning and the relevant training packages when assessing the daily plant cleaning routine). It is recommended that this be reviewed post risk assessment to inform the adequacy assessment and also that the documentation can be referenced.

Additional Recommendations

- The output of the risk process should be communicated to all relevant personnel on site to maximise the benefits of the process.
- It is recommended that the risk assessment be updated at a regular interval as appropriate so it remains a reflection of the current coal fire risk on site and so that risk reduction efforts maintain focus on the most appropriate areas.
- Unless adequately covered by other risk assessment processes, it is recommended that the site expand the SQRA analysis to cover all major mining hazards applicable to the Hazelwood mine, to gain increased confidence that the fatality risks are being managed and that the level of risk has been reduced so far as is reasonably practicable. A hazard identification exercise, to confirm all hazards have been identified, should form part of this process.

5. Conclusions

A risk assessment was undertaken for the GDF SUEZ Hazelwood mine looking at the risk of a coal fire. Semi Quantitative Risk Assessment methodology was used to complete the risk assessment, and was conducted within a workshop setting to draw on the operational experience of site personnel.

The current (pre-fire season) risk was estimated to be 0.005 fatalities per annum or approximately one fatality every 203 years for the operation. The risk of coal fire within the mine lease was considered for the worked out area, the operating area, the bunker and areas of site above grass level. Fire in the worked out areas was determined to be the largest contributor to the overall risk, accounting for 54% of the current risk. The risk for the operating area was the second highest, contributed 41% of the current risk.

Six controls were identified as critical for the coal fire risk. All of these were assessed for adequacy and it was found that none of them currently meet an adequacy rating of “high”. A total of 78 risk reduction actions were identified during the SQRA. If all identified risk reduction actions are implemented successfully, it is anticipated that one of the assessed controls will achieve a “high” rating and a further five of the controls will achieve a “satisfactory” rating. Given these are the controls which are being relied upon to prevent fatalities from occurring due to a coal fire, it is recommended that additional work be undertaken to develop further improvement actions to raise their predicted adequacy level.

If implemented as defined, it was estimated that the risk reduction actions will achieve approximately a 34% reduction in the coal fire risk level, resulting in a predicted risk of 0.003 fatalities per annum or approximately one fatality every 308 years. The SQRA Risk Reduction spreadsheet contains the list of risk reduction actions.

A number of additional tasks are required, including:

- Resolving mine fire water system philosophy uncertainties;
- Conducting further work on the critical control adequacy assessments, including identifying additional risk reduction actions to raise the level of control adequacy; and
- Developing an implementation plan for the risk reduction actions that includes accountabilities, resources and timeframes.

It is also recommended that:

- Critical control performance standards and monitoring be developed and rolled out to track the critical controls;
- Consideration should be given to undertaking additional analysis to support the case for the selected the fire protection controls for the worked out area.

6. Glossary of terms & abbreviations

Table 6-1 Glossary of terms

Term	Definition
Consequence	The impact of an event expressed qualitatively or quantitatively, being a loss, harm, disadvantage or gain.
Frequency	A measure of the rate of occurrence of an event expressed as the number of occurrences of an event in a given time. The most common timeframe in risk assessment is per annum.
Major incident hazard[2]	Any activity, procedure, plant, process, substance, situation or any other circumstance that could cause, or contribute to causing, a major incident.
Major incident[2]	An uncontrolled incident, including an emission, loss of containment, escape, fire, explosion or release of energy, that (a) involves Schedule 9 materials; and (b) poses a serious and immediate risk to health and safety.
Major mining hazard[2]	A mining hazard that has the potential to cause an incident that would cause, or pose a significant risk of causing, more than one death.
Risk	An uncertain event that if it occurs will have an impact upon the achievement of objectives (both upside and downside). It is evaluated in terms of the likelihood and consequence/s.

Table 6-2 Abbreviations

Abbreviation	Definition
CFA	Country Fire Authority (of Victoria)
PLL	Potential Loss of Life (per annum)
PPE	Personal Protective Equipment
SEC	State Electricity Commission (of Victoria)
SQRA	Semi Quantitative Risk Assessment

[2] Occupational Health and Safety Regulations 2007 (Victoria)

Appendices

Appendix A – Attendance Lists

All sessions held onsite at the Hazelwood Mine

Table A6-1 Attendance list – Full team sessions

Name	Position / Title	Organisation	Experience (years)	18/11/14	19/11/14	22/01/15
Katrina Cook	Facilitator	GHD	13	✓	✓	✓
Matthew Weir	Technical Scribe	GHD	5	✓	✓	×
Michael West	Technical Scribe	GHD	8	×	×	✓
Anthony Battista	Technical Electrician	GDF SUEZ	6	✓	✓	✓
Terry Best	Operator 2x12	GDF SUEZ	31	✓	×	×
Marc Callow	Maintainer	GDF SUEZ	37	✓	✓	✓
Rick Foster	Operator 2x12	GDF SUEZ	6	×	✓	×
Steve Gould	Senior Mechanical Engineer	GHD	40	✓	✓	✓
Stan Kemsley	Tech. Compliance Manager	GDF SUEZ	32	✓	✓	♦
Michael Laird	Principal Projects Engineer	GHD	30	✓	✓	✓
Tony Marino	Fitter / Operator	GDF SUEZ	26	✓	✓	×
Romeo Prezioso	Senior Mine Planner	GDF SUEZ	31	✓	✓	✓
David Shanahan	Services Superintendent	GDF SUEZ	30	✓	✓	✓

Legend ✓ Attendance; × Did not attend; ♦ Attendance for part of the session

Table A1-2 Tasks undertaken – Full team sessions

Day	Topics
18/11/14	Hazard dynamics
19/11/14	Hazard dynamics, current risk profile, critical control selection
22/01/15	Confirmation of actions developed by small groups, selection of potential controls for implementation & predicted risk profile

Table A1-3 Attendance list – Small group adequacy assessment sessions

Name	Position / Title	Organisation	Experience (years)	20/01/15				21/10/15	
				Operational Cleaning	Equipment Inspection	Fire Readiness	Fire water system	Clay capping	Hot Spots Procedure
Katrina Cook	Facilitator	GHD	13	✓	✓	✓	✓	✓	✓
Michael West	Technical Scribe	GHD	8	✓	✓	✓	✓	✓	✓
Geoff Crisp	Operator 2x12	GDF SUEZ	28	✓	✓	×	×	×	×
Paul Drenen	Belt Splicer	Belle Banne	30	✓	×	×	×	×	×
Steve Gould	Senior Mechanical Engineer	GHD	40	×	×	×	✓	×	×
Gary Honeychurch	O/B Field Engineer	GDF SUEZ	27	✓	✓	×	×	×	×
Stan Kemsley	Tech. Compliance Manager	GDF SUEZ	32	♦	♦	×	♦	♦	♦
Mark Knight	Leading Hand / Operator	GDF SUEZ	12	×	×	×	×	×	✓
Robert Mansell	Geotechnical Supervisor	GDF SUEZ	49	×	×	×	×	×	✓
Tony Marino	Fitter / Operator	GDF SUEZ	26	×	×	×	✓	×	×
Romeo Prezioso	Senior Mine Planner	GDF SUEZ	31	×	×	×	×	✓	×
David Shanahan	Services Superintendent	GDF SUEZ	30	×	×	✓	✓	✓	✓
Dean Suares	1x7 Superintendent	GDF SUEZ	30	×	✓	✓	×	×	×

Legend ✓ Attendance; × Did not attend; ♦ Attendance for part of the session

Appendix B – SQRA Methodology

Semi Quantitative Risk Assessment (SQRA^{TM}) uses operational experience, supplemented by industry statistics where they are known and considered valid. It is generally perceived as being the most rigorous form of risk assessment available for those industries where reliable and accurate failure statistics have not been well recorded on an industry wide basis and where site-specific conditions predominate.

