Safety Assessment of Major Mining Hazards

Stage 2 – Semi-Quantitative Risk Assessment

for

International Power Hazelwood

February 2004

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TABLE OF CONTENTS

EXECUTIVE SUMMARY

International Power Hazelwood ("IPRH") have commissioned Qest Consulting to assist them in completing a Formal Safety Assessment of the Major Mining Hazards associated with their operations. The scope of this assessment includes the current mine operations as well as the relocation activities and mining of the West Field lease area.

This report presents the results of Stage 2 of this process, which includes a Semi-Quantitative Risk Assessment (SQRA) of the 16 potential Major Mining Hazards identified during Stage 1. This stage also includes the development of bow-tie diagrams to help in understanding the dynamics of each hazard and the identification of the controls, which are critical to the management of each hazard scenario ("the Critical Controls"). A key aspect of this stage of the study is to identify those hazards that are deemed to constitute the final list of Major Mining Hazards that should be taken forward as the subject of the "Critical Control Adequacy Assessment" (Stage 3).

This risk assessment process applied was designed and completed in line with the requirements of the *Occupational Health and Safety (Mines) Regulations 2002*.

This report outlines the methodology and findings of this second stage of the process. Whilst this is a standalone document it is recommended that to ensure a comprehensive understanding of the safety assessment process, this report be read in conjunction with the report from Stage 1.

The SQRA and Critical Control identification process was completed in a workshop held at IPRH on the 3rd and 4th February 2004, facilitated by independent risk consultants from Qest Consulting. The workshop participants were made up of representatives from each relevant mine work area, including Engineering, Maintenance and Operations.

A total of 16 potential Major Mining Hazards were identified in Stage 1 for assessment through the SQRA process. These hazard scenarios and their risk values, as determined by the Risk Assessment Team, are shown in Table 1. This table also shows the 13 hazards that were identified as Major Mining Hazards and which are to be carried forward through the safety assessment process.

The numerical risk values estimated through the SQRA process are expressed in terms of Potential Loss of Life (PLL). PLL is the risk to all individuals who spend time on the site over a year. The overall PLL is the sum the values for each Major Hazard Scenario for the mine. It is the same as the statistically predicted annual fatality rate for the operation. The PLL risk level considers the number of personnel affected by the hazard. As each operation is of differing size, complexity and number of personnel, the PLL values cannot be directly compared between operational sites. Furthermore the SQRA process generates a PLL that is an indicative assessment of the risk using a 'team based' approach and as such relies on the collective knowledge of the risk assessment team and availability of relevant statistical information. This further limits the ability for comparison between sites. The strength of the SQRA approach is that it provides an assessment of the hazards relative to each other and as such enables a risk-based framework for safety management to be established. This framework enables risk priorities to be focussed and reductions efforts to be measured.

Table 1 - Major Mining Hazards and PLL Values

Rank	ID No.	Hazard Title	PLL value
1	IPRH-NO1	Vehicle incident while accessing worksite	1.15E-02
2	IPRH-IW32	Public vehicle incident during road alterations	1.00E-02
3	IPRH-NO24	Heavy Mobile equipment interactions on mine roads	6.67E-03
4	IPRH-NO4	Dropped objects from major mining plant (onto personnel / equipment)	6.00E-03
5	IPRH-NO37	Failure whilst field jacking of major mining plant	4.40E-03
6	IPRH-IW28	220KV tower incident, including construction activities	2.50E-03
7	IPRH-NO5	Uncontrolled movement of major mining plant	1.65E-03
8	IPRH-NO38	Unplanned movement of equipment	1.37E-03
9	IPRH-NO42	Fall from or tipping of EWP	1.10E-03
10	IPRH-NO26	Batter failure	1.00E-03
11	IPRH-NO39	Confined spaces	3.00E-04
12	IPRH-NO8	Explosion of electrical components on major mining plant	2.20E-04
13	IPRH-NO43	Building fire	2.20E-04
14	IPRH-IW30	Cable incident on public road	1.40E-04
15	IPRH-NO7	Major mining plant fire	1.00E-04
16	IPRH-NO36	Inrush of water into mine	1.60E-05
	IPRH-WF45	Vehicle / plant incident during West Field transfer	Included in NO24
Total Estimated Site (Major Mining Hazard) PLL			**4.72E-02**

1E-03

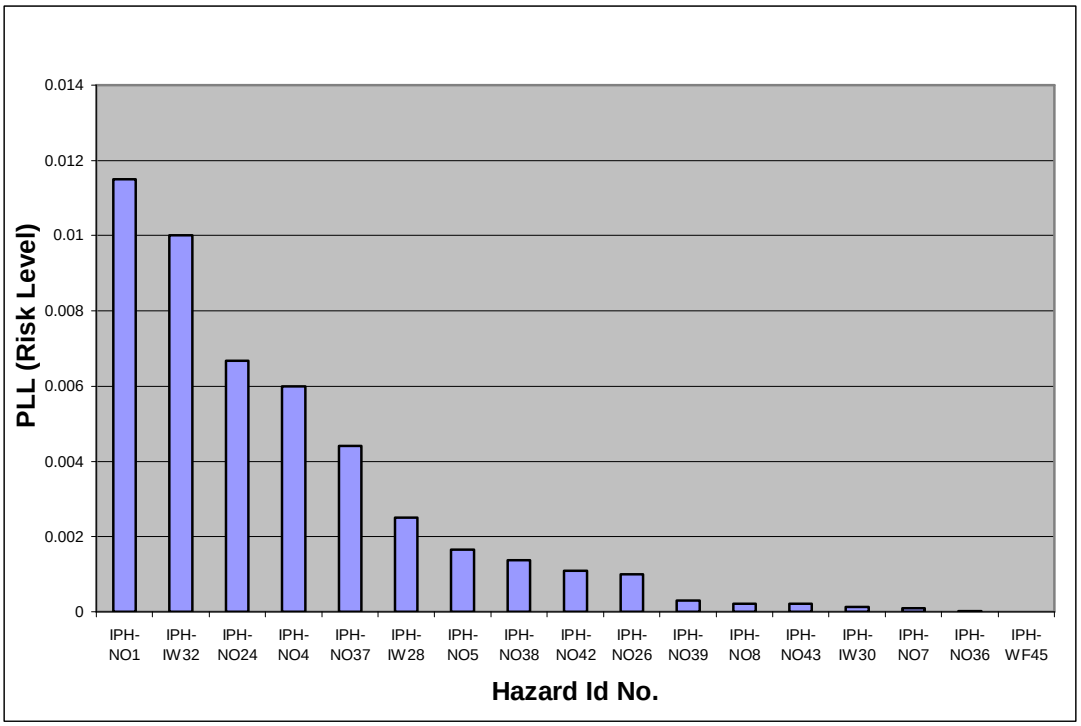
Final list of Major Mining Hazards for Stage 3 assessment.

Based on the current site controls and procedures, the Risk Assessment Team estimated the overall 'Base Case' PLL for the hazards assessed as 4.72E-02 fatalities per year, equivalent to a single fatality every 21.2 years.

The estimated Base Case Risk Profile is shown in Figure 1 (overleaf). This Figure shows that the overall site risk from Major Mining Hazards is relatively concentrated, with 81% of the risk in the top 5 hazards assessed. As such, risk reduction efforts should be focussed towards these hazards.

It must also be noted that the three top hazards in the Base Case estimate, relate to collisions involving mobile vehicles. The collective risk of these hazard scenarios places the operation of mobile equipment as the dominant hazard in the risk profile.

Figure 1 - IPRH Major Mining Hazards - Base Case Risk Profile



It is important to note that several hazards in the risk profile relate to interim activities associated with the transfer of mine activities to the West Field lease area. These hazards are in addition to the hazards that will be encountered during the normal mining operations in the West Field area. These hazards have a significant contribution to the overall safety risk profile of the Hazelwood Mine.

It is estimated that following completion of the relocation activities, the overall site risk, from the hazards assessed, would reduce by approximately 40% to a single fatality every 35.9 yrs. In addition, it is important to note that these hazards relate principally to activities to be completed by contractors under IPRH management. This further raises the need to view the controls relating to the selection and management of the contractors as critical to managing this risk.

As described, this stage also included the identification of the controls that are critical to managing the operations Major Mining Hazards. For each hazard scenario the causal pathways were analysed to determine those dominant pathways for which Critical and / or Major Controls are required. This was achieved by comparing each pathway against a pre-determined 'Critically Criteria', which in turn generates a control classification for the pathway. Qest Consulting defined the Criticality Criteria used for this process in consultation with the workshop team. This criteria was deemed as acceptable based on experience in SQRAs for similar operations and has proven successful in identifying a realistic spread of Critical and Major Controls for the hazards assessed. The final stage of this safety assessment is to review the adequacy of the Critical and Major Controls identified for the MMHs and develop a prioritised Safety Action Plan.

1.0 INTRODUCTION

International Power Hazelwood ("IPRH") is planning to expand their mining activities into a new lease area referred to as the West Field. As required by the *Occupational Health and Safety (Mines) Regulations 2002*, IPRH have committed to completing a Formal Safety Assessment of the Major Mining Hazards ("MMH") associated with this change in the mine operations. In addition, IPRH have identified this as an opportunity to expand the scope of the risk assessment to include their existing mining operations. IPRH commissioned Qest Consulting ("Qest") to assist them in completing this assessment.

This report details Stage 2 of the Formal Safety Assessment of Major Mining Hazards. This second stage of the process includes a Semi-Quantitative Risk Assessment (SQRA) of the 16 hazards identified as potential Major Mining Hazards during Stage 1[1] of the process. These hazards are described in Section 1.2.

This step will be used to rank the hazards and define the final list of Major Mining Hazards to be taken through to the next stage of the assessment process, which includes a "Critical Control Adequacy Assessment", and development of a "MMH Safety Action Plan".

It is recommended that to ensure a comprehensive understanding of the safety assessment process applied, that this report should be read in conjunction with the reporting from Stage 1.

The SQRA approach was selected as the suitable approach for this assessment as it was deemed to provide the required level of analysis to enable IPRH to understand the current mine risk profile from the Major Mining Hazards and the controls currently utilized to ensure these risks are being adequately managed.

Furthermore it was considered that the SQRA process would also satisfy the specific requirements for a Safety Risk Assessment of Major Mining Hazards under *the Occupational Health & Safety (Mines) Regulations 2002*, which requires the process to be:

- Comprehensive and systematic;
- Provide detailed understanding of major hazards;
- Appropriate assessment methodologies;
- Assess hazards cumulatively as well as individually; and
- Documented and available.

The SQRA approach was also considered to achieve the following principal deliverable's:

- Development of a 'risk-based' framework for safety management; and
- Transparent process to enable the clear communication of safety risks to all Stakeholders.

[1] Qest Consulting Pty Ltd. (2003), Identification of Major Mining Hazards for International Power Hazelwood.

This scope of work was primarily completed in a two day workshop facilitated by Qest on the 3rd and 4th February 2004. Qest also supplied a second facilitator to ensure accurate minutes from the workshops were taken.

The workshop participants were made up of representatives from each relevant function and level of the workforce. A short presentation was completed at the beginning of the workshop, to introduce the participants to the risk assessment process and the definitions used. The risk assessment team is contained in Table 1.1

Table 1.1 - SQRA Workshop Team

Name of Participant	Role
Richard Polmear	Mine Engineering Manager
Ian Quail	Operations Manager
Peter Sheridan	Shift Operations Manager
Noel Coxall	Shift Maintenance Supervisor
Bill Estrada	Maintenance Manager
Ian Wilson	Shift Fitter
Peter Kelly	Mining Engineer
Anthony Deakin	Qest Consulting
Brian Williams	Qest Consulting

1.1 Description of Hazlewood Mine Operations

An important part in establishing the context of the risk assessment is an Operations Description that outlines the nature of the main aspects of the Hazelwood mining operations and relocation activities for accessing the West Field lease area. A site map showing the current mine and planned West Field Area is shown in Figure 1 (overleaf).

The Hazelwood Mine is located in the Latrobe Valley region of South Eastern Victoria and is part of an integrated Coal Mine and Power Station operation. The operation covers some 3500 hectares, with the mine area covering around 620 hectares.

The mine has been mining a thick brown coal deposit for 40 years with operations having commenced in 1964. The coal seam is up to 100m thick in some places and is mined using large “bucket-wheel dredging machines” which load the coal onto an in-pit conveyor system for transfer to the power station bunkers. Up to four of these ‘laser guided’ “dredgers” and associated conveyor systems operate at various levels in the mine extracting both coal and removing the overburden material. The extensive conveyor system (over 40km in total length) carries the coal at over 2500 tonnes per hour to the bunkers. Additional conveying infrastructure s currently being constructed which will increase this capacity. The operation and maintenance of this mining infrastructure is completed by IPRH with teams of four / five operators per dredger on a rotating roster basis for both day and night shits.

As part of the relocation to the West Field lease area significant additional bulk earthworks, using heavy vehicle haul trucks, as well as the relocation and diversion of local infrastructure will be required. The infrastructure work includes the relocation of the Strzlecki Highway and the diversion of the Morwell River and major power lines. Such works will be undertaken by contractors under contract management by IPRH.

Significant quantities of water are pumped from aquifers below the seam to maintain wall (batter) and floor stability in the pit. This water is retained with the power station cooling water and becomes a source of fire prevention and dust suppression for the site.

As mining occurs the land is progressively rehabilitated reusing the stockpiled overburden material in accordance with approved environmental management plans.

Figure 1 - Aerial Photo showing mining areas.

1.2 List of Hazards Assessed

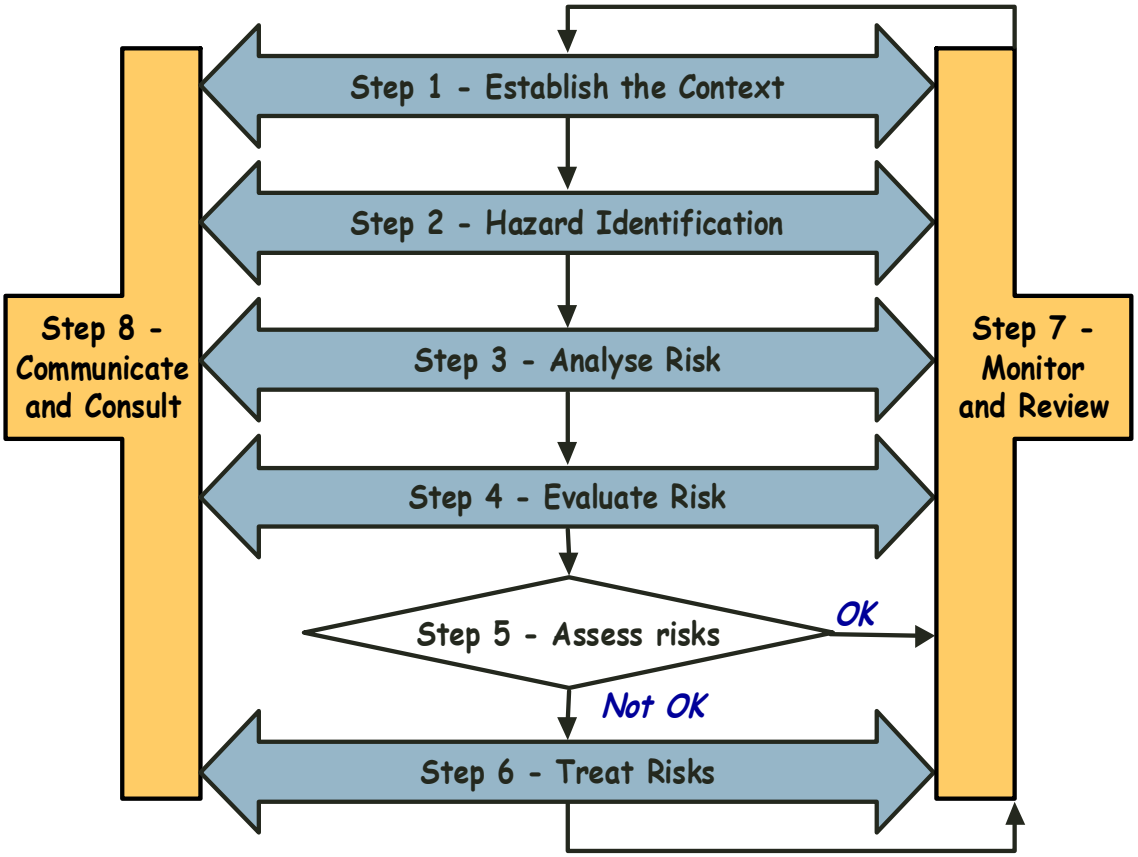
Hazard No	Hazard Title	MMH Description
IPRH-NO4	Dropped objects from major mining plant (onto personnel or equipment)	Major Mining Plant includes conveyors, stackers & dredgers. Relates to plant components falling, loose material falling or deliberate dumping, and material falling due to minor structural failure. Areas of concern: Lumps of coal falling; Complacency of stacker operator or ground personnel; Ensuring equipment is correctly designed.
IPRH-NO24	Heavy Mobile equipment interactions on mine roads	Relates to incidents during normal heavy mobile plant operations on mine roads. Issue due to sharing of roads between mobile equipment. Hazard excludes light vehicle incidents (NO1), and interactions in ,loading areas (NO29) as included as separate scenario .Areas of concern: Infrequent users of mine roads; External dumping closer to points of entry; Radio protocols (need for clearer and more positive communication).
IPRH-NO1	Vehicle incident while accessing worksite	Relates to incidents involving vehicles used for transport to work site (onsite access only), predominantly light vehicles (eg. 4wd's). Hazard includes personnel traveling around site for inspections, monitoring, etc. Events include traveling off edge, rollovers, collisions with other equipment / structures / mine walls, etc. Areas of concern: Infrequent users; Radio protocols (clear and positive coms); Higher congestion / volume during
IPRH-NO5	Uncontrolled Movement of major mining plant.	Major Mining Plant includes conveyors, stackers & dredgers. Hazard also relates to use of cranes. Mainly relates to toppling of plant but also includes derailing, collapses, operator error, slippage, toppling due to windload or soft ground, structural failure of plant or ground, etc. Excludes falling loads from cranes and excavator (NO51); falling objects from Major Ming Plant (NO24); Tripper/hopper runaway (NO-19) and Field jacking of equipment (NO37), as included as separate hazards.
IPRH-NO7	Major mining plant fire	Major Mining Plant includes conveyors, stackers & dredgers. Dredger considered biggest risk issue. Excludes Fire/explosion in bunker (NO15) and mobile equipment (NO3), as included as separate hazard scenarios. Areas of concern: Coal build up and mechanical failure.
IPRH-NO8	Explosion of electrical components on major mining plant	Relates principally to HV switching gear (6.6KV and 415V)
IPRH-NO26	Batter failure	Relates to both coal and overburden collapses onto personnel, plant and/or vehicle (eg. dozer,4wd,pedestrian)