The SQRA process involves the following seven steps:

1. Identify the hazards;
2. Describe hazard dynamics (bow tie diagrams);
3. Determine current risk profile;
4. Identify critical controls;
5. Assess the adequacy of the critical controls;
6. Select risk reduction actions and estimate the predicted risk profile;
7. Reporting and improvement planning.

B.1 Hazard Identification (HAZID)

The first stage in the SQRA process involves the identification of the hazards present. This includes the identification of the risk scenarios that may result in exposure to the hazard. The development of this list is a key step in the SQRA process as it determines which hazards are carried through the rest of the process.

Existing hazard studies and risk assessment information can be used along with a number of guidewords provided by the facilitator to ensure that all hazards relevant to the site are captured.

B.2 Understanding the Dynamics of the Hazards

The next stage of the SQRA process requires that a comprehensive understanding of the dynamics of each hazard be developed. As for the initial identification of the hazards, this step is performed in a workshop format.

The workshop team, under the guidance of the GHD facilitator and using the experience of those present, looks at each hazard individually to detail the potential causes and pathways that lead to the incident, as well as the consequences should the incident occur. The controls that are in place to prevent the incident eventuating, or to mitigate the consequences, are also identified.

The data from these workshops is represented pictorially using a bow tie diagram. The bow tie diagram is used as a visual tool to assist with the risk assessment workshops throughout the remaining stages of the process.

Figure B-1 below shows an example bow tie diagram. At the centre of the bow tie is the initiating event (or incident). The position of the initiating event shows the point of loss of control of the hazard (e.g. dropped object, fire, collision, loss of containment).

No probabilities are shown on the bow tie diagram, as its purpose is to represent the dynamics of the hazard in order to assist with further analysis. However some information generated later in the process, such as which controls are identified as being critical, is also included on the bow tie.

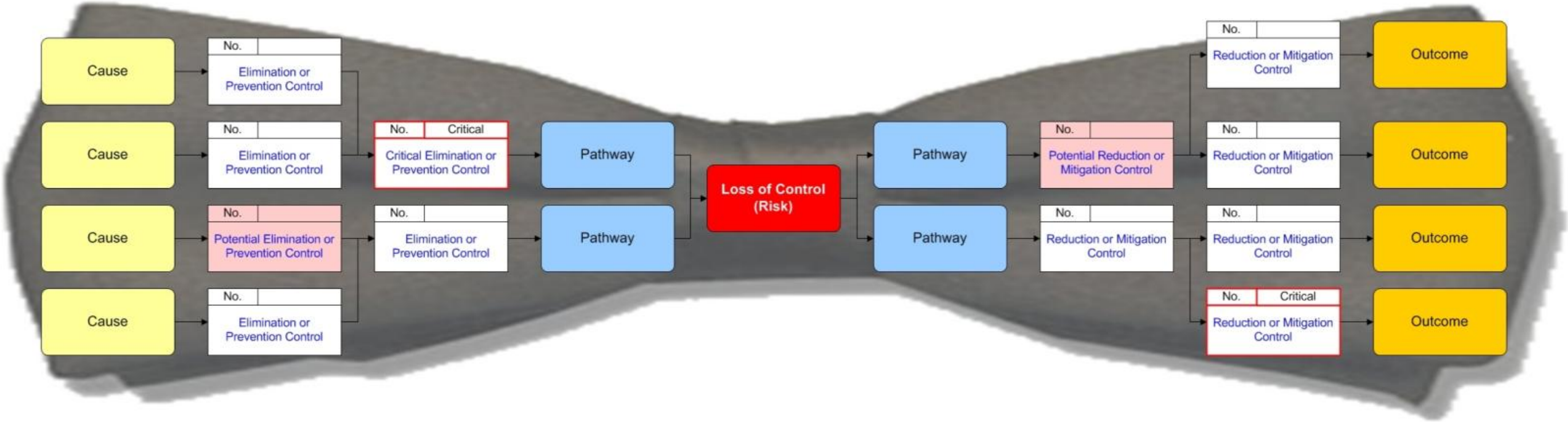


Figure B-1 Example Bow Tie Diagram

B.3 Assessment of Risks from the Hazards (Current Risk)

A semi quantitative risk assessment is carried out for each risk scenario carried forward from the hazard identification study. The SQRA provides a semi quantitative estimate of the risk for each risk scenario based on:

- The greater understanding of the hazard dynamics developed by the team during the bow tie development;
- Any site-specific (incident and operating history) and industry-wide data available; and
- Experience and knowledge of personnel in the workshop team.

The risk value estimated is the Potential Loss of Life (PLL) which represents fatalities per annum (i.e. per operating year). PLL in this assessment gives an indication of the predicted number of fatalities per year due to the hazards. PLL is determined for each risk scenario as well as overall.

For a given risk scenario, PLL is a product of the likelihood of occurrence and consequence:

$$\textbf{Risk (PLL)} = \textbf{Likelihood} \times \textbf{Consequence}$$

It is calculated via the formula:

$$\textbf{PLL} = \textbf{Event Frequency} \times \textbf{Probability of Fatality} \times \textbf{Average Number of Fatalities}$$

Likelihood is estimated as the frequency of the initiating event (occurrences per year) for a risk scenario.

The consequence analysis requires workshop attendees to assess the distribution of fatalities for that risk scenario by assigning an estimate of the percentage likelihood for each of the available fatality options:

1	Single Fatality
2	Two fatalities
3 – 5	Between three and five fatalities
6 – 9	Between six and nine fatalities
10+	Ten or more fatalities

It should be noted that there is no absolute criteria or target for PLL. However in the case of SQRA, PLL provides the platform for risk-based selection of critical controls for the dominant causal pathways in a given hazard. It is the analysis of the critical controls via detailed Adequacy Assessment and the selection of potential controls for implementation that ultimately demonstrates risk acceptability as being reduced so far as is reasonably practicable. Calculating the PLL for each risk scenario also allows the hazards to be ranked and prioritised based on their level of risk. This enables the site to focus on and target the dominant hazards in the fatality risk profile during the risk reduction process[3].

The current risk provides an estimate of the risk as it exists for current conditions (i.e. a snapshot of the risk at the time of the risk assessment). It considers all current controls, procedures and personnel for the identified hazards.

An example output risk profile is shown below in Figure B-2.

[3] The scope of the current risk assessment work involves only one risk, so ranking of risks is not relevant and a risk profile has not been produced.