Hazard No	Hazard Title	MMH Description
IPRH-IW28	220KV tower incident, including construction activities.	Relates to incidents involving HV towers either during mine operations around towers or tower erection / construction. Example causes, include structural failure, ground failure, incorrect design, natural forces, etc. Construction activities include - crainage, lifting, heights work. Tower construction to be completed by specialist contractor.
IPRH-IW30	Cable incident on public road	Relates to incidents involving HV line installation or failure during operations. Activity will be completed by specialist contractor. Less than 1 month project. During critical stages the road will be closed.
IPRH-IW32	Public vehicle incident during road alterations	Relates to road alterations during West Field relocations. Traffic Management Plan. Activity will be completed by specialist contractor in line with Vic Roads requirements. Includes public vehicle collisions and public vehicle/mine vehicle collisions.
IPRH-NO36	Inrush of water into mine	Relates to major inrush of water into mining area. Main control is the design of flood mitigation to 1:10,000 yr /event. Also considers risk of catastrophic dam wall failure as well.
IPRH-NO37	Failure whilst field jacking of major mining plant	Maintenance work for Major Mining Plant completed in field, due to size of plant. Hazard relates to jacking of plant for maintenance purposes.
IPRH-NO38	Unplanned movement of equipment	Relates to unplanned / uncontrolled movement of equipment striking personnel or equipment. Includes parts of Major Mining Plant or mine heavy vehicles / equipment. Example scenarios include; equipment runaway, operator error, belt slip, belt runaway, remote startup, vehicles parked up, conveyor anchor post failure, etc. Excludes entanglement in mechanical equipment, as included as separate hazard (NO11).
IPRH-NO39	Confined/registered spaces	Relates to both Confined and Registered Spaces. Includes maintenance work in and around bunkers. Several Registered Spaces but relatively few Confined Spaces. For mine operations (ie. Dredger tubs and Bucket wheel)
IPRH-NO42	Fall from or tipping of EWP	Relates to any equipment used for work at heights, eg. EWP, Cherry picker, JLG, Boom lift, Scissor lifts. Includes EPV (Elevated Platform Vehicle (EPV)
IPRH-NO43	Building fire	Buildings for mine operations include; Control Room, Workshop, Offices.
IPRH-WF45	Vehicle / plant incident during West Field opening up phase.	Relates to major truck and shovel programs. Includes interaction or other incident eg. off edge, into hole. Current phase 1 works at Westfield. Considered by risk assessment team to include NO24.Areas of concern: Dynamic changing nature of work areas; Watering of roads effect LV traction.

2.0 SQRA METHODOLOGY

Qest have committed to completing the risk assessment of Major Mining Hazards in line with the requirements outlined in the *OHS (Mines) Regs 2002* and consistent with the principles of the *Australian Standard for Risk Management (AS/NZ 4360:1999)*. The risk assessment process is illustrated in Figure 2.1.

Figure 2.1 – Risk Assessment Process (as per AS 3460)



Having completed the hazard Identification (HAZID) process in the first stage of the safety assessment, the potential Major Mining Hazards were then the subject of a more detailed risk analysis using a Semi-Quantitative Risk Assessment (SQRA) approach.

The Stage 2 SQRA methodology is described in the following pages and includes the following steps:

1. Understanding the Dynamics of Hazards (Develop Bow-tie diagrams)
2. SQRA – Base Case
3. Identification of Critical Controls

Having identified the hazards for referral to the SQRA process a Risk Register Database, as developed by Qest Consulting, was used to capture the information about each hazard scenario. The data collected using the database fields included: -

- Title of hazardous event
- Scenario description
- Identified causes
- Current control measures
- Comments regarding the hazard

The front-end of the risk register database is shown in Figure 2.2 below. The Data Sheets for each of the hazards assessed are included in Appendix 2.

Figure 2.2 – Risk Register Database Front-end

2.1 Understanding the Dynamics of Hazards

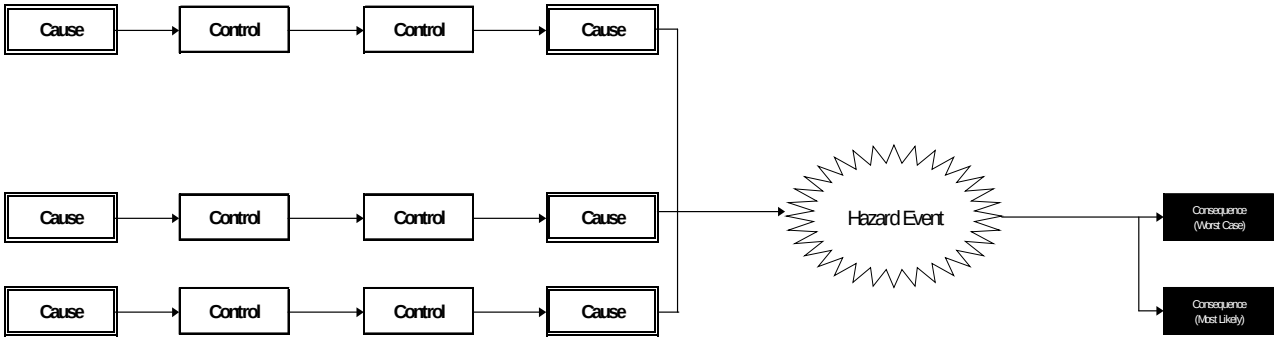
Drawing upon the information collected during the Hazard Identification stage, the second step in the risk assessment process is to develop an understanding of the dynamics of each of the hazard scenarios. This step entails a rigorous analysis of the initiating causes and pathways leading to each hazard event and the outcomes if the event does occur. In both of these analyses the controls that are in place to either prevent the causes or mitigate the outcomes are also identified.

A bow-tie diagram is used to graphically represent these relationships for the hazard. The bow-tie diagram is then used as a visual tool to assist within the risk assessment workshops through the following stages of the process.

At the centre of the bow-tie diagram is the event under consideration. The left-hand side of the diagram shows the possible 'Initiating Causes' and 'Pathways' leading to the event. The right hand side of the diagram shows the potential consequence(s) if the event occurred. The existing control measures to either prevent the event or mitigate the consequence are shown as well.

An example bow-tie diagram is detailed in Figure 2.3.

Figure 2.3 - Bow Tie Diagram Structure



No probabilities are included on the bow-tie diagram, the purpose is to clearly represent the dynamics of the hazard to assist with the further analysis of the hazard. Note that information from these later steps in the process are also included on the bow-ties, including which controls are selected as Critical or Major Controls.

The bow-tie diagrams for each of the hazard scenarios can be found in Appendix 2.

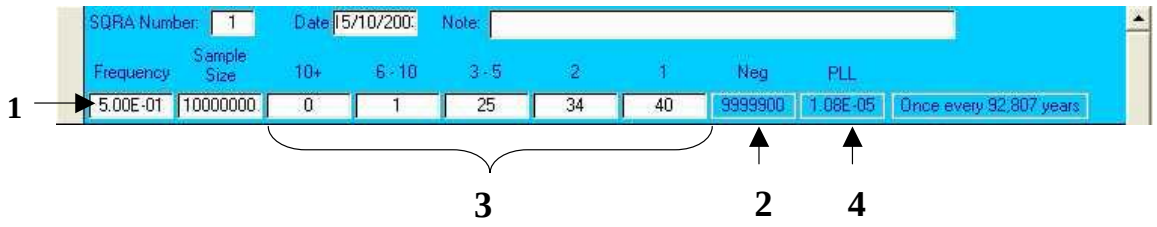
2.2 Base Case Safety Risk Assessment

This project step entails taking the work completed in the first steps of the process and considering the information in the Semi-Quantitative Risk Assessment (SQRA) for each of the Major Mining Hazard scenarios identified. This approach enables a numerical risk value (Potential Loss of Life or PLL) to be calculated. This is completed in a workshop environment with the Risk Assessment Team. The outcome of this initial SQRA workshop represents the Base Case safety risk profile which considers the current level of safety controls. The SQRA data and results are also captured using the risk register database and the SQRA process followed is outlined in the following steps (refer to Figure 2.4 for an example of the SQRA worksheet):

1) Determining initiating frequency

Whilst considering the information (eg. causes, controls) on the left-hand side of the bow-tie diagram, assess the frequency of the **initiating event** (ie the point where control is lost). The example shows an initiating event that is estimated to occur 0.5 times per annum (ie. 1 in 2 years).

Figure 2.4: Risk Register SQRA Worksheet



2) Consequence of initiating event

A discussion of the initiating event is held based on people's experience, observations and industry statistics where known. Taking into account the information (eg. mitigating controls, consequences) on the right hand side of the bow-tie diagrams, the number of times there would be NO FATALITIES is estimated, given that the initiating event has occurred. A method of estimating is outlined below in the 'Example of Consequence'. In the example above, it was estimated that given 10000000 occurrences of the initiating event, 9999900 of them would not result in a fatality (ie. 100 occurrences would result in 1 or more fatalities).

3) Number of fatalities

For the occurrences where 1 or more fatalities were estimated to occur (100 times in the example), the workshop nominates:

- The number of times there would be a single fatality (40 times out of the 100 in the example);
- The number of double fatalities (34 out of 100);
- The number of times there would be 3 to 5 fatalities (25 out of 100);
- The number of times that there would be 6 to 9 fatalities (1 out of 100);
- The number of times that there would be more than 10 fatalities (0 out of 100).

4) Calculation of PLL value

These values are imputed directly into the SQRA worksheet (within the risk register), which calculates PLL values (fatalities per annum) for each hazard by multiplying likelihood by the sum of the consequences.

0.5*((0*11.5)+(1*7)+(25*4)+(34*2)+(40*1))/10000000 = **0.0000108 or 1.08x10^{-5}**

Example of Consequence (step 2 above);

If the workshop was able to estimate that a large object would be dropped once every 5 years, but could not easily determine a sample size for the distribution of the fatality cases, steps similar to the following may be used to help generate one

a. Given that the object was dropped, the probability that someone would be in the area affected by the drop would be **X**.
b. If someone were in the area when the large object was dropped, the probability that they would be hit would be **Y.**
c. If someone was hit by the large dropped object, the probability that they would be fatally injured would be **Z**

The product of these probabilities (**X** x **Y** x **Z**) is the probability that the event would be fatal given that a large object is dropped. If X = 0.4, Y = 0.1, and Z = 0.5, then this probability would equal 0.02. Or, 2 fatal events in 100 (equivalent to 20 in 1000).

In this case, for step 2 of the SQRA process, there would be 980 occurrences of the initiating event where there would be no fatalities (1000 minus 20). In step 3 of the SQRA process the 20 fatal events would be distributed according to the number of fatalities caused**.**

The results of the SQRA workshops are presented in Section 4.0 – Findings.

2.3 Identification of Critical Controls

This step of the process entails a review of the controls that are currently in place to manage a given hazard scenario and determines those controls that are critical to the safe and effective operation across the site. The purpose of identifying critical controls is to enable future control adequacy assessment and auditing processes to be targeted.

In this assessment, two grades of controls are used that distinguish between those that are crucial to safe operation (a "Critical" control) and those that are very important (a "Major" control). This approach allows for better rationalisation of valuable implementation time and resources across critical, major and other controls.

The Critical Control identification is completed by analysing each of the causal pathways on the bow-tie diagrams, including the allocation of a percentage that each pathway contributes to the occurrence of the hazard. To ensure comprehensiveness a combination of criteria was used to identify the critical controls. This criteria is outlined below.

Control Criticality Criteria

1. Potential Loss of Life (PLL) contribution

The percentage allocated to each causal pathway for a given hazard is then multiplied by the total PLL for the hazard. This value can then be compared against pre-determined risk criticality criteria to determine the level of controls that need to be in place to prevent, and or mitigate the hazard from occurring in the identified hazard pathways. The "Criticality Criteria" used is outlined in Table 2.1.

Table 2.1 - Criticality Criteria for PLL Contribution

Hazard Pathway Risk (x 10^{-6})	Control Level Required
1500	1 Critical and 1 Major Control
750	2 Major or 1 Critical Control
250	1 Major Control

2. Causal pathway dominance

Pathways that were considered to contribute to 20% or more to the potential incident occurring were required to have 1 Critical Control (or 2 major controls). This step is designed to ensure that controls which are currently effective in reducing the risk associated with a selected scenario are not overlooked when applying a strictly risk criteria. These controls need to be identified as critical to ensure they are included in the adequacy review process.

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3. Frequency of control

Controls that frequently occurred were also reviewed for consideration as Critical Controls.

This process makes substantial use of the bow-tie diagrams developed previously, in conjunction with the risk values developed in the SQRA. Figure 2.5 shows the risk register database screen where each pathway is allocated a percentage of PLL contribution. Figure 2.6 shows the database screen used to select the appropriate number and type of critical controls for each hazard dependent on the PLL contribution and/or pathway dominance.

Figure 2.5 Database Hazard Identification Worksheet

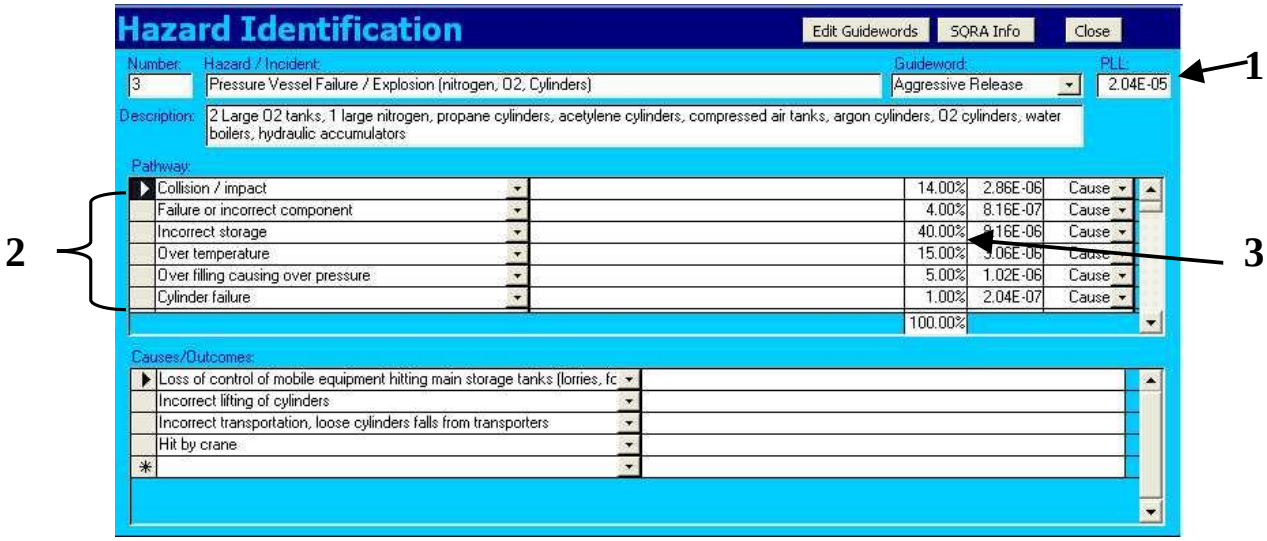
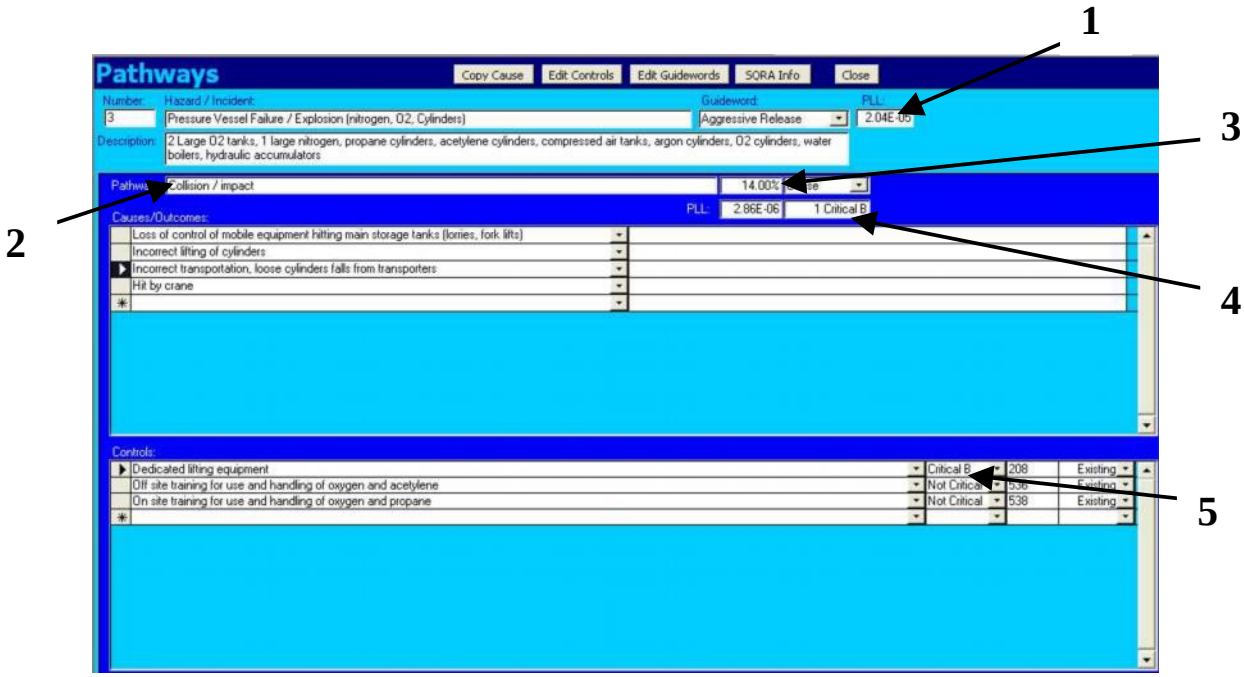


Figure 2.6 Database Pathways Worksheet



The numbered explanatory points below correspond to the parts of the database screens indicated in Figures 2.5 and 2.6

1. For each hazard, the PLL number is taken from the SQRA.

2. Using the information contained on the bowtie for each hazard, the causal pathways are determined, and a definition of each entered into the list.

3. Each causal pathway is then allocated a percentage of the risk, based on its perceived contribution (ie. the greater proportion of the risk that results from a particular pathway, the higher the percentage contribution it gets). The risk contributions from all of the pathways should sum to 100%.

4. The hazard PLL (see 1) is divided amongst the causal pathways (see 2) based on their percentage contributions (see 3). These values can then be compared against the pre-determined risk criticality criteria to determine how many of each control type (Critical and Major) are required for input into the Critical Control Adequacy Assessment.

5. Referring to the relevant bow-tie for the hazard, the required number of Critical and Major controls are nominated on each of the causal pathways, according to the definitions outlined at the beginning of this section. The control numbers, description and Critical and Major rating are then recorded in the text box supplied.

The Critical and Major controls identified in step 5 are referenced in the Data Sheets (Appendix 1) and are listed in Appendix 3.

3.0 FINDINGS

This section of the report details the findings from the SQRA process. It must be acknowledged that this method of risk estimation is semi-quantitative and uses a "team-based" approach and as such relies on the collective knowledge of the risk assessment team and availability of relevant statistical information. The accuracy of such estimating is also inherently difficult as the subject deals with very low frequency events. The strength of the SQRA approach is that it provides an assessment of the hazards relative to each other and as such enables a risk-based framework for safety management to be established. This framework enables risk priorities to be focussed and reductions efforts to be measured.

3.1 SQRA Base Case Results

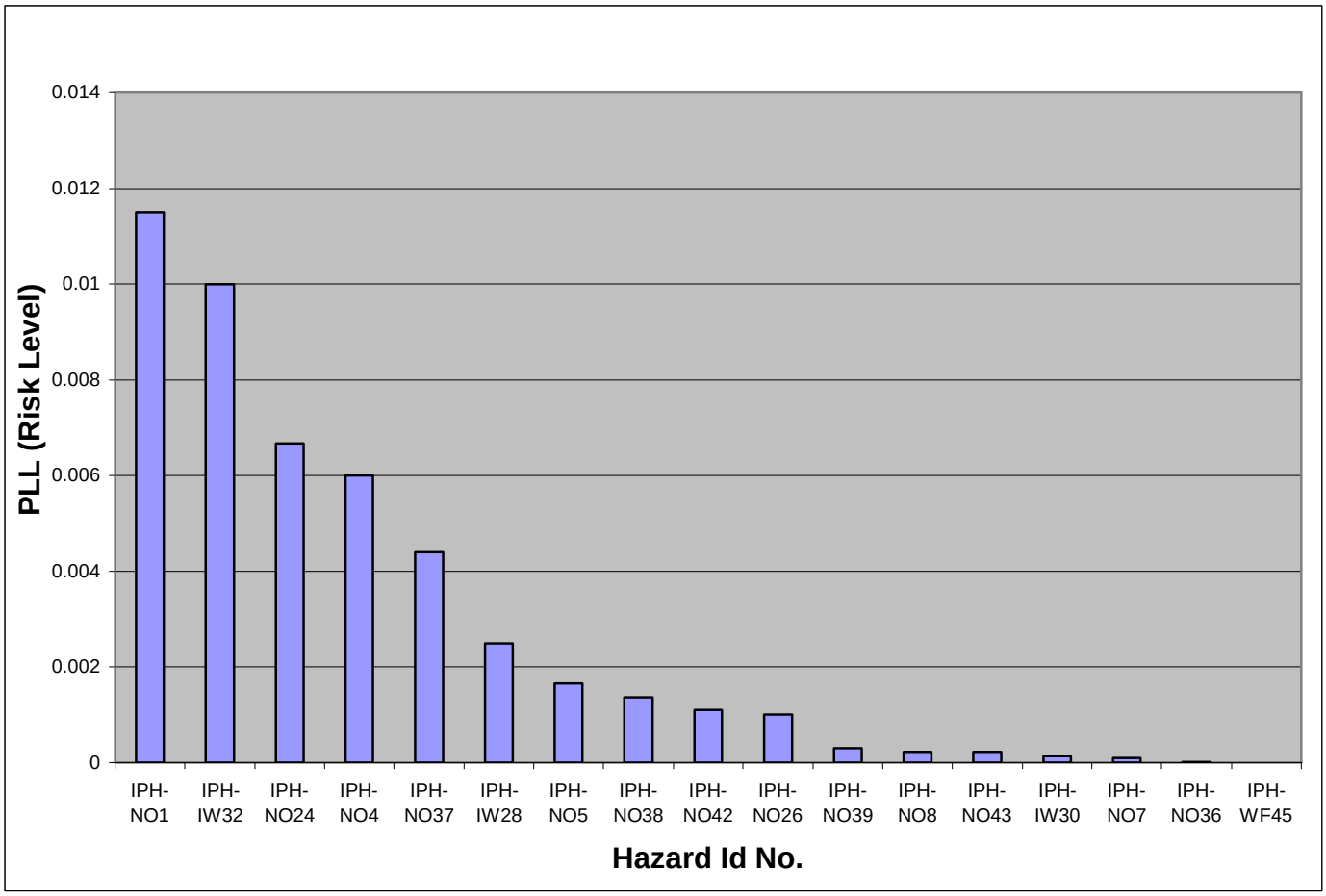
The overall Base Case Potential Loss of Life (PLL) for the 16 hazards assessed, using the SQRA approach, was estimated by the Risk Assessment Team as 4.72E-02 fatalities per year, equivalent to 1 fatality every 21.2 years.

The individual estimated PLL values for each respective hazard scenario assessed, is listed in the following Table 3.1 and graphed in Figures 3.1 and 3.2.

Table 3.1 - List of Potential Major Mining Hazards and Potential Loss of Life (PLL) Values

Rank	ID No.	Hazard Title	PLL value
1	IPRH-NO1	Vehicle incident while accessing worksite	1.15E-02
2	IPRH-IW32	Public vehicle incident during road alterations	1.00E-02
3	IPRH-NO24	Heavy Mobile equipment interactions on mine roads	6.67E-03
4	IPRH-NO4	Dropped objects from major mining plant (onto personnel / equipment)	6.00E-03
5	IPRH-NO37	Failure whilst field jacking of major mining plant	4.40E-03
6	IPRH-IW28	220KV tower incident, including construction activities	2.50E-03
7	IPRH-NO5	Uncontrolled movement of major mining plant	1.65E-03
8	IPRH-NO38	Unplanned movement of equipment	1.37E-03
9	IPRH-NO42	Fall from or tipping of EWP	1.10E-03
10	IPRH-NO26	Batter failure	1.00E-03
11	IPRH-NO39	Confined spaces	3.00E-04
12	IPRH-NO8	Explosion of electrical components on major mining plant	2.20E-04
13	IPRH-NO43	Building fire	2.20E-04
14	IPRH-IW30	Cable incident on public road	1.40E-04
15	IPRH-NO7	Major mining plant fire	1.00E-04
16	IPRH-NO36	Inrush of water into mine	1.60E-05
	IPRH-WF45	Vehicle / plant incident during West Field transfer	Included in NO24
Total Estimated PLL			**4.72E-02**

Figure 3.1 - IPRH Major Mining Hazard – Base Case Risk Profile

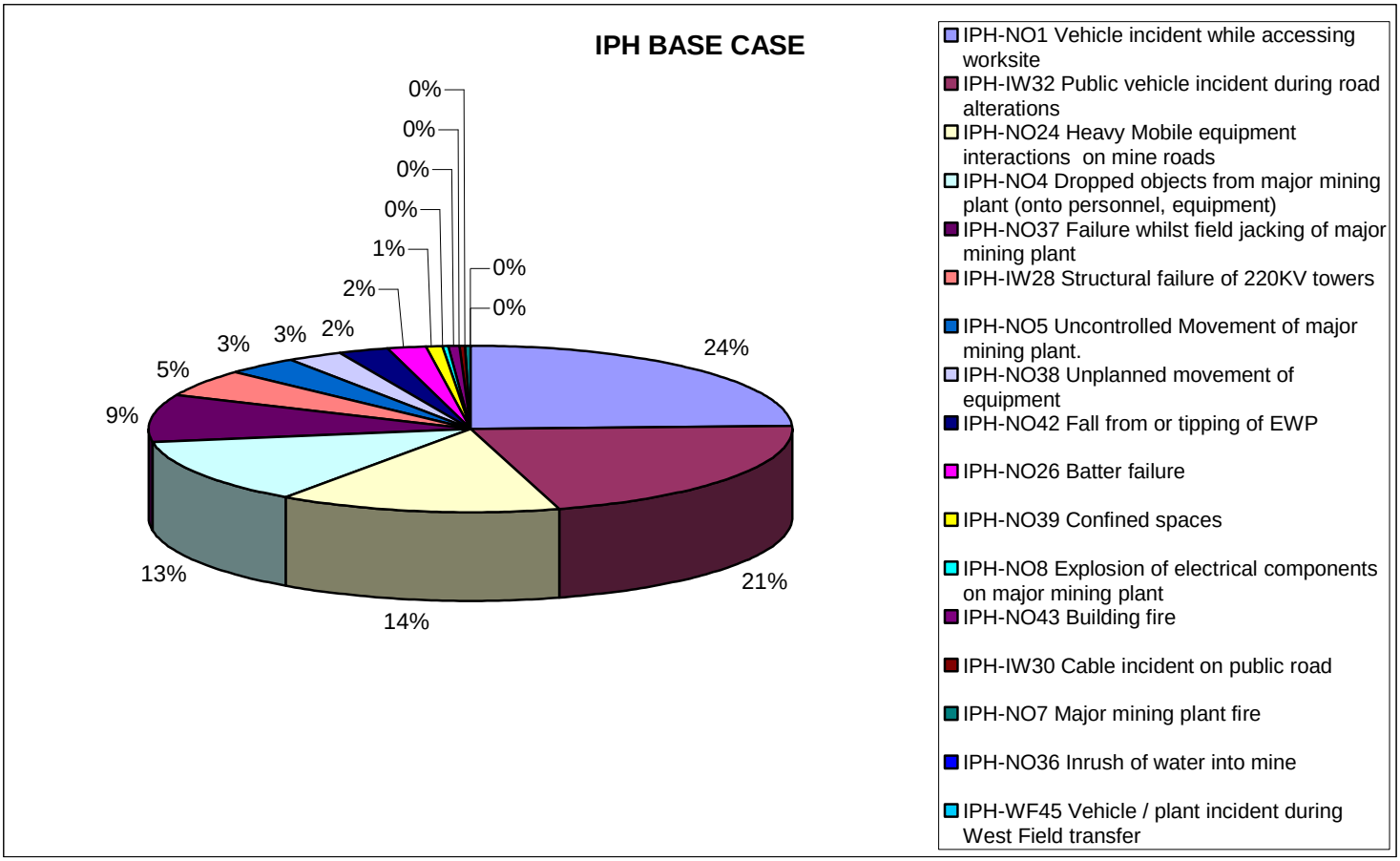


The Base Case Risk Distribution for Major Mining Hazards is shown in Figure 3.1. This figure shows that 81% of the site fatality risk is concentrated in the top 5 hazards assessed.

These hazards are:

IPRH-NO1 Vehicle incident while accessing worksite
IPRH-IW32 Public vehicle incident during road alterations
IPRH-NO24 Heavy mobile equipment interactions on mine roads
IPRH-NO4 Dropped objects from major mining plant (onto personnel / equipment)
IPRH-NO37 Failure whilst field jacking of major mining plant

Figure 3.2 - IPRH Major Mining Hazard – Base Case Risk Distribution



It must be noted that the three top hazards in the Base Case estimate, relate to collisions involving mobile vehicles. The collective risk of these hazard scenarios places the operation of mobile equipment as the dominant hazard in the risk profile.

3.1.1 Risk Assessment Assumptions

The workshop team assumptions and data used to derive the PLL values are outlined in the following Table 3.2

Table 3.2 - List of Assumptions

Hazard No Description	Assumptions
IPRH-NO1 Vehicle Incident while accessing worksite.	Hazard relates to on-site access to work areas (light vehicles). Approx 25 years of history on site. Three Types of incident identified: 1. Rollovers 1/ 2.5 years = 9% of incidents 2. Impact/Collision 1/3 months = 90% of incidents 3. Off Edge 1/30 years = 1% of incidents Of type 2. Impact/ Collision 50% are unoccupied. Of remaining incidents 30% require medical treatment with 2% of these being fatal. Of type 1 Rollovers 90% estimated requiring medical treatment. Of these 2% fatal. Of type 3 Off Edge 100% estimated as medically treated 33% fatal. Multiple occupancy vehicles generally only at shift change (2 hour window). Assumed 10% of fatal events double fatality with 1% Multiple fatality (3-5 fatalities)
IPRH-NO4 Dropped objects from major mining plant (onto personnel / equipment)	Two types of incident considered: 1. Lumps falling from conveyors/transfers 2. Components/pieces of plant dropped or ejected. For type 1. Initiating event frequency 2/yr. Ie 20 major lump incidents in 10 year period. Of these, 10% strike someone with 5% of these being fatal (1 in 20). For type 2. Initiating event frequency 1/5 years. Ie 2 major plant/equipment incidents in 10-year period. Of these it was estimated that 1% (1 in100) would impact personnel and 50% of these impacts would be fatal. Therefore 90% of risk is associated with lump incidents, 10% plant/equipment.
IPRH-NO5 Uncontrolled Movement of major mining plant	Based on site experience. 10 major events in 30 year period. Estimated with current controls in place a potential 1 in 5 yr event. Likely to occur in Maintenance and/or Operational Mode. (personnel in area 90% of the time). Estimated 1 in 20 events impact on personnel. 75% of these impacts to result in a fatality. Estimated that 10% (1in 10) would be multiple fatality events. Construction activities in the new area (Westfield) do not include Dredgers only conveyors.

Hazard No Description	Assumptions
IPRH-NO7 Major mining plant fire	Frequency of initiating event in pit area (ie fire) 150/yr. Estimated 20% (1 in 5) occur on plant. defined sizeable fire as "capable of spreading beyond ignition area". Ie CFA notified 10/year fall into this category with 1/year impacting plant. Estimated that 1 in 1000 of these events would impact personnel and 1% of these leading to a fatality.
IPRH-NO8 Explosion of electrical components on major mining plant	Site history frequency of initiating event 2/30 years (1 in 15). Estimated with improved practices and procedures (cubicle cleaning, maintenance, etc) that initiating event 1/25 years. Estimated areas of potential incident: 1. Dredges and conveyors 80% of incidents 2. Pumps 20% of incidents.
IPRH- NO24 Heavy Mobile equipment interactions on mine roads	Relates to Heavy Mobile Equipment Only. Light vehicles covered in hazard IPRH-NO1 Includes Haul trucks(25-65 tonnes), graders, dozers, water trucks, Low loaders, etc. No significant incidents on site (30 Years) Excludes loading areas, construction and relocation. With increased trucking activity expected incident 1/7.5 years. Two types of incident considered: 1. rear end collision estimated 2% fatal (1 in 50 events) Head on collision estimated 1% fatal (1 in 100 events)
IPRH-NO26 Batter failure	1 Significant incident/year 5% (1 in 20) impacts machines 5% (1 in 50) of these estimated as fatal.
IPRH-NO37 Failure whilst Field jacking of major mining plant	Frequency Of initiation event 1 incident /5 years Estimated that personnel in vicinity 95% of the time when an incident occurs. Estimated that 1 in 100 events would result in a fatality.
IPRH- NO38 Unplanned movement of equipment	Three Areas Considered: 1. Remote unplanned Start-up Of Equipment 2. Unsecured equipment (excludes trippers which was considered specifically elsewhere) 3. Parked Equipment runaway. For 1. Estimated initiating event frequency 1/50 years with current controls. Eg Soft start of conveyors, isolation systems, pre-start alarms, etc. 1 in 20 of these events fatal. For 2. Estimated initiating event frequency 1/30 years, 0.5% (1 in 200) of these being fatal. For 3. Estimated initiating event frequency 1/5 years, 0.1% (1 in 1000) of these being fatal, of which 1% (1 in 100) are double fatality events.
IPRH-NO39 Confined spaces	Very few registered confined spaces activities on site. Approximately 3/year undertaken

Hazard No Description	Assumptions
	Estimated with current controls that fatality rate 1 in 10000 events.
IPRH-NO42 Fall from or tipping of EWP	Includes EPV (Elevated Platform Vehicle) Frequency Of initiation event 1 incident /50 year 10% (1 in10) Incidents fatal.
IPRH-NO43 Building fire	No known significant fires on30 years Control room has sprinkler system Offices have smoke detectors. Control centre 2 storey, multi exit, steel framed facility Frequency Of initiation event 1 incident /50 year 1/100 of these single fatality 1/1000 of these double fatality.
IPRH-NO36 Inrush of water into mine	Flood inrush potential 1 in 10000 year event. (Site drainage/level) Dam storage potential from catastrophic failure estimated as 1in 1000 year event. Only a potential incident for next 5 years until creek diversion completed. Statutory monitoring and inspection of dams. Probability of fatality higher than flood due to lack of warning (unlike a rain event).
IPRH-IW28 Incident with 220KV towers including construction activities	Includes construction activities, in which site has no experience. Will engage competent contractor to undertake activities. 14 Towers to be relocated Estimated 1 incident per 500 towers Of which (5%)1 in 20 will be fatal.
IPRH-IW30 Cable incident on public road	Specialist contractor undertaking works. Very minimal window. ie Exposure limited to 1 month period.
IPRH- IW32 Public vehicle incident during road alterations	Time of criticality is when cutting in roads to existing infrastructure. Anticipated to be a 2-month time period. Balance of road construction activity separate from public roads. Vic Roads standard Road traffic control systems to be adopted. Estimated that 20 incidents may occur in period, 1 Collision. Fatality rate as per Vic Roads.
IPRH-WF4 Vehicle / plant incident during West Field transfer	Not assessed as a standalone hazard for SQRA as numbers captured in other vehicle/plant hazards. Eg. IPRH – IW32, IPRH – NO24, IPRH- NO1

3.1.2 Comparison of QRA and SQRA results for selected Vehicle Incidents

As an exercise to validate the SQRA findings a brief quantitative risk estimate was completed for two of these vehicle incidents. The QRA used the Federal Office of Road Safety. 1995 statistics for fatalities per 100 km travelled for the relevant vehicle types (ie. light vehicles or rigid trucks). The results of this estimate are compared to the SQRA findings in Table 3.3. The calculation sheets for this quantitative risk assessment are included as Appendix 4.