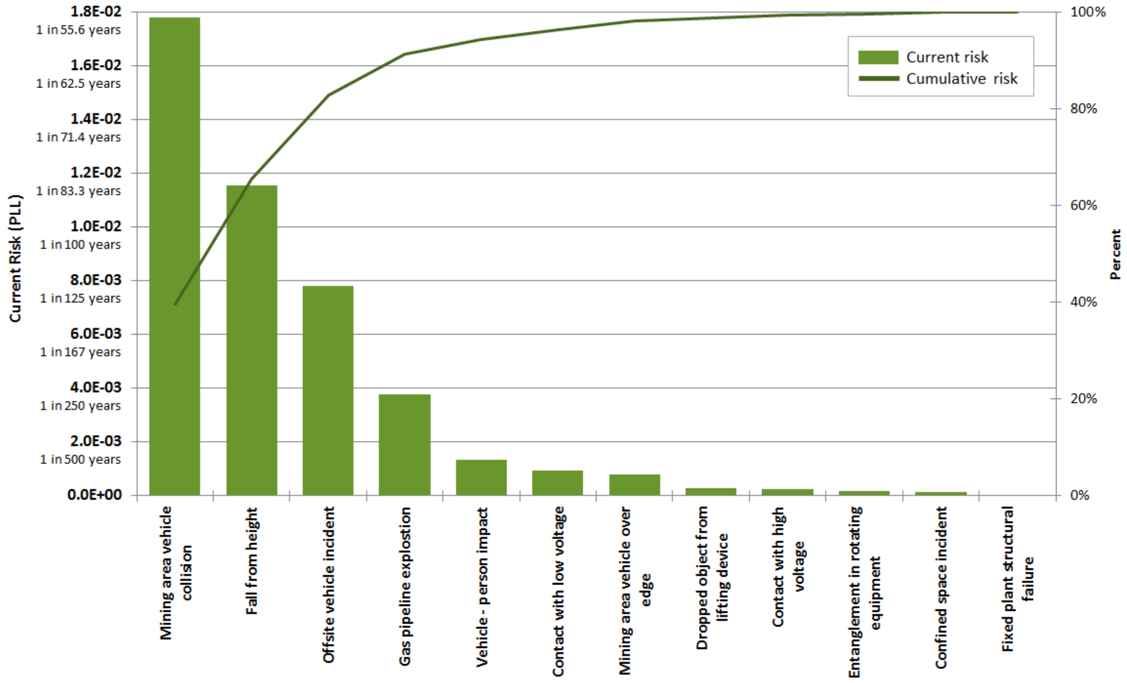


Figure B-2 Example Risk Profile

B.4 Identification of Critical Controls in Managing Risks

Following establishment of the current case risk profile, each risk scenario is analysed to determine dominant causal pathways and identify critical controls for those pathways.

Critical controls are the small number of controls that:

- Are heavily relied upon to prevent the incident or mitigate the severity of the consequence; and
- Are crucial to the safe operation of the site.

Dominant pathways for a risk scenario are determined by dividing the overall risk of the hazard across the various causal pathways by way of percentage risk. In assigning percentage of hazard risk to causal pathways workshop participants take into account the likelihood of the incident occurring due to each pathway over others.

In identifying the critical controls for a given pathway, workshop participants refer to the bow tie diagrams and consider the following:

- Which cause or causes in the pathway are most likely to lead to the incident;
- The hierarchy of controls (e.g. Elimination, Substitution, Engineering, Administrative, PPE);
- Where multiple hazards are being assessed, comparison of the risk level for each pathway against pre-determined criticality criteria, which in turn generates a control classification for the pathway (i.e. number of critical controls required for that pathway);
- Control duplication/repeatability throughout the hazard.

The SQRA Database is updated throughout the process to show which controls are critical. It is also used to record the allocation of hazard risk to the causal pathways.

B.5 Critical Control Adequacy Assessment

The next step in the SQRA process is to review the adequacy of the critical controls.

The critical control adequacy assessment is a detailed assessment of the current adequacy of each critical control and includes the identification of recommended actions required to improve a control's adequacy. The target for each critical control is to achieve a high adequacy rating where practicable.

The adequacy assessment reviews the control against detailed checklists under the headings:

- Planning / Design;
- Implementation;
- Workforce Involvement; and
- Monitoring.

An adequacy rating (Very High, High, Adequate, Fair, Poor) is given to each of the above areas and each rating is considered in relation to the overall adequacy of the control. Notes and assumptions supporting the adequacy assessment are recorded under each heading and recommended actions are captured.

B.6 Risk Reduction Actions & Revision of SQRA (Predicted Risk)

Following identification of risk reduction actions in the control adequacy review, the SQRA for each risk scenario is revisited and a Predicted Risk assessment completed. This revision takes into account the effect of any relevant actions on the frequency of the initiating event and/or the consequence/s of the outcome event.

Actions assessed in the predicted SQRA may include:

- Relevant recommended actions from the control adequacy review; and
- Potential additional controls identified during the HAZID (bow tie development) and selected for implementation.

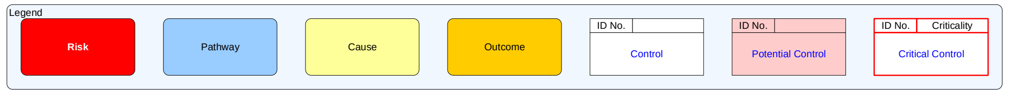
The methodology of the predicted SQRA is the same as the current case SQRA approach described above. A qualitative assessment (high, medium, low) of the contribution to the risk reduction by each action is also recorded in the SQRA Database.

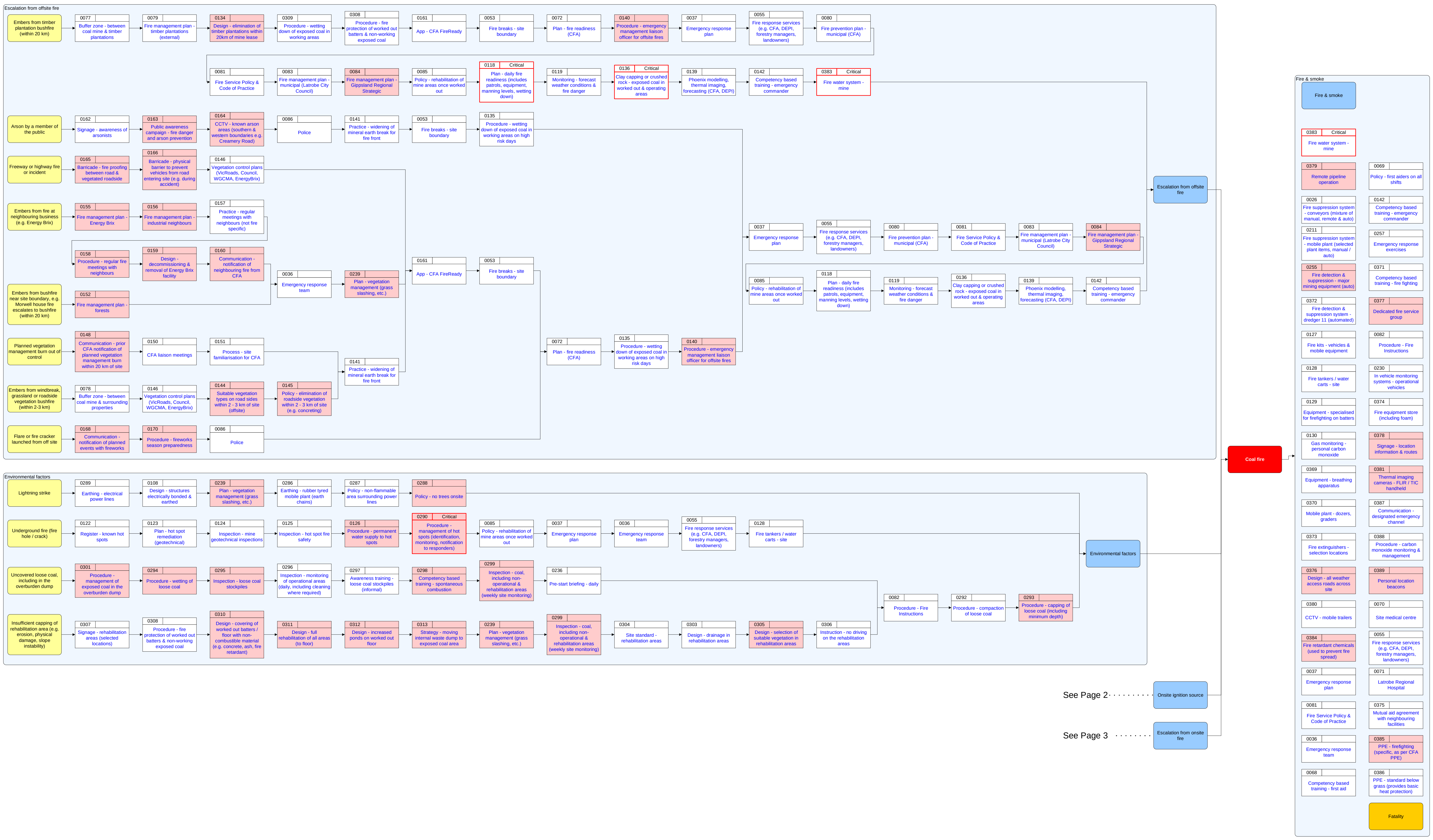
B.7 Risk Reduction Plan

After completion of the SQRA workshops, a review of the risk reduction actions is undertaken by the management team of the site. Based on this review, an implementation plan should be developed which involves the details of the actions to be completed, responsibilities and due dates. The SQRA Database may be used in conjunction with the SQRA Risk Reduction spreadsheet to assist in the development of the implementation plan for the organisation and the ongoing management of the actions.