Table 3.3 – Comparison of QRA and SQRA results for selected Vehicle Incidents

ID No.	Hazard Title	SQRA PLL value	QRA PLL Value
IPRH-NO1	Vehicle incident while accessing worksite	**1 in 87 yrs** (1.15E-02 / yr)	**1 in 203 yrs** (4.93E-03 / yr)
IPRH-NO24A	Heavy Mobile equipment interactions on mine roads For 2004 period (based on estimated distance travelled for 2004 heavy vehicles as 1,695,000 kms)	**1 in 150** (6.67E-03 / yr)	**1 in 113 yrs** (8.81E-03 / yr)
IPRH-NO24B	Normal operations (based on estimated distance travelled for normal operations as 250,000 kms)	SQRA completed for current period	**1 in 769 yrs** (1.30E-03 / yr)

In interpreting the QRA results it must be considered that the risk estimate was based on the following two critical assumptions:

- IPRH mine roads were considered the same condition and utilise the same traffic controls as public roads.
- Traffic conditions for the mine roads are similar to traffic conditions for public roads.

The two risk assessment methods have relatively similar risk estimates. The risk assessment team have assessed the risk of driving light vehicles in the mine is a factor of two higher than on public roads, however the results are still within the same order of magnitude. This slightly higher estimate for light vehicle incidents is justifiable due to the local factors, including the more difficult driving conditions for light vehicles in the mine. These results are also consistent with risk estimates obtained from risk processes for similar mining operations.

3.1.3 Contribution of West Field relocation hazards to the risk profile

It is important to note that several hazards in the risk profile relate to interim activities associated with the transfer of mine activities to the West Field lease area. These hazards are in addition to the hazards which will be encountered during the normal mining operations in the West Field area. A summary of these hazards and their affect on the risk profile is included in Table 3.4.

Table 3.4 - Contribution of West Field relocation to risk profile

ID No	Hazard Title	PLL value	1 Fatality every …yrs
IPRH-IW32	Public vehicle incident during road alterations	1.00E-02	100.0
IPRH-NO24A	Heavy Mobile equipment interactions on mine roads	6.67E-03	149.9
IPRH-IW28	Structural failure of 220KV towers	2.50E-03	400.0
IPRH-IW30	Cable incident on public road	1.40E-04	7142.9
Total for West Field relocation activities		1.93E-02	51.8
Total for Hazelwood Major Mining Hazards		4.72E-02	21.2
IPRH-NO24B	Heavy Mobile equipment interactions on mine roads (normal operations) – QRA result	1.30E-03	769.2
MMH Site risk not including relocation activities*		**2.79E-02**	**35.9**

* MMH Risk (not including relocation activities) = (Total mine MMH PLL) – (West Field relocation PLL) + (NO24B PLL)

It is evident from the risk results outlined in Table 3.4 that the activities associated with the relocation to the West Field area are significant in the risk profile of the Hazelwood Mine. Following the relocation to the West Field the risk, from the hazards assessed, would decrease by approximately 40%. In addition, it is important to note that the hazards above relate principally to activities to be completed by contractors under IPRH management. This further raises the need to view the controls relating to selection and management of contractors as critical to managing this risk.

3.2 Critical Controls Identified

All of the hazards were reviewed to identify the Critical Controls. The list of controls identified as critical or major using the criticality criteria outlined in section 2.4 is contained in Table 3.5 and included on the Data Sheets which are Appendix 1.

Table 3.5 - Critical and Major Controls Identified

Hazard and Id No.	Control	Type (Critical or Major)
IPRH-NO36 Inrush of water into mine	Ancold Regulations (Statutory Dam Inspections, Monitoring, Survey, etc)	Critical
IPRH-NO1 Vehicle Incident while accessing worksite.	Drive to conditions Road maintenance program Supervision Access control through control centre / shift manager Competent personnel Guide posts and reflectors Pre start checks and recording Preventative maintenance program. Remarking of road lines Shiftly fault inspections (reporting) Signage	Critical Critical Critical Major Major Major Major Major Major Major Major Major
IPRH-NO37 Failure whilst Field jacking of major mining plant	Ballast (excavation and backfill) Ground Assessment Procedure Competent maintenance personnel SOPs Surface drainage Plan	Critical Major Major Major Major
IPRH-NO43 Building fire	Circuit breakers PETE system,	Major Major
IPRH-NO4 Dropped objects from major mining plant (onto personnel / equipment)	Competent personnel Designed conveyor systems (chute size, gradient) Preventative maintenance program Sequencing and breaking design Sequencing of conveyors Cleaning daily or on request (hose down / shovel clean) Competent design engineers Design to prevent spillage Experienced workforce Shiftly fault inspections(reporting) Design Standard	Critical Critical Critical Critical Major Major Major Major Major Major Major Major
IPRH-NO7 Major mining plant fire	Cleaning daily or on request (hose down / shovel clean) Shiftly inspection	Major Major

Hazard and Id No.	Control	Type (Critical or Major)
	Permit System (Hot Work)	Major
IPRH- NO38 Unplanned movement of equipment	Competent maintenance personnel Routine inspection JSA	Major Major Major
IPRH- NO24 Heavy Mobile equipment interactions on mine roads	Drive to conditions Competent personnel Contractor management process (fatigue management, selection process) Preventative maintenance program. Shiftly fault inspections (reporting) Supervision	Major Major Major Major Major Major
IPRH-NO39 Confined spaces	Confined space procedure CS Training Labelling of confined space	Critical Major Major
IPRH-IW28 Incident with 220KV towers including construction activities	Competent sub-contractors Contractor management process (fatigue management, selection process) Approved construction SMP	Critical Major Major
IPRH-IW30 Cable incident on public road	Competent sub-contractors Contractor management process (fatigue management, selection process) Approved construction SMP	Critical Major Major
IPRH-NO29 Batter failure	Digging procedures Face mapping of OB Surcharge removal Surface drainage Plan Crack orientation for dig plan Shift face inspections	Critical Critical Critical Critical Major Major
IPRH-NO5 Uncontrolled Movement of major mining plant	Electronic feedback (survey control) Experienced workforce	Critical Major
IPRH- IW32 Public vehicle incident during road alterations	Enforcement of Vic Roads requirements Construction contractor QA system compliance with Vic Roads requirements	Critical Major
IPRH-NO8 Explosion of electrical components on major mining plant	HV Routine Maintenance (Insulator Cleaning, inspection and servicing) SOP (Isolation / set up sequence) Ticketed electricians to AS Explosion vents (compliance to AS3000)	Major Major Major Major
IPRH-NO42 Fall from or tipping of EWP	JSA Ticketed operators	Major Major

3.3 Selection of Major Mining Hazards for Further Assessment

The Risk Assessment Team ranked and reviewed the list of hazards to identify those hazards that should be considered as MMHs for further analysis in Stage 3 of the process (ie. Control Adequacy Review). The selection of MMHs was achieved through applying two criteria:

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

As such, 13 hazards were identified as MMHs and taken forward for control analysis. These hazards are shown in Table 3.6.

The three hazard not taken forward were:

- Confined Spaces (NO39)
- Explosion of electrical components (NO8)
- Major mining plant Fire (NO7)

Table 3.6 - Major Mining Hazards for Stage 3 Assessment

Rank	ID No.	Hazard Title	PLL value
1	IPRH-NO1	Vehicle incident while accessing worksite	1.15E-02
2	IPRH-IW32	Public vehicle incident during road alterations	1.00E-02
3	IPRH-NO24	Heavy Mobile equipment interactions on mine roads	6.67E-03
4	IPRH-NO4	Dropped objects from major mining plant (onto personnel / equipment)	6.00E-03
5	IPRH-NO37	Failure whilst field jacking of major mining plant	4.40E-03
6	IPRH-IW28	220KV tower incident, including construction activities	2.50E-03
7	IPRH-NO5	Uncontrolled movement of major mining plant	1.65E-03
8	IPRH-NO38	Unplanned movement of equipment	1.37E-03
9	IPRH-NO42	Fall from or tipping of EWP	1.10E-03
10	IPRH-NO26	Batter failure	1.00E-03
11	IPRH-NO39	Confined spaces	3.00E-04
12	IPRH-NO8	Explosion of electrical components on major mining plant	2.20E-04
13	IPRH-NO43	Building fire	2.20E-04
14	IPRH-IW30	Cable incident on public road	1.40E-04
15	IPRH-NO7	Major mining plant fire	1.00E-04
16	IPRH-NO36	Inrush of water into mine	1.60E-05

Hazards identified for final list of Major Mining Hazards for Stage 3 assessment.

Appendix 1

Major Mining Hazard Data Sheets

Hazard Register Data Sheet

Hazard **IPRH-IW28 220KV tower incident, including construction activities.** *PLL* 2.50E-03

Relates to incidents involving HV towers either during mine operations around towers or tower erection / construction. Example causes, include structural failure, ground failure, incorrect design, natural forces, etc. Construction activities include - crainage, lifting, heights work. Tower construction to be completed by specialist contractor.

Control	*%*	*PLL Contr*	*Control Class*
Causal Pathway **Design Fault**	4.00%	1.00E-04	None
Design fault			
64 Competent sub-contractors			
33 Contractor management process(fatigue management, selection process)			
65 Approved construction SMP			
93 Joint management with SPI			
127 Powernet for contract management			
66 Ensure risk assessment and SOPs			
Causal Pathway **Sabotage**	1.00%	2.50E-05	None
Sabotage			
64 Competent sub-contractors			
33 Contractor management process(fatigue management, selection process)			
65 Approved construction SMP			
93 Joint management with SPI			
127 Powernet for contract management			
66 Ensure risk assessment and SOPs			
Causal Pathway **Wind loading**	10.00%	2.50E-04	1 Major
Wind loading			
64 Competent sub-contractors			**Major**
33 Contractor management process(fatigue management, selection process)			
65 Approved construction SMP			
93 Joint management with SPI			
127 Powernet for contract management			
66 Ensure risk assessment and SOPs			
Causal Pathway **Incorrect assembly procedures**	50.00%	1.25E-03	1 Critical or 2 Major
Incorrect assembly procedures			
64 Competent sub-contractors			**Critical**
33 Contractor management process(fatigue management, selection process)			**Major**
65 Approved construction SMP			**Major**
93 Joint management with SPI			
127 Powernet for contract management			
66 Ensure risk assessment and SOPs			
Causal Pathway **Stability**	5.00%	1.25E-04	None
Stability			
64 Competent sub-contractors			
33 Contractor management process(fatigue management, selection process)			
65 Approved construction SMP			
93 Joint management with SPI			
127 Powernet for contract management			
66 Ensure risk assessment and SOPs			

Hazard Register Data Sheet

Hazard **IPRH-IW28 220KV tower incident, including construction activities.** *PLL* 2.50E-03

Relates to incidents involving HV towers either during mine operations around towers or tower erection / construction. Example causes, include structural failure, ground failure, incorrect design, natural forces, etc. Construction activities include - crainage, lifting, heights work. Tower construction to be completed by specialist contractor.

Control	*%*	*PLL Contr*	*Control Class*
Causal Pathway **Equipment/rigging failure**	30.00%	7.50E-04	1 Critical or 2 Major
Equipment/rigging failure			
64 Competent sub-contractors			**Critical**
33 Contractor management process(fatigue management, selection process)			**Major**
65 Approved construction SMP			
93 Joint management with SPI			
127 Powernet for contract management			
66 Ensure risk assessment and SOPs			
Outcome Pathw **Consequence**	0.00%	0.00E+00	None
Multiple fatalities			
214 Emergency response procedure			

Hazard Register Data Sheet

Hazard **IPRH-IW30 Cable incident on public road** *PLL* 1.40E-04

Relates to incidents involving HV line installation or failure during operations. Activity will be completed by specialist contractor. Less than 1 month project. During critical stages the road will be closed.

Control	*%*	*PLL Contr*	*Control Class*
Causal Pathway **Design/failure of cable support**	20.00%	2.80E-05	None
Design of cable support			
64 Competent sub-contractors			
33 Contractor management process(fatigue management, selection process)			
65 Approved construction SMP			
93 Joint management with SPI			
127 Powernet for contract management			
66 Ensure risk assessment and SOPs			
Causal Pathway **Failure to follow assembly procedure**	80.00%	1.12E-04	None
Failure to follow assembly procedure			
64 Competent sub-contractors			**Critical**
33 Contractor management process(fatigue management, selection process)			**Major**
65 Approved construction SMP			**Major**
93 Joint management with SPI			
127 Powernet for contract management			
66 Ensure risk assessment and SOPs			

Hazard **IPRH-IW32 Public vehicle incident during road alterations** *PLL* 1.00E-02

Relates to road alterations during West Field relocations. Traffic Management Plan. Activity will be completed by specialist contractor in line with Vic Roads requirements. Includes public vehicle collisions and public vehicle/mine vehicle collisions.

Control	*%*	*PLL Contr*	*Control Class*
Causal Pathway **Changes to traffic patterns/confusion**	70.00%	7.00E-03	1 Critical and 1 Major
Changes to traffic patterns			
63 Enforcement of Vic Roads requirements			**Critical**
67 Construction contractor QA system compliance with Vic Roads requirements			**Major**
33 Contractor management process(fatigue management, selection process)			
66 Ensure risk assessment and SOPs			
Causal Pathway **Changes to road surface conditions**	10.00%	1.00E-03	1 Critical or 2 Major
Changes to road surface conditions			
63 Enforcement of Vic Roads requirements			**Critical**
67 Construction contractor QA system compliance with Vic Roads requirements			
33 Contractor management process(fatigue management, selection process)			
66 Ensure risk assessment and SOPs			
Causal Pathway **Poor visibility**	10.00%	1.00E-03	1 Critical or 2 Major
Poor visibility			
63 Enforcement of Vic Roads requirements			**Critical**
67 Construction contractor QA system compliance with Vic Roads requirements			**Major**
33 Contractor management process(fatigue management, selection process)			
66 Ensure risk assessment and SOPs			
Causal Pathway **Impatience of drivers**	10.00%	1.00E-03	1 Critical or 2 Major
Impatience of drivers			
63 Enforcement of Vic Roads requirements			**Critical**
67 Construction contractor QA system compliance with Vic Roads requirements			
33 Contractor management process(fatigue management, selection process)			
66 Ensure risk assessment and SOPs			

Hazard **IPRH-NO24 Heavy Mobile equipment interactions on mine roads** *PLL* 6.67E-03

Relates to incidents during normal heavy mobile plant operations on mine roads. Issue due to sharing of roads between mobile equipment. Hazard excludes light vehicle incidents (NO1), and interactions in ,loading areas (NO29) as included as separate scenario .Areas of concern: Infrequent users of mine roads; External dumping closer to points of entry; Radio protocols (need for clearer and more positive communication).

Control	*%*	*PLL Contr*	*Control Class*
Causal Pathway **Poor visibility**	10.00%	6.67E-04	1 Major
Rain			
102 Minimum equipment standards			
141 Road watering			
77 Fog lights			
76 Flashing lights			
171 Sun glasses supplied			
192 wipers			
129 Pre start checks and recording			
153 Shift changeover meeting			
17 Cease / delay task in extreme conditions			
56 Drive to conditions			**Major**
134 Remarking of road lines			
83 Guide posts and reflectors			
Fog			
102 Minimum equipment standards			
141 Road watering			
77 Fog lights			
76 Flashing lights			
171 Sun glasses supplied			
192 wipers			
129 Pre start checks and recording			
153 Shift changeover meeting			
17 Cease / delay task in extreme conditions			
56 Drive to conditions			
134 Remarking of road lines			
83 Guide posts and reflectors			
Dust			
102 Minimum equipment standards			
141 Road watering			
77 Fog lights			
76 Flashing lights			
171 Sun glasses supplied			
192 wipers			
129 Pre start checks and recording			
153 Shift changeover meeting			
17 Cease / delay task in extreme conditions			
56 Drive to conditions			
134 Remarking of road lines			
83 Guide posts and reflectors			
Sun			
102 Minimum equipment standards			
141 Road watering			
77 Fog lights			
76 Flashing lights			
171 Sun glasses supplied			
192 wipers			
129 Pre start checks and recording			

Hazard **IPRH-NO24 Heavy Mobile equipment interactions on mine roads** *PLL* 6.67E-03

Relates to incidents during normal heavy mobile plant operations on mine roads. Issue due to sharing of roads between mobile equipment. Hazard excludes light vehicle incidents (NO1), and interactions in ,loading areas (NO29) as included as separate scenario .Areas of concern: Infrequent users of mine roads; External dumping closer to points of entry; Radio protocols (need for clearer and more positive communication).

Control	*%*	*PLL Contr*	*Control Class*
153 Shift changeover meeting			
17 Cease / delay task in extreme conditions			
56 Drive to conditions			
134 Remarking of road lines			
83 Guide posts and reflectors			

Causal Pathway **Poor road conditions** 2.00% 1.33E-04 None

Construction

- 133 Regular grading
- 138 Road maintenance program
- 140 Road surfacing material (borrow areas / import rock)
- 144 Safety walks

Surfacing

- 133 Regular grading
- 138 Road maintenance program
- 140 Road surfacing material (borrow areas / import rock)
- 144 Safety walks

Drainage

- 133 Regular grading
- 138 Road maintenance program
- 140 Road surfacing material (borrow areas / import rock)
- 144 Safety walks

Hazard Register Data Sheet

Hazard **IPRH-NO24 Heavy Mobile equipment interactions on mine roads** *PLL* 6.67E-03

Relates to incidents during normal heavy mobile plant operations on mine roads. Issue due to sharing of roads between mobile equipment. Hazard excludes light vehicle incidents (NO1), and interactions in ,loading areas (NO29) as included as separate scenario .Areas of concern: Infrequent users of mine roads; External dumping closer to points of entry; Radio protocols (need for clearer and more positive communication).

Control	*%*	*PLL Contr*	*Control Class*
Causal Pathway **Driver error / not following road rules**	40.00%	2.67E-03	1 Critical and 1 Major
Driving to conditions			
1 4wd training for IPH personnel			
28 Competent personnel			**Major**
161 Site induction process			
49 Disciplinary policy			
33 Contractor management process(fatigue management, selection process)			**Major**
153 Shift changeover meeting			
157 Shift notes			
51 Documented road rules			
160 Signage			
172 Supervision			**Critical**
88 Incident reporting and CA			
198 Consider publishing mine traffic rules handbook.		**New**	
Rules			
1 4wd training for IPH personnel			
28 Competent personnel			
161 Site induction process			
49 Disciplinary policy			
33 Contractor management process(fatigue management, selection process)			
153 Shift changeover meeting			
157 Shift notes			
51 Documented road rules			
160 Signage			
172 Supervision			
88 Incident reporting and CA			
198 Consider publishing mine traffic rules handbook.		**New**	
Unfamiliar with conditions			
1 4wd training for IPH personnel			
28 Competent personnel			
161 Site induction process			
49 Disciplinary policy			
33 Contractor management process(fatigue management, selection process)			
153 Shift changeover meeting			
157 Shift notes			
51 Documented road rules			
160 Signage			
172 Supervision			
88 Incident reporting and CA			
198 Consider publishing mine traffic rules handbook.		**New**	
Fatigue / Fitness-For-Work			
177 Task rotation			
156 Shift management			
53 Draft drug & Alcohol policy			
6 Annual medical tests available			
60 EAP available			
101 Medical tests / first aid available			
96 Leave policies			

Hazard **IPRH-NO24 Heavy Mobile equipment interactions on mine roads** *PLL* 6.67E-03

Relates to incidents during normal heavy mobile plant operations on mine roads. Issue due to sharing of roads between mobile equipment. Hazard excludes light vehicle incidents (NO1), and interactions in ,loading areas (NO29) as included as separate scenario .Areas of concern: Infrequent users of mine roads; External dumping closer to points of entry; Radio protocols (need for clearer and more positive communication).

Control	*%*	*PLL Contr*	*Control Class*
59 Duty of Care			
Distracted			
1 4wd training for IPH personnel			
28 Competent personnel			
161 Site induction process			
49 Disciplinary policy			
33 Contractor management process(fatigue management, selection process)			
153 Shift changeover meeting			
157 Shift notes			
51 Documented road rules			
160 Signage			
172 Supervision			
88 Incident reporting and CA			
198 Consider publishing mine traffic rules handbook.		**New**	
Driving to conditions			
1 4wd training for IPH personnel			
28 Competent personnel			
161 Site induction process			
49 Disciplinary policy			
33 Contractor management process(fatigue management, selection process)			
153 Shift changeover meeting			
157 Shift notes			
51 Documented road rules			
160 Signage			
172 Supervision			
88 Incident reporting and CA			
198 Consider publishing mine traffic rules handbook.		**New**	
Causal Pathway **Mechanical failure**	40.00%	2.67E-03	1 Critical and 1 Major
Mechanical failure			
130 Preventative maintenance program (light and heavy mobile vehicles)			**Critical**
158 Shiftly fault inspections(reporting)			**Major**
28 Competent personnel			
194 Works Management System			
169 Spare vehicles			
16 Call out service			
57 Dry hire lease arrangements			
Causal Pathway **Over / uneven loading of trucks**	2.00%	1.33E-04	None
Spillage			
27 Competent operators			
172 Supervision			
168 Maintenance procedures			
139 Road rules			

Hazard **IPRH-NO24 Heavy Mobile equipment interactions on mine roads** *PLL* 6.67E-03

Relates to incidents during normal heavy mobile plant operations on mine roads. Issue due to sharing of roads between mobile equipment. Hazard excludes light vehicle incidents (NO1), and interactions in ,loading areas (NO29) as included as separate scenario .Areas of concern: Infrequent users of mine roads; External dumping closer to points of entry; Radio protocols (need for clearer and more positive communication).

Control	*%*	*PLL Contr*	*Control Class*
Causal Pathway **Poor road design**	2.00%	1.33E-04	None
Poor road design			
39 Design of permanent roads & ramps to Vic Roads standard			
26 Competent mine planner			
68 Erection of temporary barriers			
137 Review intersections for traffic management			
Causal Pathway **Unauthorised access**	2.00%	1.33E-04	None
Unauthorised access			
89 Induction process			
147 Security gates			
148 Security guard			
145 Sealed roads as boundary of mine			
160 Signage			
2 Access control through control centre / shift manager			
50 Disseminate haul road info IPH wide			
199 Security review to be completed.		**New**	
Causal Pathway **Poor communication**	2.00%	1.33E-04	None
Poor communication			
182 Tool box meetings			
152 Shift changeover			
84 Hand held and fixed radios			
28 Competent personnel			
139 Road rules			
130 Preventative maintenance program (light and heavy mobile vehicles)			
50 Disseminate haul road info IPH wide			
Outcome Pathw **Consequence**	0.00%	0.00E+00	None
Single fatality or irreversible disability			
233 Seat belts in all vehicles			
231 ROPs on mining plant			
207 Air bags on selected LVs			
211 Bull bars			
223 First aid room on site			
214 Emergency response procedure			
224 First Aiders on all shifts			
212 Close proximity to Emergency Services and Hospital			
213 Diamond Protection for first response			

Hazard Register Data Sheet

Hazard **IPRH-NO26 Batter failure** *PLL* 1.00E-03

Relates to both coal and overburden collapses onto personnel, plant and/or vehicle (eg. dozer,4wd,pedestrian)

Control	*%*	*PLL Contr*	*Control Class*
Causal Pathway **Material type / soft formation**	35.00%	3.50E-04	1 Major
Material type / soft formation			
48 Digging procedures			**Critical**
34 Crack monitoring			
154 Shift face inspections			**Major**
35 Crack orientation for dig plan			**Major**
107 Monthly engineering face inspections			
29 Computer modelling of stability (internal)			
55 Drilling and testing as required			
7 Annual stability and dewatering reports (externally reviewed)			
92 Investigation pans for fire holes			
105 Modify digging programs as required			
72 Face mapping of Over Burden			**Critical**
173 Supply of face maps to OB operations			
Causal Pathway **Operator Error**	10.00%	1.00E-04	None
Not digging to plan			
27 Competent operators			
172 Supervision			
70 Experienced workforce			
46 Dig charts			
157 Shift notes			
62 Electronic feedback (survey control)			
173 Supply of face maps to OB operations			
205 Confirm documented parking procedures about parking at toe of batter.		**New**	
Causal Pathway **Water pressure**	10.00%	1.00E-04	None
Water pressure			
44 Dewatering			
82 Groundwater profile monitoring			
7 Annual stability and dewatering reports (externally reviewed)			
85 Horizontal bores (relief bores)			
175 Surface drainage Plan			
47 Dig plan design for drainage control			
109 Monthly stability inspections			
88 Incident reporting and CA			
136 Remediation works			
124 Pin lines (monitoring)			

Hazard Register Data Sheet

Hazard **IPRH-NO26 Batter failure** *PLL* 1.00E-03

Relates to both coal and overburden collapses onto personnel, plant and/or vehicle (eg. dozer,4wd,pedestrian)

Control	*%*	*PLL Contr*	*Control Class*
Causal Pathway **Surcharge / over height**	20.00%	2.00E-04	None
Surcharge / over height			
174 Surcharge removal			**Critical**
48 Digging procedures			
34 Crack monitoring			
154 Shift face inspections			
35 Crack orientation for dig plan			
107 Monthly engineering face inspections			
29 Computer modelling of stability (internal)			
55 Drilling and testing as required			
7 Annual stability and dewatering reports (externally reviewed)			
92 Investigation pans for fire holes			
105 Modify digging programs as required			
72 Face mapping of Over Burden			
173 Supply of face maps to OB operations			
Causal Pathway **Surface drainage**	23.00%	2.30E-04	None
Surface drainage			
175 Surface drainage Plan			**Critical**
47 Dig plan design for drainage control			
109 Monthly stability inspections			
88 Incident reporting and CA			
136 Remediation works			
124 Pin lines (monitoring)			
Causal Pathway **Heaving**	2.00%	2.00E-05	None
Heaving			
44 Dewatering			
82 Groundwater profile monitoring			
7 Annual stability and dewatering reports (externally reviewed)			
85 Horizontal bores (relief bores)			
Outcome Pathw **Consequence**	0.00%	0.00E+00	None
Multiple fatalities			
223 First aid room on site			
214 Emergency response procedure			
224 First Aiders on all shifts			
212 Close proximity to Emergency Services and Hospital			
213 Diamond Protection for first response			

Hazard Register Data Sheet

Hazard **IPRH-NO36 Inrush of water into mine** *PLL* 1.60E-05

Relates to major inrush of water into mining area. Main control is the design of flood mitigation to 1:10,000 yr /event. Also considers risk of catastrophic dam wall failure as well.

Control	*%*	*PLL Contr*	*Control Class*
Causal Pathway **Water volume of catchment area above design of cut off drains**	10.00%	1.60E-06	None
Water volume of catchment area above design of cut off drains			
31 Construction of levy banks at 1 in 10,000 yr event			
Causal Pathway **Failure / breach of flood protection**	10.00%	1.60E-06	None
Failure			
31 Construction of levy banks at 1 in 10,000 yr event			
Breach			
31 Construction of levy banks at 1 in 10,000 yr event			
Causal Pathway **Failure of dam wall**	80.00%	1.28E-05	None
Failure of Dam Wall			
245 Ancold Regulations (Statuatory Dam Inspections, Monitoring, Survey, etc)			**Critical**
Outcome Pathw **Consequence**	0.00%	0.00E+00	None
Multiple fatalities			
223 First aid room on site			
214 Emergency response procedure			
224 First Aiders on all shifts			
212 Close proximity to Emergency Services and Hospital			
213 Diamond Protection for first response			

Hazard Register Data Sheet

Hazard **IPRH-NO37 Failure whilst field jacking of major mining plant** *PLL* 4.40E-03

Maintenance work for Major Mining Plant completed in field, due to size of plant. Hazard relates to jacking of plant for maintenance purposes.

Control	*%*	*PLL Contr*	*Control Class*
Causal Pathway **Equipment failure**	5.00%	2.20E-04	None
Equipment failure			
25 Competent maintenance personnel			
168 Maintenance procedures			
18 Certified and rated jacking equipment			
9 Appropriately stored equipment			
10 Asset register of equipment			
189 Weight / balance diagrams (weight and balance audit)			
210 Annual training in fire fighting			
Causal Pathway **Failure to follow procedure**	20.00%	8.80E-04	1 Critical or 2 Major
Failure to follow procedure			
25 Competent maintenance personnel			**Major**
168 Maintenance procedures			**Major**
Causal Pathway **Ground conditions**	60.00%	2.64E-03	1 Critical and 1 Major
Ground conditions			
11 Ballast (excavation and backfill)			**Critical**
243 Ground Assessment Procedure			**Major**
175 Surface drainage Plan			**Major**
Causal Pathway **Incorrect procedure**	10.00%	4.40E-04	1 Major
Incorrect procedure			
25 Competent maintenance personnel			**Major**
168 Maintenance procedures			**Major**
18 Certified and rated jacking equipment			
9 Appropriately stored equipment			
10 Asset register of equipment			
189 Weight / balance diagrams (weight and balance audit)			
210 Annual training in fire fighting			
Causal Pathway **Ground vibration**	5.00%	2.20E-04	None
Seismic			
150 Separation of plant from activity			
166 SOP (Jack & Pack)			
Plant Movements			
150 Separation of plant from activity			
166 SOP (Jack & Pack)			
Outcome Pathw **Consequence**	0.00%	0.00E+00	None
Multiple fatalities			
223 First aid room on site			
214 Emergency response procedure			
224 First Aiders on all shifts			
212 Close proximity to Emergency Services and Hospital			
213 Diamond Protection for first response			

Hazard Register Data Sheet

Hazard **IPRH-NO38 Unplanned movement of equipment** *PLL* 1.37E-03

Relates to unplanned / uncontrolled movement of equipment striking personnel or equipment. Includes parts of Major Mining Plant or mine heavy vehicles / equipment. Example scenarios include; equipment runaway, operator error, belt slip, belt runaway, remote startup, vehicles parked up, conveyor anchor post failure, etc. Excludes entanglement in mechanical equipment, as included as separate hazard (NO11).

Control	*%*	*PLL Contr*	*Control Class*
Causal Pathway **Brake Failure**	25.00%	3.42E-04	1 Major
Brake Failure			
142 Routine inspection			**Major**
143 Safety device testing for major plant			
246 Preventative maintenance program (major mining plant)			
73 Fail safe designs			
121 Permit procedures			
244 Dual Brakes			
Causal Pathway **Electrical failure**	5.00%	6.84E-05	None
Electrical failure			
142 Routine inspection			
143 Safety device testing for major plant			
246 Preventative maintenance program (major mining plant)			
73 Fail safe designs			
121 Permit procedures			
Causal Pathway **Not following procedure**	50.00%	6.83E-04	1 Major
Not following procedure			
94 JSA			**Major**
168 Maintenance procedures			
25 Competent maintenance personnel			**Major**
Causal Pathway **Inadequate anchoring**	0.00%	0.00E+00	None
Inadequate anchoring			
41 Designated anchoring points			
119 Pendant ropes			
185 Trestles for specific components			
179 Testing and inspection of Trestles and Pendent ropes (external)			
4 Anchor posts for conveyors			
184 Training of fire man / spotter for Hot Work			
Causal Pathway **Wind loading**	0.00%	0.00E+00	None
Wind loading			
190 Wind gauges			
191 Wind restrictions in mine			
115 Orientation for wind			
Causal Pathway **Mechanical failure**	20.00%	2.73E-04	1 Major
Mechanical failure			
142 Routine inspection			**Major**
143 Safety device testing for major plant			
246 Preventative maintenance program (major mining plant)			
73 Fail safe designs			
121 Permit procedures			

Hazard Register Data Sheet

Hazard **IPRH-NO38 Unplanned movement of equipment** *PLL* 1.37E-03

Relates to unplanned / uncontrolled movement of equipment striking personnel or equipment. Includes parts of Major Mining Plant or mine heavy vehicles / equipment. Example scenarios include; equipment runaway, operator error, belt slip, belt runaway, remote startup, vehicles parked up, conveyor anchor post failure, etc. Excludes entanglement in mechanical equipment, as included as separate hazard (NO11).

Control	*%*	*PLL Contr*	*Control Class*
Outcome Pathw **Consequence**	0.00%	0.00E+00	None

Multiple fatalities

223 First aid room on site

214 Emergency response procedure

224 First Aiders on all shifts

212 Close proximity to Emergency Services and Hospital

213 Diamond Protection for first response

Hazard Register Data Sheet

Hazard **IPRH-NO39 Confined/registered spaces** *PLL* 3.00E-04

Relates to both Confined and Registered Spaces. Includes maintenance work in and around bunkers. Several Registered Spaces but relatively few Confined Spaces. For mine operations (ie. Dredger tubs and Bucket wheel)

Control	*%*	*PLL Contr*	*Control Class*
Causal Pathway **Failure to follow procedures**	80.00%	2.40E-04	None
Failure to follow procedures			
30 Confined space procedure			**Critical**
80 Gas testing			
187 Ventilation fans			
42 Designated confined space officer			
36 Confined Space Training			**Major**
132 Register of confined spaces			
95 Warning signage at all restricted / confined spaces			**Major**
128 PPE			
30 Confined space procedure			
80 Gas testing			
187 Ventilation fans			
42 Designated confined space officer			
36 Confined Space Training			
132 Register of confined spaces			
95 Warning signage at all restricted / confined spaces			
128 PPE			
30 Confined space procedure			
80 Gas testing			
187 Ventilation fans			
42 Designated confined space officer			
36 Confined Space Training			
132 Register of confined spaces			
95 Warning signage at all restricted / confined spaces			
128 PPE			
Causal Pathway **Limited exits**	10.00%	3.00E-05	None
Limited exits			
30 Confined space procedure			
80 Gas testing			
187 Ventilation fans			
42 Designated confined space officer			
36 Confined Space Training			
132 Register of confined spaces			
95 Warning signage at all restricted / confined spaces			
128 PPE			
Causal Pathway **Lack of ventilation**	10.00%	3.00E-05	None
Lack of ventilation			
30 Confined space procedure			
80 Gas testing			
187 Ventilation fans			
42 Designated confined space officer			
36 Confined Space Training			
132 Register of confined spaces			
95 Warning signage at all restricted / confined spaces			
128 PPE			

Hazard Register Data Sheet

Hazard **IPRH-NO39 Confined/registered spaces** *PLL* 3.00E-04

Relates to both Confined and Registered Spaces. Includes maintenance work in and around bunkers. Several Registered Spaces but relatively few Confined Spaces. For mine operations (ie. Dredger tubs and Bucket wheel)

Control	*%*	*PLL Contr*	*Control Class*
Outcome Pathw **Consequence**	0.00%	0.00E+00	None

Multiple fatalities

223 First aid room on site

214 Emergency response procedure

224 First Aiders on all shifts

212 Close proximity to Emergency Services and Hospital

213 Diamond Protection for first response

Hazard **IPRH-NO4 Dropped objects from major mining plant (onto personnel or equipment)** *PLL* 6.00E-03

Major Mining Plant includes conveyors, stackers & dredgers. Relates to plant components falling, loose material falling or deliberate dumping, and material falling due to minor structural failure. Areas of concern: Lumps of coal falling; Complacency of stacker operator or ground personnel; Ensuring equipment is correctly designed.

Control	*%*	*PLL Contr*	*Control Class*
Causal Pathway **Equipment Failure**	10.00%	6.00E-04	1 Major
Equipment Failure			
246 Preventative maintenance program (major mining plant)			**Critical**
158 Shiftly fault inspections(reporting)			**Major**
28 Competent personnel			
194 Works Management System			
239 Design Standard			**Major**
Causal Pathway **Blocked Chute**	0.00%	0.00E+00	None
Blocked Chute			
246 Preventative maintenance program (major mining plant)			
158 Shiftly fault inspections(reporting)			
28 Competent personnel			
43 Designed conveyor systems (chute size, gradient)			
14 Block chute limits			
122 Permit System			
168 Maintenance procedures			
116 Overload devices			
106 Monitor weightometers on machines			
151 Sequencing of conveyors			
12 Belt alignment limit switches			
195 Install dynamic braking in conveyor systems in WF to match sequence		**New**	
196 Ensure correct barricades are erected during cleaning of major plant		**New**	
Causal Pathway **Conveyor Run-on (gradient)**	50.00%	3.00E-03	1 Critical and 1 Major
Conveyor Run-on (gradient)			
246 Preventative maintenance program (major mining plant)			**Major**
158 Shiftly fault inspections(reporting)			
28 Competent personnel			
43 Designed conveyor systems (chute size, gradient)			**Critical**
14 Block chute limits			
122 Permit System			
168 Maintenance procedures			
116 Overload devices			
106 Monitor weightometers on machines			
151 Sequencing of conveyors			**Major**
12 Belt alignment limit switches			
195 Install dynamic braking in conveyor systems in WF to match sequence		**New**	
196 Ensure correct barricades are erected during cleaning of major plant		**New**	

Hazard Register Data Sheet

Hazard **IPRH-NO4 Dropped objects from major mining plant (onto personnel or equipment)** *PLL* 6.00E-03

Major Mining Plant includes conveyors, stackers & dredgers. Relates to plant components falling, loose material falling or deliberate dumping, and material falling due to minor structural failure. Areas of concern: Lumps of coal falling; Complacency of stacker operator or ground personnel; Ensuring equipment is correctly designed.