Appendix C – Bow Tie Diagram

Operation	Hazelwood Mine
Hazard Type	Thermal / Fire / Explosion
Risk No	1
Risk	**Coal fire**
SQRA Date	18 Nov 2014

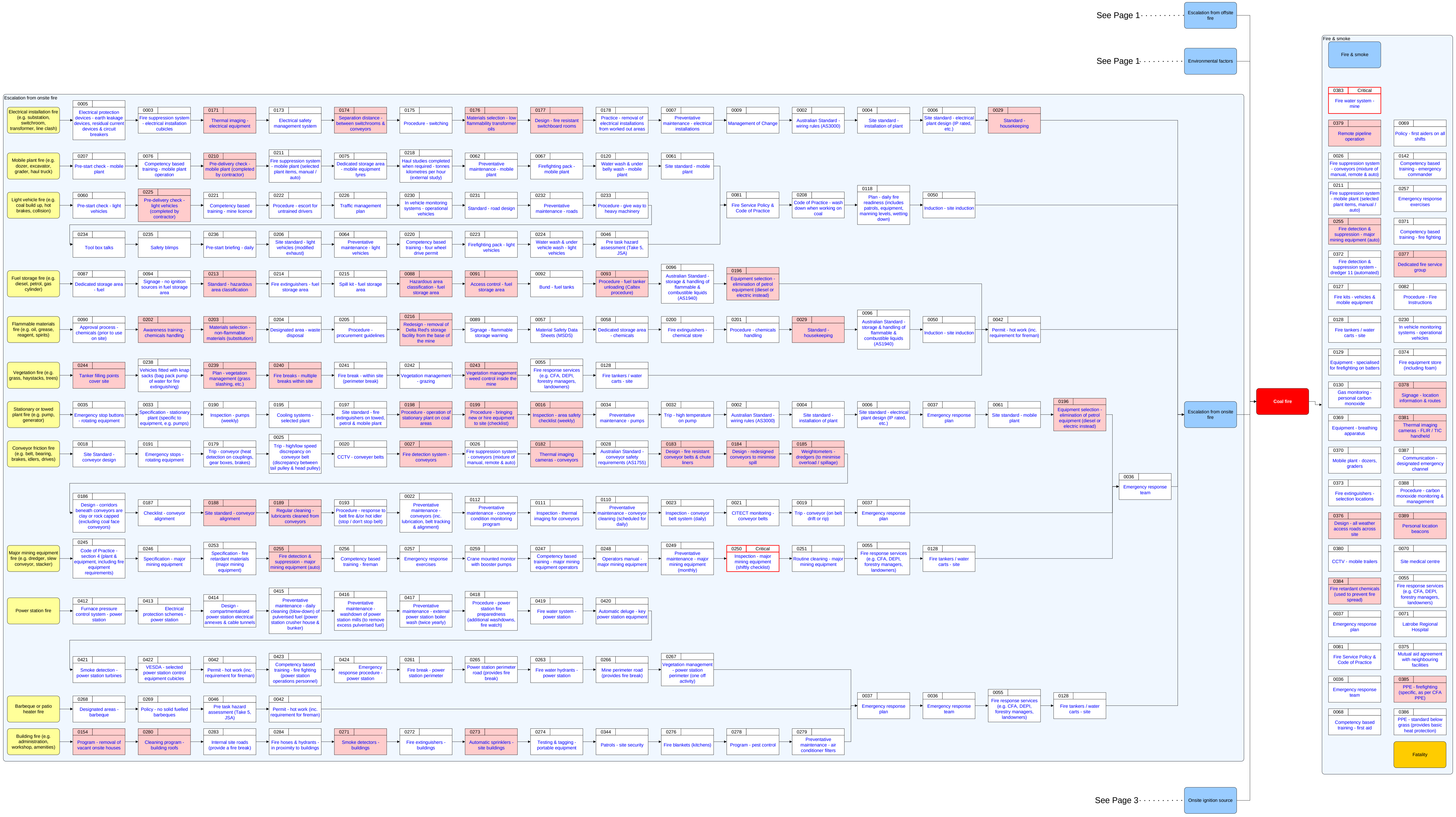




Operation	Hazelwood Mine
Hazard Type	Thermal / Fire / Explosion
Risk No	1
Risk	Coal fire
SQRA Date	18 Nov 2014