Control	*%*	*PLL Contr*	*Control Class*
Causal Pathway **Overloaded Conveyor**	1.00%	6.00E-05	None
Overloaded Conveyor			
246 Preventative maintenance program (major mining plant)			
158 Shiftly fault inspections(reporting)			
28 Competent personnel			
43 Designed conveyor systems (chute size, gradient)			
14 Block chute limits			
122 Permit System			
168 Maintenance procedures			
116 Overload devices			
106 Monitor weightometers on machines			
151 Sequencing of conveyors			
12 Belt alignment limit switches			
195 Install dynamic braking in conveyor systems in WF to match sequence		**New**	
196 Ensure correct barricades are erected during cleaning of major plant		**New**	
Causal Pathway **Poor Design**	12.00%	7.20E-04	1 Major
Poor Design			
24 Competent design engineers			**Major**
126 Plant / AS regulations			
118 Past experience			
240 Sequencing and breaking design			**Critical**

Hazard **IPRH-NO4 Dropped objects from major mining plant (onto personnel or equipment)** *PLL* 6.00E-03

Major Mining Plant includes conveyors, stackers & dredgers. Relates to plant components falling, loose material falling or deliberate dumping, and material falling due to minor structural failure. Areas of concern: Lumps of coal falling; Complacency of stacker operator or ground personnel; Ensuring equipment is correctly designed.

Control	*%*	*PLL Contr*	*Control Class*
Causal Pathway **Operator / Maintenance Error**	12.00%	7.20E-04	1 Major
Mis-communication			
84 Hand held and fixed radios			
28 Competent personnel			**Major**
22 Communication procedures			
172 Supervision			
70 Experienced workforce			**Major**
197 Introduction of Safe Work Observation Process		**New**	
Dropped Object			
84 Hand held and fixed radios			
28 Competent personnel			
22 Communication procedures			
172 Supervision			
70 Experienced workforce			
197 Introduction of Safe Work Observation Process		**New**	
Fatigue / Fitness-for-Work			
177 Task rotation			
156 Shift management			
53 Draft drug & Alcohol policy			
6 Annual medical tests available			
60 EAP available			
101 Medical tests / first aid available			
96 Leave policies			
59 Duty of Care			
197 Introduction of Safe Work Observation Process		**New**	
Incorrect Fitting			
84 Hand held and fixed radios			
28 Competent personnel			
22 Communication procedures			
172 Supervision			
70 Experienced workforce			
197 Introduction of Safe Work Observation Process		**New**	
Causal Pathway **Dirty Conveyor Belt**	1.00%	6.00E-05	None
Dirty Conveyor Belt			
74 Finger scrapers			
Causal Pathway **Poor Housekeeping**	4.00%	2.40E-04	None
Poor Housekeeping			
40 Design to prevent spillage			**Major**
246 Preventative maintenance program (major mining plant)			
20 Cleaning daily or on request (hose down / shovel clean)			**Major**
158 Shiftly fault inspections(reporting)			
144 Safety walks			

Hazard Register Data Sheet

Hazard **IPRH-NO4 Dropped objects from major mining plant (onto personnel or equipment)** *PLL* 6.00E-03

Major Mining Plant includes conveyors, stackers & dredgers. Relates to plant components falling, loose material falling or deliberate dumping, and material falling due to minor structural failure. Areas of concern: Lumps of coal falling; Complacency of stacker operator or ground personnel; Ensuring equipment is correctly designed.

Control	*%*	*PLL Contr*	*Control Class*
Causal Pathway **Unauthorised Access**	0.00%	0.00E+00	None
Unauthorised Access			
122 Permit System			
168 Maintenance procedures			
28 Competent personnel			
70 Experienced workforce			
97 Level 3 induction process			
160 Signage			
15 Boundary fences			
147 Security gates			
148 Security guard			
Outcome Pathw **Consequence**	0.00%	0.00E+00	None
Single fatality or irreversible disability			
238 Spill trays			
237 Spill mesh			
223 First aid room on site			
214 Emergency response procedure			
224 First Aiders on all shifts			
212 Close proximity to Emergency Services and Hospital			
213 Diamond Protection for first response			

Hazard Register Data Sheet

Hazard **IPRH-NO42 Fall from or tipping of EWP** *PLL* 1.10E-03

Relates to any equipment used for work at heights, eg. EWP, Cherry picker, JLG, Boom lift, Scissor lifts. Includes EPV (Elevated Platform Vehicle (EPV)

Control	*%*	*PLL Contr*	*Control Class*
Causal Pathway **Failure to follow procedures**	30.00%	3.30E-04	1 Major
Failure to follow procedures			
181 Ticketed operators (EWP)			**Major**
71 External training and testing			
33 Contractor management process(fatigue management, selection process)			
114 Operations manual			
94 JSA			**Major**
Causal Pathway **Ground conditions**	35.00%	3.85E-04	1 Major
Ground conditions			
181 Ticketed operators (EWP)			**Major**
71 External training and testing			
33 Contractor management process(fatigue management, selection process)			
114 Operations manual			
94 JSA			**Major**
Causal Pathway **Component failure (Structural / Mechanical)**	0.00%	0.00E+00	None
Component failure (Structural / Mechanical)			
5 Annual external testing			
99 Log books			
33 Contractor management process(fatigue management, selection process)			
Causal Pathway **Overloading**	15.00%	1.65E-04	None
Overloading			
91 Interlock			
176 SWL			
181 Ticketed operators (EWP)			
71 External training and testing			
33 Contractor management process(fatigue management, selection process)			
114 Operations manual			
94 JSA			
Causal Pathway **Wind loading**	10.00%	1.10E-04	None
Wind loading			
190 Wind gauges			
191 Wind restrictions in mine			
115 Orientation for wind			
Causal Pathway **Collision**	5.00%	5.50E-05	None
Collision			
170 Spotter			
Causal Pathway **Overbalance**	5.00%	5.50E-05	None
Overbalance			
181 Ticketed operators (EWP)			
71 External training and testing			
33 Contractor management process(fatigue management, selection process)			
114 Operations manual			
94 JSA			

Hazard **IPRH-NO42 Fall from or tipping of EWP** *PLL* 1.10E-03

Relates to any equipment used for work at heights, eg. EWP, Cherry picker, JLG, Boom lift, Scissor lifts. Includes EPV (Elevated Platform Vehicle (EPV)

Control	*%*	*PLL Contr*	*Control Class*
Outcome Pathw **Consequence**	0.00%	0.00E+00	None

Multiple fatalities

223 First aid room on site

214 Emergency response procedure

224 First Aiders on all shifts

212 Close proximity to Emergency Services and Hospital

213 Diamond Protection for first response

Hazard Register Data Sheet

Hazard **IPRH-NO43 Building fire** *PLL* 2.20E-04

Buildings for mine operations include; Control Room, Workshop, Offices.

Control	*%*	*PLL Contr*	*Control Class*
Causal Pathway **Hot work**	30.00%	6.60E-05	None
Hot work			
25 Competent maintenance personnel			
Causal Pathway **Cooking utensils**	5.00%	1.10E-05	None
Cooking utensils			
86 Housekeeping			
123 PETE system,			
19 Circuit breakers			
61 Earth leakage in workshop			
Causal Pathway **Electrical fault**	50.00%	1.10E-04	None
Electrical fault			
123 PETE system,			**Major**
19 Circuit breakers			**Major**
61 Earth leakage in workshop			
Causal Pathway **Arson**	5.00%	1.10E-05	None
Arson			
146 Secured area (gate, fences)			
Causal Pathway **Failure to follow no-smoking procedure**	10.00%	2.20E-05	None
Failure to follow no-smoking procedure			
111 No-smoking policy			

Hazard **IPRH-NO5 Uncontrolled Movement of major mining plant.** *PLL* 1.65E-03

Major Mining Plant includes conveyors, stackers & dredgers. Hazard also relates to use of cranes. Mainly relates to toppling of plant but also includes derailing, collapses, operator error, slippage, toppling due to windload or soft ground, structural failure of plant or ground, etc. Excludes falling loads from cranes and excavator (NO51); falling objects from Major Ming Plant (NO24); Tripper/hopper runaway (NO-19) and Field jacking of equipment (NO37), as included as separate hazards.

Control	*%*	*PLL Contr*	*Control Class*
Causal Pathway **Batter collapse**	5.00%	8.25E-05	None
Depressions			
48 Digging procedures			
34 Crack monitoring			
154 Shift face inspections			
35 Crack orientation for dig plan			
107 Monthly engineering face inspections			
44 Dewatering			
82 Groundwater profile monitoring			
175 Surface drainage Plan			
174 Surcharge removal			
29 Computer modelling of stability (internal)			
55 Drilling and testing as required			
7 Annual stability and dewatering reports (externally reviewed)			
92 Investigation pans for fire holes			
105 Modify digging programs as required			
72 Face mapping of Over Burden			
173 Supply of face maps to OB operations			
200 Improve info dissemination on ground conditions to mine operators (electronic).		**New**	
Water Pressure			
48 Digging procedures			
34 Crack monitoring			
154 Shift face inspections			
35 Crack orientation for dig plan			
107 Monthly engineering face inspections			
44 Dewatering			
82 Groundwater profile monitoring			
175 Surface drainage Plan			
174 Surcharge removal			
29 Computer modelling of stability (internal)			
55 Drilling and testing as required			
7 Annual stability and dewatering reports (externally reviewed)			
92 Investigation pans for fire holes			
105 Modify digging programs as required			
72 Face mapping of Over Burden			
173 Supply of face maps to OB operations			
200 Improve info dissemination on ground conditions to mine operators (electronic).		**New**	

Hazard **IPRH-NO5 Uncontrolled Movement of major mining plant.** *PLL* 1.65E-03

Major Mining Plant includes conveyors, stackers & dredgers. Hazard also relates to use of cranes. Mainly relates to toppling of plant but also includes derailing, collapses, operator error, slippage, toppling due to windload or soft ground, structural failure of plant or ground, etc. Excludes falling loads from cranes and excavator (NO51); falling objects from Major Ming Plant (NO24); Tripper/hopper runaway (NO-19) and Field jacking of equipment (NO37), as included as separate hazards.

Control	*%*	*PLL Contr*	*Control Class*
Causal Pathway **Operator error/Design interface**	45.00%	7.42E-04	1 Major
Over Edge			
27 Competent operators			
172 Supervision			
70 Experienced workforce			**Major**
46 Dig charts			
157 Shift notes			
62 Electronic feedback (survey control)			**Major**
193 Working & backup limits			
201 Improve electronic feedback and control for dredge operators.		**New**	
202 Investigate installing tilt device in dredges.		**New**	
Off Load Bucket			
27 Competent operators			
172 Supervision			
70 Experienced workforce			
46 Dig charts			
157 Shift notes			
62 Electronic feedback (survey control)			
193 Working & backup limits			
201 Improve electronic feedback and control for dredge operators.		**New**	
202 Investigate installing tilt device in dredges.		**New**	
Wheel Drop Cuts			
27 Competent operators			
172 Supervision			
70 Experienced workforce			
46 Dig charts			
157 Shift notes			
62 Electronic feedback (survey control)			
193 Working & backup limits			
201 Improve electronic feedback and control for dredge operators.		**New**	
202 Investigate installing tilt device in dredges.		**New**	
Fatigue / Fitness-For-Work			
177 Task rotation			
156 Shift management			
53 Draft drug & Alcohol policy			
6 Annual medical tests available			
60 EAP available			
101 Medical tests / first aid available			
96 Leave policies			
59 Duty of Care			
Causal Pathway **Soft formation/Ground conditions (unknown objects)**	30.00%	4.95E-04	1 Major
Soft formation			
112 Ongoing inspection by operator / shift management			
81 Grade control and mine planning			
54 Drainage			
135 Remediation plan for soft areas			

Hazard **IPRH-NO5 Uncontrolled Movement of major mining plant.** *PLL* 1.65E-03

Major Mining Plant includes conveyors, stackers & dredgers. Hazard also relates to use of cranes. Mainly relates to toppling of plant but also includes derailing, collapses, operator error, slippage, toppling due to windload or soft ground, structural failure of plant or ground, etc. Excludes falling loads from cranes and excavator (NO51); falling objects from Major Ming Plant (NO24); Tripper/hopper runaway (NO-19) and Field jacking of equipment (NO37), as included as separate hazards.

Control	*%*	*PLL Contr*	*Control Class*
Causal Pathway **Dump slip**	5.00%	8.25E-05	None
Dump slip			
159 Shiftly inspection			
108 Monthly inspection			
58 Dump design (height)			
54 Drainage			
52 Dozer maintenance of dump grades			
125 Placement of material			
Causal Pathway **Safety & electrical device failure**	1.00%	1.65E-05	None
Safety & electrical device failure			
246 Preventative maintenance program (major mining plant)			
162 Six monthly routine elect. maintenance			
110 Monthly testing of devices by operators			
163 six monthly testing of devices by engineers			
159 Shiftly inspection			
Causal Pathway **Incorrect jacking or failure**	5.00%	8.25E-05	None
Incorrect jacking or failure			
25 Competent maintenance personnel			
168 Maintenance procedures			
18 Certified and rated jacking equipment			
9 Appropriately stored equipment			
10 Asset register of equipment			
189 Weight / balance diagrams (weight and balance audit)			
21 Cleaning of machines			
203 Ensure JSA is completed for jacking activities in field.			
Causal Pathway **Equipment / rope / structure failure**	5.00%	8.25E-05	None
Equipment / rope / structure failure			
246 Preventative maintenance program (major mining plant)			
8 Annual structural inspection			
13 Biennial External structural and rope inspections			
25 Competent maintenance personnel			
100 Lubrication procedure			
117 Painting programs			
110 Monthly testing of devices by operators			
163 six monthly testing of devices by engineers			
159 Shiftly inspection			
Causal Pathway **Machine standoff**	4.00%	6.60E-05	None
Machine standoff			
167 SOP (machine stand off)			
204 Confirm documentation of rules for standoff of machines		**New**	

Hazard **IPRH-NO5 Uncontrolled Movement of major mining plant.** *PLL* 1.65E-03

Major Mining Plant includes conveyors, stackers & dredgers. Hazard also relates to use of cranes. Mainly relates to toppling of plant but also includes derailing, collapses, operator error, slippage, toppling due to windload or soft ground, structural failure of plant or ground, etc. Excludes falling loads from cranes and excavator (NO51); falling objects from Major Ming Plant (NO24); Tripper/hopper runaway (NO-19) and Field jacking of equipment (NO37), as included as separate hazards.

Control	*%*	*PLL Contr*	*Control Class*
Outcome Pathw **Consequence**	0.00%	0.00E+00	None

Multiple fatalities

232 Safety hooks

216 Escape routes from machine

223 First aid room on site

214 Emergency response procedure

224 First Aiders on all shifts

212 Close proximity to Emergency Services and Hospital

213 Diamond Protection for first response

Hazard Register Data Sheet

Hazard **IPRH-NO7 Major mining plant fire** *PLL* 1.00E-04

Major Mining Plant includes conveyors, stackers & dredgers. Dredger considered biggest risk issue. Excludes Fire/explosion in bunker (NO15) and mobile equipment (NO3), as included as separate hazard scenarios. Areas of concern: Coal build up and mechanical failure.

Control	*%*	*PLL Contr*	*Control Class*
Causal Pathway **Electrical / mechanical failure**	20.00%	2.00E-05	None
Electrical / mechanical failure			
246 Preventative maintenance program (major mining plant)			
159 Shiftly inspection			**Major**
178 Temperature censors / protection			
Causal Pathway **Grease/Oil build up**	20.00%	2.00E-05	None
Grease build up			
38 Degreasing of plant			
155 Shift inspections			
Causal Pathway **Coal build up**	20.00%	2.00E-05	None
Coal build up			
40 Design to prevent spillage			
246 Preventative maintenance program (major mining plant)			
20 Cleaning daily or on request (hose down / shovel clean)			**Major**
159 Shiftly inspection			
144 Safety walks			
Causal Pathway **Hot work**	20.00%	2.00E-05	None
Hot work			
122 Permit System			**Major**
78 Follow up inspections			
184 Training of fire man / spotter for Hot Work			
Causal Pathway **Housekeeping**	20.00%	2.00E-05	None
Housekeeping			
20 Cleaning daily or on request (hose down / shovel clean)			**Major**
159 Shiftly inspection			
144 Safety walks			
Causal Pathway **External fire**	0.00%	0.00E+00	None
External fire			
120 Perimeter slashing			
75 Fire brakes			
113 On-site fire fighting tankers			
Causal Pathway **Lightning**	0.00%	0.00E+00	None
Lightning			
98 Lightning rods on major plant			
Causal Pathway **Spot fire from vehicle / plant**	0.00%	0.00E+00	None
Spot fire from vehicle / plant			
104 Modified exhausts			
103 Modified braking systems			
186 Vehicle washing			
246 Preventative maintenance program (major mining plant)			
112 Ongoing inspection by operator / shift management			
45 Diesel powered vehicles			

Hazard Register Data Sheet

Hazard **IPRH-NO7 Major mining plant fire** *PLL* 1.00E-04

Major Mining Plant includes conveyors, stackers & dredgers. Dredger considered biggest risk issue. Excludes Fire/explosion in bunker (NO15) and mobile equipment (NO3), as included as separate hazard scenarios. Areas of concern: Coal build up and mechanical failure.

Control	*%*	*PLL Contr*	*Control Class*
Causal Pathway **Belt fire**	0.00%	0.00E+00	None
Belt fire			
246 Preventative maintenance program (major mining plant)			
158 Shiftly fault inspections(reporting)			
28 Competent personnel			
194 Works Management System			
79 FRAS belts			
Outcome Pathw **Consequence**	0.00%	0.00E+00	None
Multiple fatalities			
222 Fire extinguishers on all plant			
221 Fire extinguishers (testing and inspection)			
209 Annual testing of extinguishers			
230 Reticulated fire water protection to all major mining plant			
210 Annual training in fire fighting			
226 LV fitted with hoses			
217 Escape routes from MMP			
214 Emergency response procedure			
206 Adequate fire water pressure and supply			
113 On-site fire fighting tankers			
208 Annual spray pattern testing			

Hazard Register Data Sheet

Hazard **IPRH-NO8 Explosion of electrical components on major mining plant**	*PLL*	2.20E-04	
Relates principally to HV switching gear (6.6KV and 415V)			
Control	*%*	*PLL Contr*	*Control Class*
Causal Pathway **Failure to follow procedures / operator error**	60.00%	1.32E-04	None
Failure to follow procedures / operator error			
25 Competent maintenance personnel			
180 Ticketed / competent electricians			**Major**
165 Plant isolation procedures			**Major**
Causal Pathway **Faulty equipment**	10.00%	2.20E-05	None
Faulty equipment			
87 HV Routine Maintenance (Insulator Cleaning, inspection and servicing)			**Major**
Causal Pathway **Housekeeping (dust build up leading to flash over)**	30.00%	6.60E-05	None
Housekeeping (dust build up leading to flash over)			
87 HV Routine Maintenance (Insulator Cleaning, inspection and servicing)			**Major**
Outcome Pathw **Consequence**	0.00%	0.00E+00	None
Multiple fatalities			
220 Explosion vents (compliance to AS3000)			**Major**
229 Procedure for electrically isolating personnel			
128 PPE			
223 First aid room on site			
214 Emergency response procedure			
224 First Aiders on all shifts			
212 Close proximity to Emergency Services and Hospital			
213 Diamond Protection for first response			

Hazard **IRPH-NO1 Vehicle incident while accessing worksite** *PLL* 1.15E-02

Relates to incidents involving vehicles used for transport to work site (onsite access only), predominantly light vehicles (eg. 4wd's). Hazard includes personnel traveling around site for inspections, monitoring, etc. Events include traveling off edge, rollovers, collisions with other equipment / structures / mine walls, etc. Areas of concern: Infrequent users; Radio protocols (clear and positive coms); Higher congestion / volume during

Control	*%*	*PLL Contr*	*Control Class*
Causal Pathway **Poor visibility**	20.00%	2.30E-03	1 Critical and 1 Major
Rain			
102 Minimum equipment standards			
141 Road watering			
77 Fog lights			
76 Flashing lights			
171 Sun glasses supplied			
192 wipers			
129 Pre start checks and recording			**Major**
153 Shift changeover meeting			
17 Cease / delay task in extreme conditions			
56 Drive to conditions			**Critical**
134 Remarking of road lines			**Major**
83 Guide posts and reflectors			**Major**
Dust			
102 Minimum equipment standards			
141 Road watering			
77 Fog lights			
76 Flashing lights			
171 Sun glasses supplied			
192 wipers			
129 Pre start checks and recording			
153 Shift changeover meeting			
17 Cease / delay task in extreme conditions			
56 Drive to conditions			
134 Remarking of road lines			
83 Guide posts and reflectors			
Fog			
102 Minimum equipment standards			
141 Road watering			
77 Fog lights			
76 Flashing lights			
171 Sun glasses supplied			
192 wipers			
129 Pre start checks and recording			
153 Shift changeover meeting			
17 Cease / delay task in extreme conditions			
56 Drive to conditions			
134 Remarking of road lines			
83 Guide posts and reflectors			
Sun			
102 Minimum equipment standards			
141 Road watering			
77 Fog lights			
76 Flashing lights			
171 Sun glasses supplied			
192 wipers			
129 Pre start checks and recording			

Hazard Register Data Sheet

Hazard **IRPH-NO1 Vehicle incident while accessing worksite** *PLL* 1.15E-02

Relates to incidents involving vehicles used for transport to work site (onsite access only), predominantly light vehicles (eg. 4wd's). Hazard includes personnel traveling around site for inspections, monitoring, etc. Events include traveling off edge, rollovers, collisions with other equipment / structures / mine walls, etc. Areas of concern: Infrequent users; Radio protocols (clear and positive coms); Higher congestion / volume during

Control	*%*	*PLL Contr*	*Control Class*
153 Shift changeover meeting			
17 Cease / delay task in extreme conditions			
56 Drive to conditions			
134 Remarking of road lines			
83 Guide posts and reflectors			

Causal Pathway **Poor road conditions** 10.00% 1.15E-03 1 Critical or 2 Major

Construction

133 Regular grading	
138 Road maintenance program	**Critical**
140 Road surfacing material (borrow areas / import rock)	
144 Safety walks	
188 Washing of roads	

Surfacing

133 Regular grading	
138 Road maintenance program	
140 Road surfacing material (borrow areas / import rock)	
144 Safety walks	
188 Washing of roads	

Drainage

133 Regular grading	
138 Road maintenance program	
140 Road surfacing material (borrow areas / import rock)	
144 Safety walks	
188 Washing of roads	

Hazard **IRPH-NO1 Vehicle incident while accessing worksite** *PLL* 1.15E-02

Relates to incidents involving vehicles used for transport to work site (onsite access only), predominantly light vehicles (eg. 4wd's). Hazard includes personnel traveling around site for inspections, monitoring, etc. Events include traveling off edge, rollovers, collisions with other equipment / structures / mine walls, etc. Areas of concern: Infrequent users; Radio protocols (clear and positive coms); Higher congestion / volume during

Control	*%*	*PLL Contr*	*Control Class*
Causal Pathway **Driver error / not following road rules**	50.00%	5.74E-03	1 Critical and 1 Major
Driving to conditions			
1 4wd training for IPH personnel			
28 Competent personnel			**Critical**
161 Site induction process			
49 Disciplinary policy			
33 Contractor management process(fatigue management, selection process)			
153 Shift changeover meeting			
157 Shift notes			
51 Documented road rules			
160 Signage			
172 Supervision			**Critical**
88 Incident reporting and CA			
Rules			
1 4wd training for IPH personnel			
28 Competent personnel			
161 Site induction process			
49 Disciplinary policy			
33 Contractor management process(fatigue management, selection process)			
153 Shift changeover meeting			
157 Shift notes			
51 Documented road rules			
160 Signage			
172 Supervision			
88 Incident reporting and CA			
Unfamiliar with conditions			
1 4wd training for IPH personnel			
28 Competent personnel			
161 Site induction process			
49 Disciplinary policy			
33 Contractor management process(fatigue management, selection process)			
153 Shift changeover meeting			
157 Shift notes			
51 Documented road rules			
160 Signage			
172 Supervision			
88 Incident reporting and CA			
Distracted			
1 4wd training for IPH personnel			
28 Competent personnel			
161 Site induction process			
49 Disciplinary policy			
33 Contractor management process(fatigue management, selection process)			
153 Shift changeover meeting			
157 Shift notes			
51 Documented road rules			
160 Signage			
172 Supervision			

Hazard **IRPH-NO1 Vehicle incident while accessing worksite** *PLL* 1.15E-02

Relates to incidents involving vehicles used for transport to work site (onsite access only), predominantly light vehicles (eg. 4wd's). Hazard includes personnel traveling around site for inspections, monitoring, etc. Events include traveling off edge, rollovers, collisions with other equipment / structures / mine walls, etc. Areas of concern: Infrequent users; Radio protocols (clear and positive coms); Higher congestion / volume during

Control	*%*	*PLL Contr*	*Control Class*
88 Incident reporting and CA			
Fatigue / Fitness-for-Work			
177 Task rotation			
156 Shift management			
53 Draft drug & Alcohol policy			
6 Annual medical tests available			
60 EAP available			
101 Medical tests / first aid available			
96 Leave policies			
59 Duty of Care			
Causal Pathway **Mechanical failure**	7.00%	8.04E-04	1 Critical or 2 Major
Mechanical failure			
130 Preventative maintenance program (light and heavy mobile vehicles)			**Major**
158 Shiftly fault inspections(reporting)			**Major**
28 Competent personnel			
194 Works Management System			
169 Spare vehicles			
16 Call out service			
57 Dry hire lease arrangements			
Causal Pathway **Spillage**	2.00%	2.30E-04	None
Over / uneven / unsecured loading of trucks			
37 Current statutory licence			
27 Competent operators			
172 Supervision			
168 Maintenance procedures			
139 Road rules			
Causal Pathway **Poor road design**	2.00%	2.30E-04	None
Poor road design			
39 Design of permanent roads & ramps to Vic Roads standard			
26 Competent mine planner			
68 Erection of temporary barriers			
137 Review intersections for traffic management			
149 Separation of LV and HV			
Causal Pathway **Unauthorised access**	5.00%	5.74E-04	1 Major
Unauthorised access			
89 Induction process			
147 Security gates			
148 Security guard			
145 Sealed roads as boundary of mine			
160 Signage			**Major**
2 Access control through control centre / shift manager			**Major**
50 Disseminate haul road info IPH wide			

Hazard Register Data Sheet

Hazard **IRPH-NO1 Vehicle incident while accessing worksite** *PLL* 1.15E-02

Relates to incidents involving vehicles used for transport to work site (onsite access only), predominantly light vehicles (eg. 4wd's). Hazard includes personnel traveling around site for inspections, monitoring, etc. Events include traveling off edge, rollovers, collisions with other equipment / structures / mine walls, etc. Areas of concern: Infrequent users; Radio protocols (clear and positive coms); Higher congestion / volume during

Control	*%*	*PLL Contr*	*Control Class*
Causal Pathway **Poor communication**	2.00%	2.30E-04	None
Poor communication			
182 Tool box meetings			
152 Shift changeover			
84 Hand held and fixed radios			
28 Competent personnel			
139 Road rules			
130 Preventative maintenance program (light and heavy mobile vehicles)			
50 Disseminate haul road info IPH wide			
Causal Pathway **Inadequate windrow / guard rails**	2.00%	2.30E-04	None
Inadequate windrow / guard rails			
32 Construction of windrows			**Major**
131 Program for replacing windrows			
90 Install guard rails as required			
Outcome Pathw **Consequence**	0.00%	0.00E+00	None
Multiple fatalities			
233 Seat belts in all vehicles			
231 ROPs on mining plant			
207 Air bags on selected LVs			
211 Bull bars			
223 First aid room on site			
214 Emergency response procedure			
224 First Aiders on all shifts			
212 Close proximity to Emergency Services and Hospital			
213 Diamond Protection for first response			

Hazard Register Data Sheet

Hazard **IRPH-WF45 Vehicle / plant incident during West Field opening up phase.** *PLL* 0.00E+00

Relates to major truck and shovel programs. Includes interaction or other incident eg. off edge, into hole. Current phase 1 works at Westfield. Considered by risk assessment team to include NO24.Areas of concern: Dynamic changing nature of work areas; Watering of roads effect LV traction.

Control	*%*	*PLL Contr*	*Control Class*
Causal Pathway **Poor visibility**	0.00%	0.00E+00	None
Rain			
102 Minimum equipment standards			
141 Road watering			
77 Fog lights			
76 Flashing lights			
171 Sun glasses supplied			
192 wipers			
129 Pre start checks and recording			
153 Shift changeover meeting			
17 Cease / delay task in extreme conditions			
56 Drive to conditions			
134 Remarking of road lines			
83 Guide posts and reflectors			
Dust			
102 Minimum equipment standards			
141 Road watering			
77 Fog lights			
76 Flashing lights			
171 Sun glasses supplied			
192 wipers			
129 Pre start checks and recording			
153 Shift changeover meeting			
17 Cease / delay task in extreme conditions			
56 Drive to conditions			
134 Remarking of road lines			
83 Guide posts and reflectors			
Fog			
102 Minimum equipment standards			
141 Road watering			
77 Fog lights			
76 Flashing lights			
171 Sun glasses supplied			
192 wipers			
129 Pre start checks and recording			
153 Shift changeover meeting			
17 Cease / delay task in extreme conditions			
56 Drive to conditions			
134 Remarking of road lines			
83 Guide posts and reflectors			
Sun			
102 Minimum equipment standards			
141 Road watering			
77 Fog lights			
76 Flashing lights			
171 Sun glasses supplied			
192 wipers			
129 Pre start checks and recording			
153 Shift changeover meeting			

Hazard Register Data Sheet

Hazard **IRPH-WF45 Vehicle / plant incident during West Field opening up phase.** *PLL* 0.00E+00

Relates to major truck and shovel programs. Includes interaction or other incident eg. off edge, into hole. Current phase 1 works at Westfield. Considered by risk assessment team to include NO24.Areas of concern: Dynamic changing nature of work areas; Watering of roads effect LV traction.

Control	*%*	*PLL Contr*	*Control Class*
17 Cease / delay task in extreme conditions			
56 Drive to conditions			
134 Remarking of road lines			
83 Guide posts and reflectors			

Causal Pathway **Poor road conditions** 0.00% 0.00E+00 None

Construction

- 133 Regular grading
- 138 Road maintenance program
- 140 Road surfacing material (borrow areas / import rock)
- 144 Safety walks

Surfacing

- 133 Regular grading
- 138 Road maintenance program
- 140 Road surfacing material (borrow areas / import rock)
- 144 Safety walks

Drainage

- 133 Regular grading
- 138 Road maintenance program
- 140 Road surfacing material (borrow areas / import rock)
- 144 Safety walks

Hazard **IRPH-WF45 Vehicle / plant incident during West Field opening up phase.** *PLL* 0.00E+00

Relates to major truck and shovel programs. Includes interaction or other incident eg. off edge, into hole. Current phase 1 works at Westfield. Considered by risk assessment team to include NO24.Areas of concern: Dynamic changing nature of work areas; Watering of roads effect LV traction.

Control	*%*	*PLL Contr*	*Control Class*
Causal Pathway **Driver error / not following road rules**	0.00%	0.00E+00	None

Driving to conditions

- 1 4wd training for IPH personnel
- 28 Competent personnel
- 161 Site induction process
- 49 Disciplinary policy
- 33 Contractor management process(fatigue management, selection process)
- 153 Shift changeover meeting
- 157 Shift notes
- 51 Documented road rules
- 160 Signage
- 172 Supervision
- 88 Incident reporting and CA

Rules

- 1 4wd training for IPH personnel
- 28 Competent personnel
- 161 Site induction process
- 49 Disciplinary policy
- 33 Contractor management process(fatigue management, selection process)
- 153 Shift changeover meeting
- 157 Shift notes
- 51 Documented road rules
- 160 Signage
- 172 Supervision
- 88 Incident reporting and CA

Unfamiliar with conditions

- 1 4wd training for IPH personnel
- 28 Competent personnel
- 161 Site induction process
- 49 Disciplinary policy
- 33 Contractor management process(fatigue management, selection process)
- 153 Shift changeover meeting
- 157 Shift notes
- 51 Documented road rules
- 160 Signage
- 172 Supervision
- 88 Incident reporting and CA

Fatigue / Fitness-For-Work

- 177 Task rotation
- 156 Shift management
- 53 Draft drug & Alcohol policy
- 6 Annual medical tests available
- 60 EAP available
- 101 Medical tests / first aid available
- 96 Leave policies
- 59 Duty of Care

Distracted

- 1 4wd training for IPH personnel
- 28 Competent personnel

Hazard Register Data Sheet

Hazard **IRPH-WF45 Vehicle / plant incident during West Field opening up phase.** *PLL* 0.00E+00

Relates to major truck and shovel programs. Includes interaction or other incident eg. off edge, into hole. Current phase 1 works at Westfield. Considered by risk assessment team to include NO24.Areas of concern: Dynamic changing nature of work areas; Watering of roads effect LV traction.

Control	*%*	*PLL Contr*	*Control Class*
161 Site induction process			
49 Disciplinary policy			
33 Contractor management process(fatigue management, selection process)			
153 Shift changeover meeting			
157 Shift notes			
51 Documented road rules			
160 Signage			
172 Supervision			
88 Incident reporting and CA			

Causal Pathway **Mechanical failure** 0.00% 0.00E+00 None

Mechanical failure

- 130 Preventative maintenance program (light and heavy mobile vehicles)
- 158 Shiftly fault inspections(reporting)
- 28 Competent personnel
- 194 Works Management System
- 169 Spare vehicles
- 16 Call out service
- 57 Dry hire lease arrangements

Causal Pathway **Spillage** 0.00% 0.00E+00 None

Over / uneven loading of trucks

- 27 Competent operators
- 172 Supervision
- 168 Maintenance procedures
- 139 Road rules

Causal Pathway **Poor road design** 0.00% 0.00E+00 None

Poor road design

- 39 Design of permanent roads & ramps to Vic Roads standard
- 26 Competent mine planner
- 68 Erection of temporary barriers
- 137 Review intersections for traffic management

Causal Pathway **Unauthorised access** 0.00% 0.00E+00 None

Unauthorised access

- 89 Induction process
- 147 Security gates
- 148 Security guard
- 145 Sealed roads as boundary of mine
- 160 Signage
- 2 Access control through control centre / shift manager
- 50 Disseminate haul road info IPH wide

Causal Pathway **Poor communication** 0.00% 0.00E+00 None

Poor communication

- 182 Tool box meetings
- 152 Shift changeover
- 84 Hand held and fixed radios
- 28 Competent personnel
- 139 Road rules
- 130 Preventative maintenance program (light and heavy mobile vehicles)
- 50 Disseminate haul road info IPH wide

Hazard Register Data Sheet

Hazard **IRPH-WF45 Vehicle / plant incident during West Field opening up phase.** *PLL* 0.00E+00

Relates to major truck and shovel programs. Includes interaction or other incident eg. off edge, into hole. Current phase 1 works at Westfield. Considered by risk assessment team to include NO24.Areas of concern: Dynamic changing nature of work areas; Watering of roads effect LV traction.