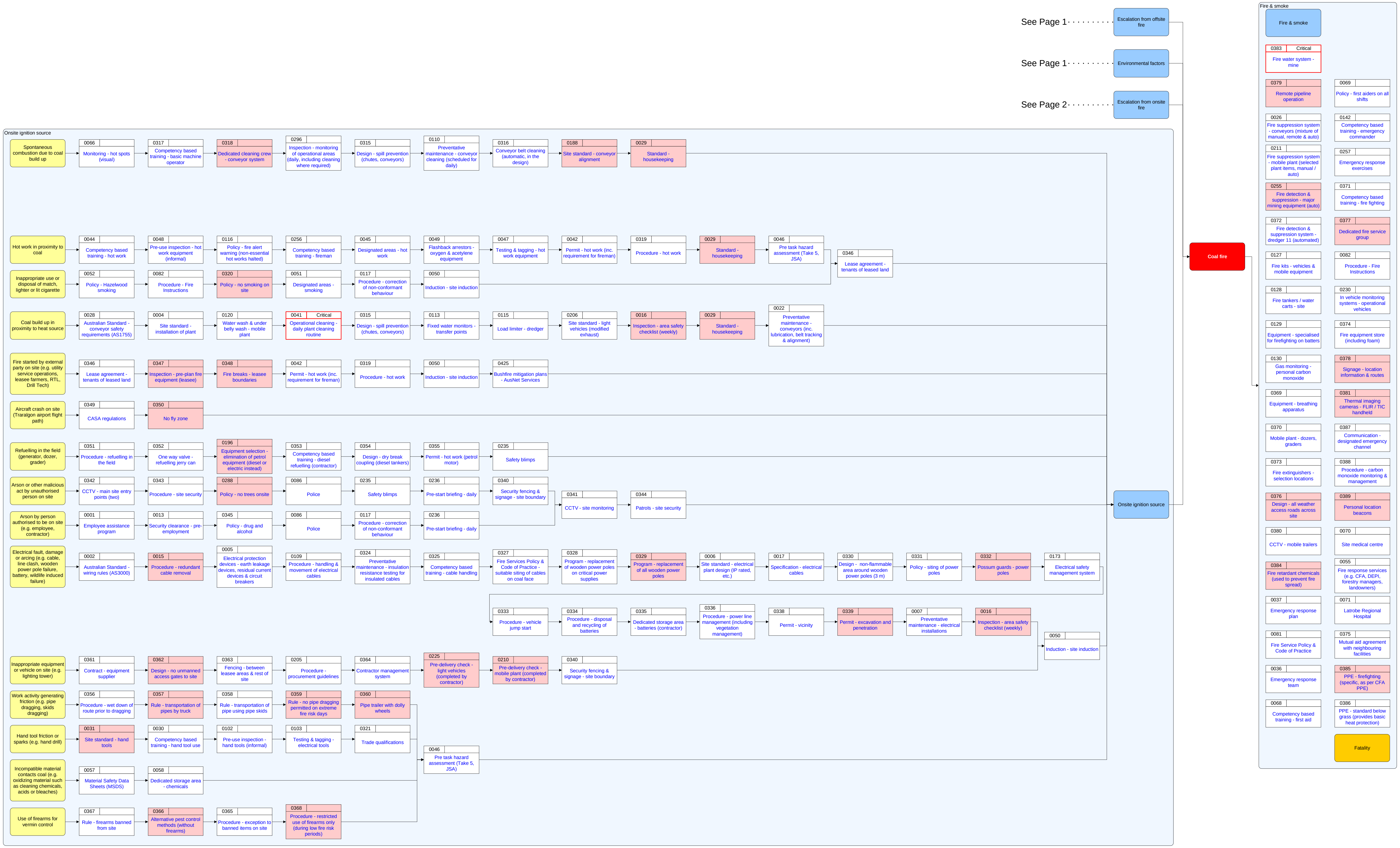
Legend

Risk	Pathway	Cause	Outcome	ID No. Control	ID No. Potential Control	ID No. Criticality Critical Control



Legend: Risk | Pathway | Cause | Outcome | ID No. Control | ID No. Potential Control | ID No. Criticality Critical Control

Operation	Hazelwood Mine
Hazard Type	Thermal / Fire / Explosion
Risk No	1
Risk	**Coal fire**
SQRA Date	18 Nov 2014



Appendix D – Risk Reduction Actions

Risk Reduction Spreadsheet

Hazelwood Mine			
Workshop Date:	22-Jan-15		
Last Revised Date:	22-Jan-15		
Overall Base Case Risk	4.93E-03		
Overall Predicted Case Risk	3.25E-03		
% Predicted Risk Reduction	34.0%		
Start of Period % Risk Reduction	0.0%	Start of Period Date	01-Feb-15
End of Period % Risk Reduction	0.0%	End of Period Date	
% Actual Risk Reduction	0.0%		

Instructions:
Enter the Position Responsible, due date, status and Percent Complete in this sheet.
The "Risk Reduction Spreadsheet" sheet will update automatically based on the information entered here.

Action No.	Action	Predicted Impact on Risk Reduction	Related Control	Critical/ Potential	Position Responsible	Due Date	Status	Percent Complete		% Overall risk reduction
								Start of Period	End of Period	
50	Implement the Potential Control - 0239 Plan - vegetation management (grass slashing, grazing, etc.)	High	0239 - Plan - vegetation management (grass slashing, etc.)	Potential				0%	0%	1.8803%
51	Implement the Potential Control - 0240 Fire breaks - multiple breaks within site	High	0240 - Fire breaks - multiple breaks within site	Potential				0%	0%	1.8803%
69	Implement the Potential Control - 0310 Design - covering of worked out batters / floor with non-combustible material (e.g. concrete, ash, fire retardant, water)	High	0310 - Design - covering of worked out batters / floor with non-combustible material (e.g. concrete, ash, fire retardant)	Potential				0%	0%	1.8803%
101	Implement the Potential Control - 0385 PPE - firefighting (specific, as per CFA PPE)	High	0385 - PPE - firefighting (specific, as per CFA PPE)	Potential				0%	0%	1.8803%
138	A number of areas on site do not currently meet the requirements of the fire policy with respect to access to the fire water system and/or tanker filling capability being within 5 minutes away. Compile a list of these discrepancies and rectify.	High	0383 - Fire water system - mine	Critical				0%	0%	1.8803%
144	Finalise and roll out the updated Mine Fire Service Policy & Code of Practice which is currently in development (and includes improvements to the sections relating to clay capping).	High	0136 - Clay capping or crushed rock - exposed coal in worked out & operating areas	Critical				0%	0%	1.8803%
146	Develop and implement a dump management procedure to prevent coal (including coal mixed with the overburden material) being placed on the surface of the overburden dump (where it could be ignited by embers from a nearby fire).	High	0136 - Clay capping or crushed rock - exposed coal in worked out & operating areas	Critical				0%	0%	1.8803%
21	Implement the Potential Control - 0027 Fire detection system - conveyor drive heads	Med	0027 - Fire detection system - conveyors	Potential				0%	0%	0.5641%
55	Implement the Potential Control - 0255 Fire detection & suppression - major mining equipment (auto)	Med	0255 - Fire detection & suppression - major mining equipment (auto)	Potential				0%	0%	0.5641%
62	Implement the critical potential control as described in the adequacy assessment - 0290 Procedure - management of hot spots (removal, monitoring, capping, etc.)	Med	0290 - Procedure - management of hot spots (identification, monitoring, notification to responders)	Critical Potential				0%	0%	0.5641%
85	Implement the Potential Control - 0348 Fire breaks - leasee boundaries	Med	0348 - Fire breaks - leasee boundaries	Potential				0%	0%	0.5641%
95	Implement the Potential Control - 0376 All weather access roads across site	Med	0376 - Design - all weather access roads across site	Potential				0%	0%	0.5641%
97	Implement the Potential Control - 0378 Signage - location information & routes	Med	0378 - Signage - location information & routes	Potential				0%	0%	0.5641%
104	Update the Dredger Driver's Report checklists to include a line item to complete the daily plant cleaning routine.	Med	0041 - Operational cleaning - daily plant cleaning routine	Critical				0%	0%	0.5641%
107	Implement a formal requirement for each shift to take follow-up action if daily plant cleaning problems have been identified on the shift report / Shift Supervisor's daily report from the previous shift (for example if the previous shift were unable to address a coal build-up in a particularly location, this information is passed onto the next shift for action).	Med	0041 - Operational cleaning - daily plant cleaning routine	Critical				0%	0%	0.5641%

Action No.	Action	Predicted Impact on Risk Reduction	Related Control	Critical/ Potential	Position Responsible	Due Date	Status	Percent Complete		% Overall risk reduction
								Start of Period	End of Period	
109	Redesign the Dredge Drivers Log to: (1) Clearly differentiate between pre-start, in-shift and post-use tasks (2) Provide answer boxes to suit all situations (For example currently some tasks have only yes or no answers, yet these checks are not always relevant. This leads to the line item being left blank, and it is later unclear if the item was missed or not relevant. This can be solved by adding a "not applicable" option) (3) Clearly identify that the dredger should not be operated if a critical check item is failed (Currently there is no information or indication provided on the form, so it is not clear that the equipment should not be operated in this circumstance) (4) Include a check of the discharge boom connection point (5) Reword the check item on fire hoses to "available at machine" instead of "on the rack", as this more accurately reflects requirements (6) Require the use of initials in the answer boxes rather than ticks (to address the current issue that some personnel fail to sign the form after filling it in).	Med	0250 - Inspection - major mining equipment (shiftly checklist)	Critical				0%	0%	0.5641%
110	Develop and implement a shiftly inspection checklist for mobile slews which includes checks for fire preparedness. The checklist should cover the slew when connected to dredger and when parked up.	Med	0250 - Inspection - major mining equipment (shiftly checklist)	Critical				0%	0%	0.5641%
111	Confirm that the fire policy clearly defines the procedure to prevent fire escalation on unmanned dredgers, in particular the selection of the spray system to be connected: birds' mouth (to prevent a fire starting on machine) or rotary sprays (to wet the area and protect the machine from external fire). If not, update the document to provide this information.	Med	0250 - Inspection - major mining equipment (shiftly checklist)	Critical				0%	0%	0.5641%
112	Update the pre-start inspection checklist for the stacker to reflect the required standard including: (1) Clearly identify that the equipment should not be operated if a critical check item is failed (2) Include additional fire preparedness checks (number of fire hoses in fire rack, inspection of hose up point) (3) Ensure the checks / questions are clear and user-friendly.	Med	0250 - Inspection - major mining equipment (shiftly checklist)	Critical				0%	0%	0.5641%
115	Involve representatives from each group of people who use the forms in the redesign of the Dredge Drivers Log, the update of the stacker checklist and the development of the shiftly inspection checklist for mobile slews to ensure the forms are user-friendly and well designed for the both the personnel who fill in the forms and those who use the recorded information. As a minimum operators, mine planning and the production superintendent must be involved.	Med	0250 - Inspection - major mining equipment (shiftly checklist)	Critical				0%	0%	0.5641%
118	Develop and implement a monitoring program to track compliance with and effectiveness of the major mining equipment shiftly inspection checklist. The monitoring program should include confirming that the checklists are correctly and completely filled out and signed, as well as that the appropriate action is taken upon identifying any issues during the check.	Med	0250 - Inspection - major mining equipment (shiftly checklist)	Critical				0%	0%	0.5641%
124	Develop and implement formal competency based training programs in the daily fire readiness plan (covering theoretical and practical aspects) for management, supervisors, operators and control centre attendants (i.e. four role-specific packages).	Med	0118 - Plan - daily fire readiness (includes patrols, equipment, manning levels, wetting down)	Critical				0%	0%	0.5641%

Action No.	Action	Predicted Impact on Risk Reduction	Related Control	Critical/ Potential	Position Responsible	Due Date	Status	Percent Complete		% Overall risk reduction
								Start of Period	End of Period	
125	Develop and implement a monitoring process to track compliance with and effectiveness of the daily fire readiness plan and to ensure that any identified problems are reported and rectified.	Med	0118 - Plan - daily fire readiness (includes patrols, equipment, manning levels, wetting down)	Critical				0%	0%	0.5641%
128	The site has implemented a back up power supply for the fire water system. Obtain verification / certification from an independent electrical engineering specialist to confirm that the back up power system does provide redundancy as expected. If any gaps in the independence of the backup system are identified by the independent specialist, rectify.	Med	0383 - Fire water system - mine	Critical				0%	0%	0.5641%
130	Develop a formal, controlled document (e.g. procedure, guideline) that defines how to operate the fire water system for the different situations that may arise (e.g. typical fire response, situations that place a higher demand on the system, upon pump failure).	Med	0383 - Fire water system - mine	Critical				0%	0%	0.5641%
139	Develop and implement competency-based, role-specific training programs, covering theory and practice, in the operation of the fire water system for personnel who are required to use the system (i.e. control centre attendants, the service team operators and 2x12 shift operators).	Med	0383 - Fire water system - mine	Critical				0%	0%	0.5641%
150	Develop and implement a regular vegetation inspection, monitoring and maintenance program for clay and crushed rock capped areas, to prevent the effectiveness of the capping being undermined by vegetation growth. As part of the development process, the standard for acceptable and unacceptable vegetation types and growth must be defined.	Med	0136 - Clay capping or crushed rock - exposed coal in worked out & operating areas	Critical				0%	0%	0.5641%
168	Implement the improved version of the daily fire readiness plan (which has already been drafted but has not yet been formally rolled out).	Med	0118 - Plan - daily fire readiness (includes patrols, equipment, manning levels, wetting down)	Critical				0%	0%	0.5641%
169	Develop and implement a batter wetting system (as an alternative control to the clay capping firebreak system that the Mine Fire Policy stipulates should be provided every 500m, but which is not in place) for the batter (top-to-toe) of all unrehabilitated, worked-out, non-operating face batters (i.e. including conveyor corridors, transport corridors, northern batters, eastern batters, etc.). Update the Mine Fire Policy to reflect this.	Med	0383 - Fire water system - mine	Critical				0%	0%	0.5641%
170	Define, develop and implement fire suppression requirements (i.e. continuous water supply and hoses to fight fire) for all unrehabilitated, worked-out, non-operating face batters with exposed coal (including conveyor corridors, transport corridors, northern batters, eastern batters, etc.) and update the Mine Fire Policy to reflect these fire suppression requirements.	Med	0383 - Fire water system - mine	Critical				0%	0%	0.5641%
5	Implement the Potential Control - 0140 Procedure - emergency management liaison officer for offsite fires	Low	0140 - Procedure - emergency management liaison officer for offsite fires	Potential				0%	0%	0.1880%
6	Implement the Potential Control - 0144 Suitable vegetation types on road sides within 2 - 3 km of site (offsite)	Low	0144 - Suitable vegetation types on road sides within 2 - 3 km of site (offsite)	Potential				0%	0%	0.1880%
9	Implement the Potential Control - 0148 Communication - prior CFA notification of planned vegetation management burn within 20 km of site	Low	0148 - Communication - prior CFA notification of planned vegetation management burn within 20 km of site	Potential				0%	0%	0.1880%
17	Implement the Potential Control - 0160 Communication - notification of neighbouring fire from CFA	Low	0160 - Communication - notification of neighbouring fire from CFA	Potential				0%	0%	0.1880%

Action No.	Action	Predicted Impact on Risk Reduction	Related Control	Critical/ Potential	Position Responsible	Due Date	Status	Percent Complete		% Overall risk reduction
								Start of Period	End of Period	
18	Implement the Potential Control - 0163 Public awareness campaign - fire danger & arson prevention	Low	0163 - Public awareness campaign - fire danger and arson prevention	Potential				0%	0%	0.1880%
28	Implement the Potential Control - 0171 Thermal imaging - electrical equipment	Low	0171 - Thermal imaging - electrical equipment	Potential				0%	0%	0.1880%
34	Implement the Potential Control - 0183 Design - fire resistant chute liners	Low	0183 - Design - fire resistant conveyor belts & chute liners	Potential				0%	0%	0.1880%
37	Implement the Potential Control - 0188 Site standard - conveyor alignment	Low	0188 - Site standard - conveyor alignment	Potential				0%	0%	0.1880%
38	Implement the Potential Control - 0189 Regular cleaning - lubricants cleaned from conveyors	Low	0189 - Regular cleaning - lubricants cleaned from conveyors	Potential				0%	0%	0.1880%
39	Implement the Potential Control - 0196 Equipment selection - elimination of petrol equipment (diesel or electric instead)	Low	0196 - Equipment selection - elimination of petrol equipment (diesel or electric instead)	Potential				0%	0%	0.1880%
41	Implement the Potential Control - 0199 Procedure - bringing new or hire equipment to site (checklist)	Low	0199 - Procedure - bringing new or hire equipment to site (checklist)	Potential				0%	0%	0.1880%
44	Implement the Potential Control - 0088 Hazardous area classification - fuel storage area	Low	0088 - Hazardous area classification - fuel storage area	Potential				0%	0%	0.1880%
48	Investigate - Redesign - removal of Delta Red's storage facility from the base of the mine	Low	0216 - Redesign - removal of Delta Red's storage facility from the base of the mine	Potential				0%	0%	0.1880%
56	Implement the Potential Control - 0271 Smoke detectors - buildings	Low	0271 - Smoke detectors - buildings	Potential				0%	0%	0.1880%
63	Implement the Potential Control - 0295 Inspection - loose coal stockpiles	Low	0295 - Inspection - loose coal stockpiles	Potential				0%	0%	0.1880%
84	Implement the Potential Control - 0347 Inspection - pre-plan fire equipment (leasee)	Low	0347 - Inspection - pre-plan fire equipment (leasee)	Potential				0%	0%	0.1880%
88	Implement the Potential Control - 0359 Rule - no pipe dragging permitted on extreme fire risk days	Low	0359 - Rule - no pipe dragging permitted on extreme fire risk days	Potential				0%	0%	0.1880%
90	Implement the Potential Control - 0362 Design - control access through currently unmanned access gates to site	Low	0362 - Design - no unmanned access gates to site	Potential				0%	0%	0.1880%
91	Implement the Potential Control - 0210 Pre-delivery check - mobile plant (completed by contractor)	Low	0210 - Pre-delivery check - mobile plant (completed by contractor)	Potential				0%	0%	0.1880%
92	Implement the Potential Control - 0225 Pre-delivery check - light vehicles (completed by contractor)	Low	0225 - Pre-delivery check - light vehicles (completed by contractor)	Potential				0%	0%	0.1880%
94	Implement the Potential Control - 0368 Procedure - restricted use of firearms only (during low fire risk periods)	Low	0368 - Procedure - restricted use of firearms only (during low fire risk periods)	Potential				0%	0%	0.1880%
99	Implement the Potential Control - 0381 Thermal imaging cameras - FLIR / TIC handheld	Low	0381 - Thermal imaging cameras - FLIR / TIC handheld	Potential				0%	0%	0.1880%
100	Implement the Potential Control - 0384 Investigate - Fire retardant chemicals (put out to prevent fire spread)	Low	0384 - Fire retardant chemicals (used to prevent fire spread)	Potential				0%	0%	0.1880%
103	Confirm the daily checklists for each operator area except the control room (i.e. bunker, hopper, dredgers, stackers, conveyors and one other) include a line item to complete the daily plant cleaning routine. If not, update the checklist/s to include this item.	Low	0041 - Operational cleaning - daily plant cleaning routine	Critical				0%	0%	0.1880%
105	Implement a formal, documented requirement that specifies that a trainee operator who has been trained by only one mentor cannot be assessed for competency by that same mentor.	Low	0041 - Operational cleaning - daily plant cleaning routine	Critical				0%	0%	0.1880%
106	Confirm that the self-paced learner's guide for each operator area includes the daily plant operational cleaning routine in the list of role duties at the front of the guide, and that the content of the learner's guide covers the daily plant operational cleaning routine. If not, update the learner's guide/s to include this information.	Low	0041 - Operational cleaning - daily plant cleaning routine	Critical				0%	0%	0.1880%

Action No.	Action	Predicted Impact on Risk Reduction	Related Control	Critical/ Potential	Position Responsible	Due Date	Status	Percent Complete		% Overall risk reduction
								Start of Period	End of Period	
108	Implement, at the start of each shift, a physical inspection of unmanned large mining equipment (LME) if it has been operated on the previous shift, to prevent any build-up of coal that could be ignited by surfaces still hot from the previous shift. The shift report may be the appropriate location to include this inspection.	Low	0041 - Operational cleaning - daily plant cleaning routine	Critical				0%	0%	0.1880%
113	Update the competency assessments for dredger operator, stacker operator and mobile slew operator to include a practical assessment of competency in completing the shiftly equipment inspection checklist (Dredger Drivers Log, conveyor attendant's checklist, mobile slew checklist) to assess competency in undertaking the checks as well as competency in completing the form.	Low	0250 - Inspection - major mining equipment (shiftly checklist)	Critical				0%	0%	0.1880%
116	Ensure all the three shiftly major mining equipment inspection checklists (Dredge Drivers Log, stacker checklist/s and mobile slew checklist) are controlled documents in the document controls system (and are reviewed and updated at a regular interval).	Low	0250 - Inspection - major mining equipment (shiftly checklist)	Critical				0%	0%	0.1880%
123	Develop and implement a supervisor report/log (controlled document / form) which includes a section requiring recording of the weather forecast (as this information guides the decision-making for the daily fire readiness).	Low	0118 - Plan - daily fire readiness (includes patrols, equipment, manning levels, wetting down)	Critical				0%	0%	0.1880%
126	Develop and implement a method for securely storing fire readiness plans in a central location to allow future reference and/or auditing (i.e. similar to permit system).	Low	0118 - Plan - daily fire readiness (includes patrols, equipment, manning levels, wetting down)	Critical				0%	0%	0.1880%
133	Develop P&IDs for the fire water system and upgrade the fire water system layout drawings to show additional key information (including valve numbers).	Low	0383 - Fire water system - mine	Critical				0%	0%	0.1880%
134	Implement a management of change system for the fire water system.	Low	0383 - Fire water system - mine	Critical				0%	0%	0.1880%
135	Repair or replace the flowmeters on the dirty water system.	Low	0383 - Fire water system - mine	Critical				0%	0%	0.1880%
136	Install pressure monitors at key strategic locations in the fire water system to provide system performance information.	Low	0383 - Fire water system - mine	Critical				0%	0%	0.1880%
137	Develop and implement an inspection and maintenance program for the mine drainage system, as ineffective drainage can limit the quantity of fire water that can safely be used in firefighting efforts (as high groundwater level will lead to batter instability and therefore if the drainage is not effective, less water may be used to fight the fire due to the potential for batter collapse).	Low	0383 - Fire water system - mine	Critical				0%	0%	0.1880%
140	Develop and implement a monitoring program to track the effectiveness of the fire water system, and to ensure that any identified problems are recorded and addressed.	Low	0383 - Fire water system - mine	Critical				0%	0%	0.1880%
142	Develop and implement a fire water system access inspection and maintenance regime (to identify and address problems with the access such as build-up of vegetation and unacceptable road condition).	Low	0383 - Fire water system - mine	Critical				0%	0%	0.1880%

Action No.	Action	Predicted Impact on Risk Reduction	Related Control	Critical/ Potential	Position Responsible	Due Date	Status	Percent Complete		% Overall risk reduction
								Start of Period	End of Period	
143	Develop and implement a document / standard which clearly defines the installation requirements for clay capping (i.e. thickness, material considerations, consideration of weather conditions at the time of installation, equipment). Including the definitions of when and where clay capping is required (as currently described in the Mine Fire Service Policy & Code of Practice) in the same document may be of benefit.	Low	0136 - Clay capping or crushed rock - exposed coal in worked out & operating areas	Critical				0%	0%	0.1880%
147	Confirm that there are suitable qualification requirements in place for personnel who determine when and where clay & crushed rock capping is to be installed, and who decide what materials will be used for capping at a particular location (i.e. clay quality/source location, crushed rock selection). The qualification requirements must include previous experience in supervising earthworks.	Low	0136 - Clay capping or crushed rock - exposed coal in worked out & operating areas	Critical				0%	0%	0.1880%
148	Develop and implement a theoretical and practical training program for the personnel who determine when and where clay & crushed rock capping is to be installed, and who decide what materials will be used for capping at a particular location. The objective of the training is to ensure these personnel with the site-specific information needed to make appropriate capping decisions.	Low	0136 - Clay capping or crushed rock - exposed coal in worked out & operating areas	Critical				0%	0%	0.1880%
151	Develop and implement a regular inspection and monitoring program for clay and crushed rock capping to identify, report and rectify any areas where the capping is no longer effective (for example due to the capping being washed away or dug up) and where there is exposed coal that should be capped according to the Mine Fire Service Policy & Code of Practice but is not.	Low	0136 - Clay capping or crushed rock - exposed coal in worked out & operating areas	Critical				0%	0%	0.1880%
127	NOTE: The team were unclear regarding the philosophy regarding the fire system, for example is it expected only to meet the current Fire Service Policy (which is based on the former SEC document), is it expected to protect against ember attacks from offsite, or are there other performance expectations. This question could not be resolved by the team, and requires further thought outside the workshop.		0383 - Fire water system - mine	Critical				0%	0%	0.0000%
129	At a management level, review the fire policy with respect to the specified required number of days of fire fighting expected from the fire water system to determine if the current policy is still appropriate, given the duration of the 2014 fire. If not, update the policy to reflect the new requirements.		0383 - Fire water system - mine	Critical				0%	0%	0.0000%
4	Implement the Potential Control - 0134 Design - elimination of timber plantations within 20km of mine lease (i.e. Liaison with local planning authorities to encourage elimination of timber plantations with a reasonable distance of site, e.g. 5km).		0134 - Design - elimination of timber plantations within 20km of mine lease	Potential				0%	0%	0.0000%
										34.0339%

Appendix E – Critical Control Adequacy Assessment

Critical Control Adequacy Assessment

The following are the prompts that are used by the facilitator for each section (note that there are slightly different prompts for engineering and administrative controls). Definitions of the ratings are also provided before the summary table of the Hazelwood team assessment.

Critical Control Adequacy Prompts – Engineering & Process

- Engineering & process – **Physical (Passive)**
  - *Ground control, road design, slope design, vehicle design, fixed guarding and barricading, bunds, structures, layout, blast walls, blast panels, bursting discs, lightning rods, fixed electrical grounding, intrinsically safe equipment etc.*
- Engineering & process – **Automated**
  - *Instrumented safety, process control, interlocks, automated shutdown, pressure relief, fire suppression, vehicle air bags, anti-collision, limit switches etc.*
- Engineering & process – **Human Activated**
  - *Manual shutdown systems, brake systems, seat belts, fall restraint/arrest, breathing apparatus, fire-fighting equipment, etc.*

Planning/Design

- Is the control designed to manage the specific risks?
- Is the control designed for the full range of required conditions (e.g. process, environmental, abnormal operations, etc.)?
- Has a Hazard Analysis been undertaken as part of the design of the control?
- Is this the industry accepted control for managing these specific risks?
- Has the control been design to comply with site, company, industry and regulatory standards and codes?
- Has the control been designed with consideration of the resources for implementation over the life of the control?
- Is appropriate documentation about the control available (design documents, specifications, OEM data, etc.)
- Does it work or can it be operated within an appropriate time frame?
- Will the control still be functional if another part of the system fails or during an incident (e.g. power loss)
- Does the control “fail-safe”?
- Has the control been designed to consider any significant human factor issues (e.g. Human-Machine Interface, etc.)

Implementation

- Is the control implemented as per the design?
- Does the control act every time it is called upon to give the protection it was designed to give?
- Is the control tested or inspected appropriately to ensure functionality?
- Does this control spend a lot of time out of service due to failures/maintenance/ calibration?
- Has the control and documentation been updated to reflect changes to operations, learnings from incidents, codes and standards, etc.?
- Are incidents still occurring despite the presence of the control?
- Have responsibilities and accountabilities for implementation of the control been assigned?
- Is the control a source of nuisance alarms or other incorrect data and therefore likely to be ignored?
- Does the control remain effective even if key personnel are unavailable?
- Can the control be bypassed in an uncontrolled or unauthorised manner?
- Is there appropriate redundancy, spares or contingencies in place for when the control in unavailable?

Workforce Involvement

- Has the design of the control included appropriate workforce involvement?
- Do personnel have the required competencies to ensure the functionality of the control?
- Is appropriate training undertaken that specifically addresses functionality of the control?
- Do personnel know how to identify when the control is not fully functioning?

Monitoring

- Is data about the performance of the control recorded?
- Is there a specific measure and target for the performance of the control?
- Is the frequency of measurement appropriate for the control?
- Have responsibilities for monitoring the control been assigned?
- Are performance monitoring results reported appropriately?
- Are reported issues responded to appropriately?
- Are monitoring results verified by an appropriate party?
- Are actual and potential incidents used as an indicator of control performance?
- Are inspections, audits and observations used as an indicator of control performance?

Critical Control Adequacy Prompts – Administrative or management strategies

- Administrative – **Inspection, Testing and Maintenance**
  - *Equipment specific pre-start inspections, preventative maintenance, testing and certification, etc.*
- Administrative – **Permits & authorisations**
  - *Access control, Isolation, Lock out Tag out, management of change, Hot Work Permit, Confined space entry Permit, critical lift plan, etc.*
- Administrative – **Systems, procedures & practices**
  - *Fitness for work, contractor management system, procurement process, operating procedures, work instructions, golden rules, traffic management plans, mine plan, emergency response, supervision etc.*
- Administrative – **Competency**
  - *Competency training programmes, ticketed qualification, nominated responsibilities etc.*
- Administrative – **Awareness & warning devices**
  - *Awareness training and inductions, warning signs, warning alarms requiring human response, speed indicators, demarcation, pre-task hazard assessment (Take 5 and JHA), general checklists, toolbox meetings, safety observations, etc.*

Planning/Design

- Is the control designed to manage the specific risks?
- Is the control designed for the full range of required conditions (e.g. process, environmental, abnormal operations, etc.)?
- Has a Hazard Analysis been undertaken as part of the design of the control?
- Is this the industry accepted control for managing these specific risks?
- Has the control been design to comply with site, company, industry and regulatory standards and codes?
- Has the control been designed with consideration of the resources for implementation over the life of the control?
- Is the control formally documented as part of a document control system?
- Is the control designed to be compatible with other controls (e.g. same format for procedures)?
- Is there more suitable engineering control available?

Implementation

- Is the control consistently followed in the field (e.g. night shift, contractors, etc.)?
- Does the control remain effective even if key personnel are unavailable?
- Does the control get bypassed in an uncontrolled or unauthorised manner?
- Are there appropriate contingencies in place for when the control in unavailable?
- Has the control and documentation been updated to reflect changes to operations, learnings from incidents, standards, etc.?
- Are incidents still occurring despite the presence of the control?
- Have responsibilities and accountabilities for implementation of the control been assigned?
- Is it clear how the control should be used to manage the risks (e.g. the critical steps to be taken, equipment to be used, reporting requirements, etc.)?
- Does the control specify the action to take if deviation is required?
- Is it clear when the control needs to be followed (e.g. scope, boundaries, conflicting procedures, etc.)?
- Are the consequences of not following the control understood?
- Is non compliance of the control tolerated or is appropriate action taken?

Workforce Involvement

- Has the design of the control included appropriate workforce involvement (e.g. end user in mind)?
- Do personnel have the required competencies to ensure the functionality of the control?
- Is appropriate training undertaken that specifically addresses functionality of the control?
- Do personnel know how to identify when the control is not fully functioning?

Monitoring

- Is data about the performance of the control recorded?
- Is there a specific measure and target for the performance of the control?
- Is the frequency of measurement appropriate for the control?
- Have responsibilities for monitoring the control been assigned?
- Are performance monitoring results reported appropriately?
- Are reported issues responded to appropriately?
- Are monitoring results verified by an appropriate party?
- Are actual and potential incidents used as an indicator of control performance?
- Are inspections, audits and observations used as an indicator of control performance?

Definitions

Very High	Never fails Generally reserved for engineering controls – industry best practice.
High	Good performance requires no improvements. Confident of application across the hazard.
Adequate	Generally works well but this dimension could be improved.
Fair	Dimension is understood / implemented but major improvements still required.
Poor	If this dimension of the control works it is by luck. Totally ad hoc in its application.

Control Rating	Definitions
High	Control is in place and all adequacy areas have been given a '*High'* or *'Very High'* rating
Satisfactory	Control in place and deemed adequate to manage the risk although some aspects of the management of the control. Half or more adequacy areas have been given an '*Adequate'* rating
Unsatisfactory	Control in place but inadequately reduces the risk of the hazard. Half or more adequacy areas have been given a '*Fair'* rating OR Any adequacy area was given a *'Poor'* rating

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Document Status

Rev No.	Author	Reviewer		Approved for Issue		
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