Control	*%*	*PLL Contr*	*Control Class*
Causal Pathway **Dynamic changing environment**	0.00%	0.00E+00	None
Internal roads and dig and dump sites / routes / infrastructure works / patterns			
183 Traffic management plans			
182 Tool box meetings			
23 Communication via pay dockets / notice boards			
3 Additional traffic controls (signage, bollards, gates, lights, etc) as required			
69 Escorting of infrequent visitors to WF operational areas			
Outcome Pathw **Consequence**	0.00%	0.00E+00	None
Multiple fatalities			
233 Seat belts in all vehicles			
231 ROPs on mining plant			
207 Air bags on selected LVs			
211 Bull bars			
223 First aid room on site			
214 Emergency response procedure			
224 First Aiders on all shifts			
212 Close proximity to Emergency Services and Hospital			
231 ROPs on mining plant			
213 Diamond Protection for first response			

Appendix 2

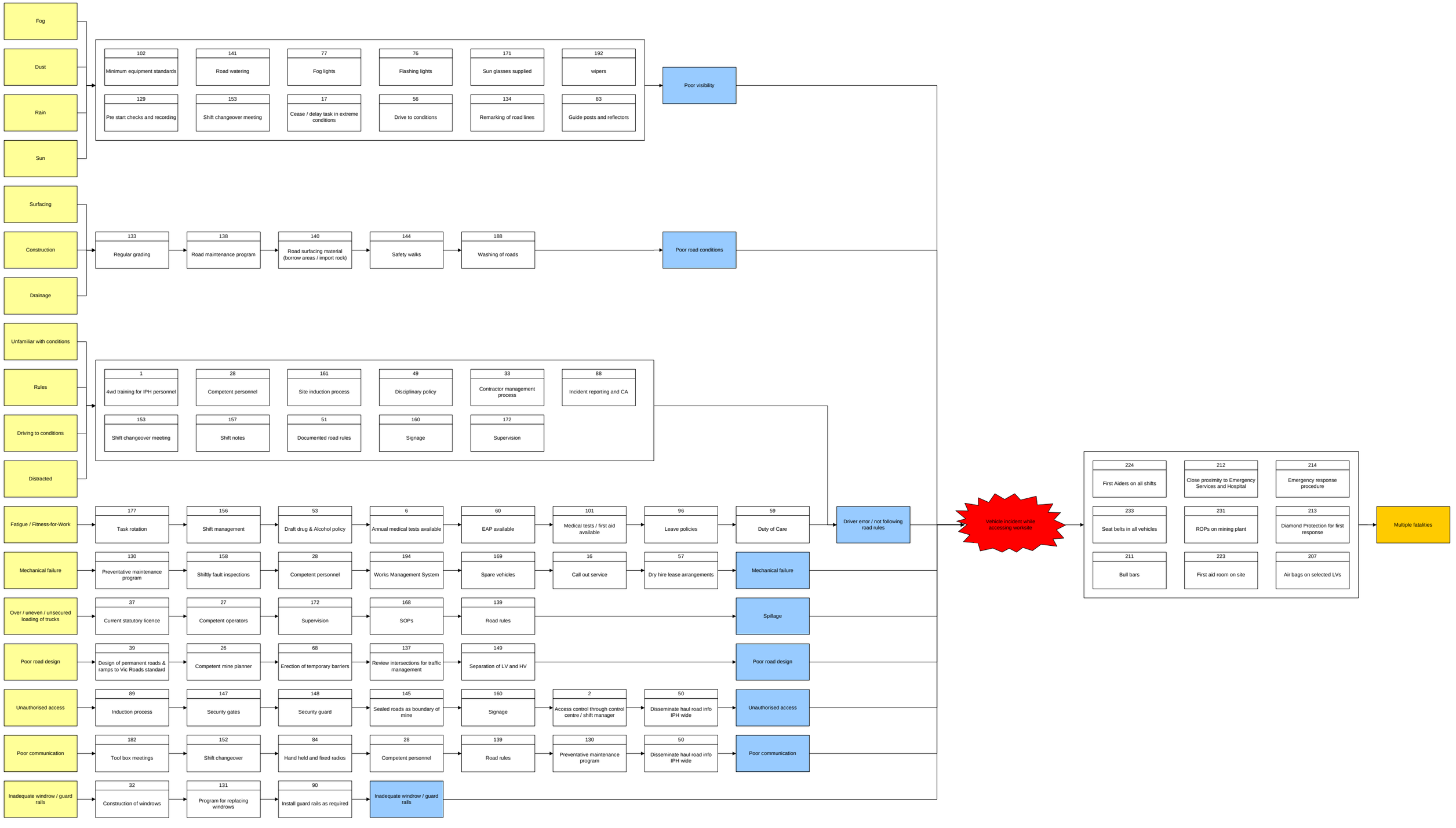
Bow-Tie Diagrams

Bow-tie Diagram

Area	Normal Operations
Guideword	Collisions
Hazard Number	IPH-NO1
Hazard/ Incident	Vehicle incident while accessing worksite

Document Revision Record

Rev	Description	Prepared by	Date	Approved by	Date	Reviewed by	Date
A B	Draft (for Qest comment) Draft (for Client comment)	Matthew Wallace	January 2004	Anthony Deakin	January 2004		



Bow-tie Diagram

Area	Normal Operations
Guideword	Dropped Object
Hazard Number	IPH-NO4
Hazard/ Incident	Dropped objects from major mining plant (onto personnel, equipment)

Document Revision Record

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A B	Draft (for Qest comment) Draft (for Client comment)	Matthew Wallace	January 2004	Anthony Deakin	January 2004		

Bow-tie Diagram

Area	Normal Operations
Guideword	Dropped Object / Structural Failure
Hazard Number	IPH-NO5
Hazard/ Incident	Toppling of major mining plant

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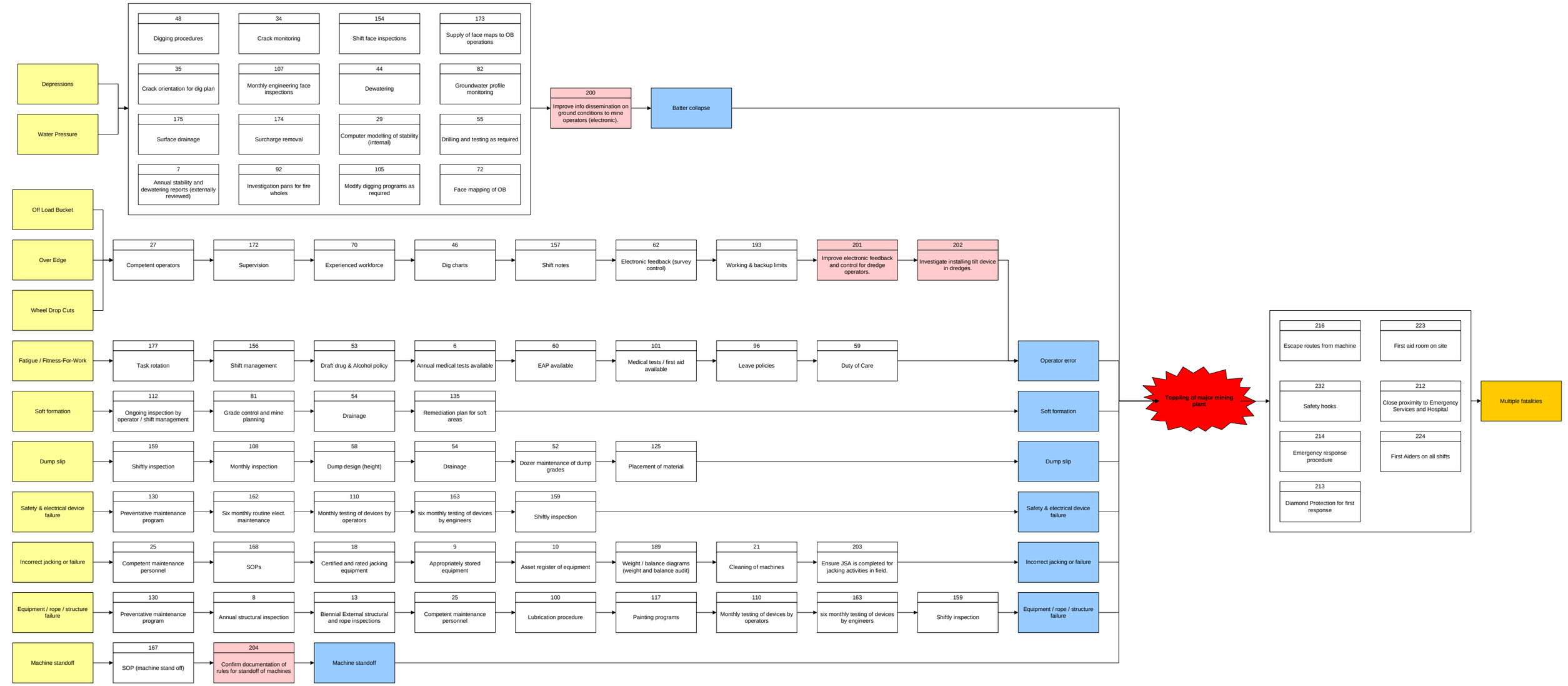
Rev	Description	Prepared by	Date	Approved by	Date	Reviewed by	Date
A B	Draft (for Qest comment) Draft (for Client comment)	Matthew Wallace	January 2004	Anthony Deakin	January 2004		

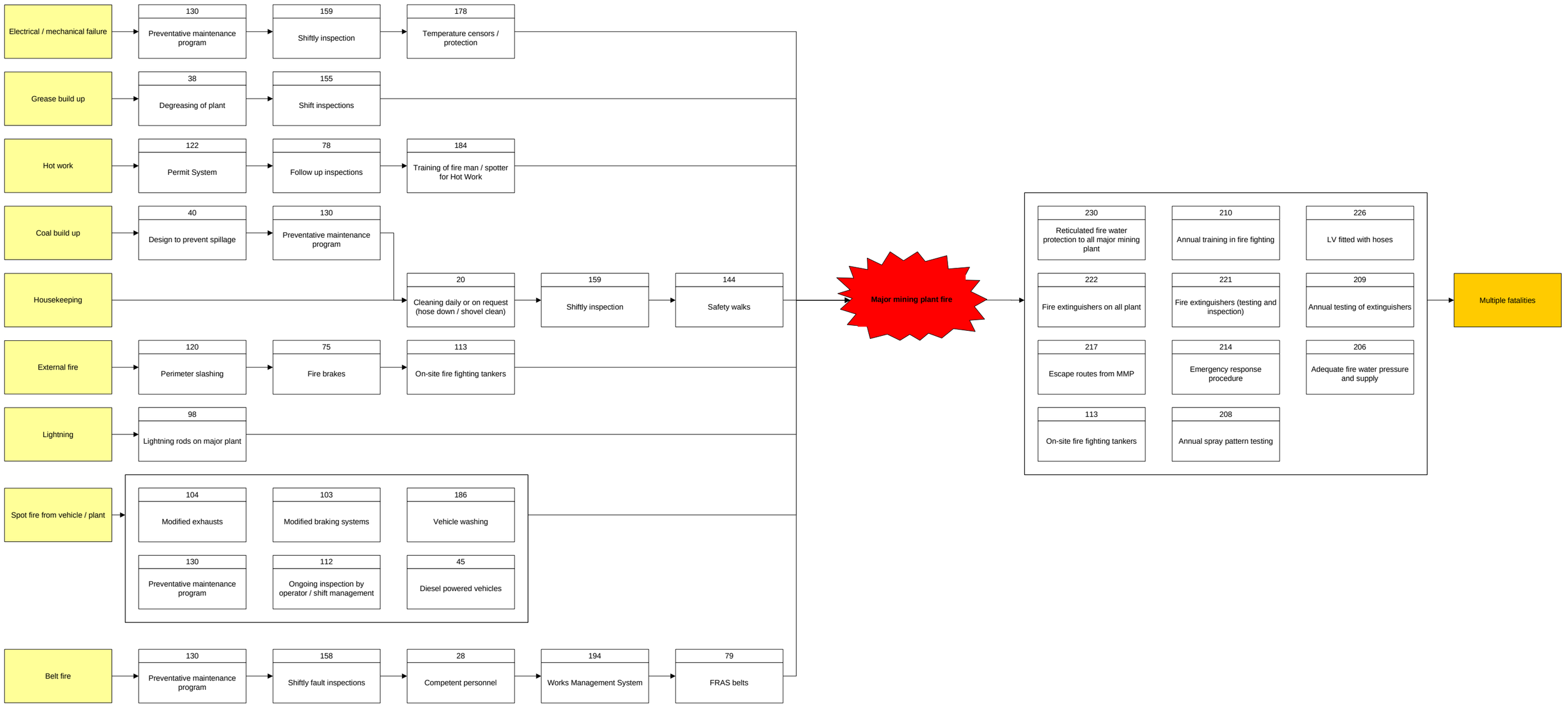


Bow-tie Diagram

Area	Normal Operations
Guideword	Fire and Explosion
Hazard Number	IPH-NO7
Hazard/ Incident	Major mining plant fire

Document Revision Record

Rev	Description	Prepared by	Date	Approved by	Date	Reviewed by	Date
A B	Draft (for Qest comment) Draft (for Client comment)	Matthew Wallace	January 2004	Anthony Deakin	January 2004		

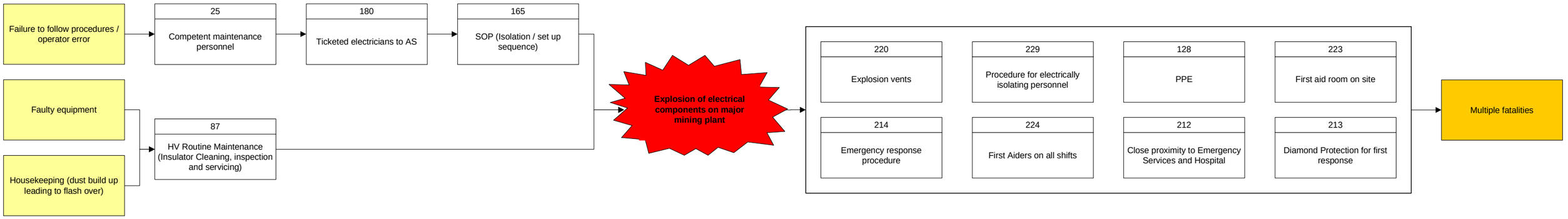


Bow-tie Diagram

Area	Normal Operations
Guideword	Fire and Explosion
Hazard Number	IPH-NO8
Hazard/ Incident	Explosion of electrical components on major mining plant

Document Revision Record

Rev	Description	Prepared by	Date	Approved by	Date	Reviewed by	Date
A B	Draft (for Qest comment) Draft (for Client comment)	Matthew Wallace	January 2004	Anthony Deakin	January 2004		

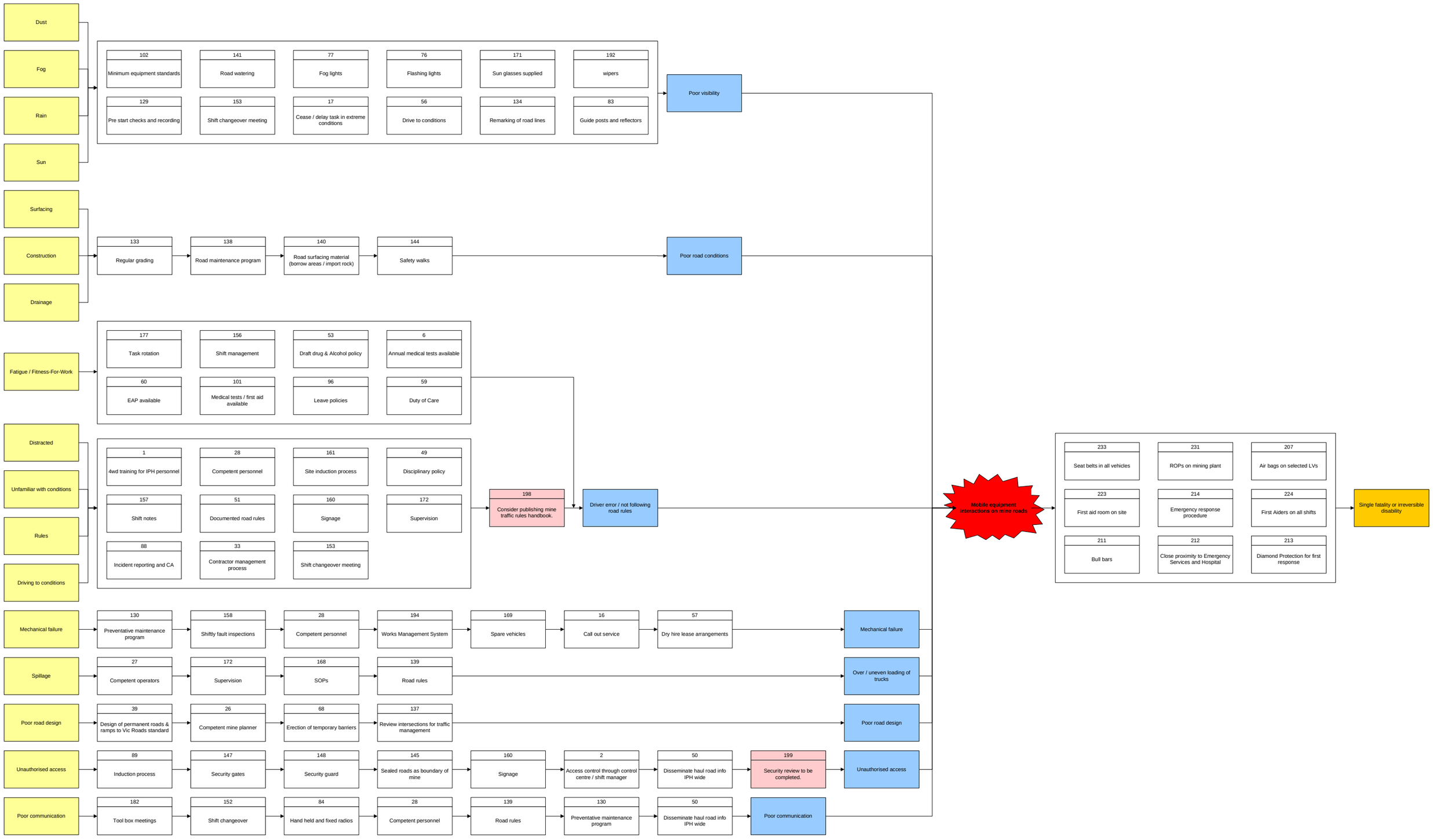


Bow-tie Diagram

Area	Normal Operations
Guideword	Collision
Hazard Number	IPH-NO24
Hazard/ Incident	Mobile equipment interactions on mine roads

Document Revision Record

Rev	Description	Prepared by	Date	Approved by	Date	Reviewed by	Date
A B	Draft (for Qest comment) Draft (for Client comment)	Matthew Wallace	January 2004	Anthony Deakin	January 2004		

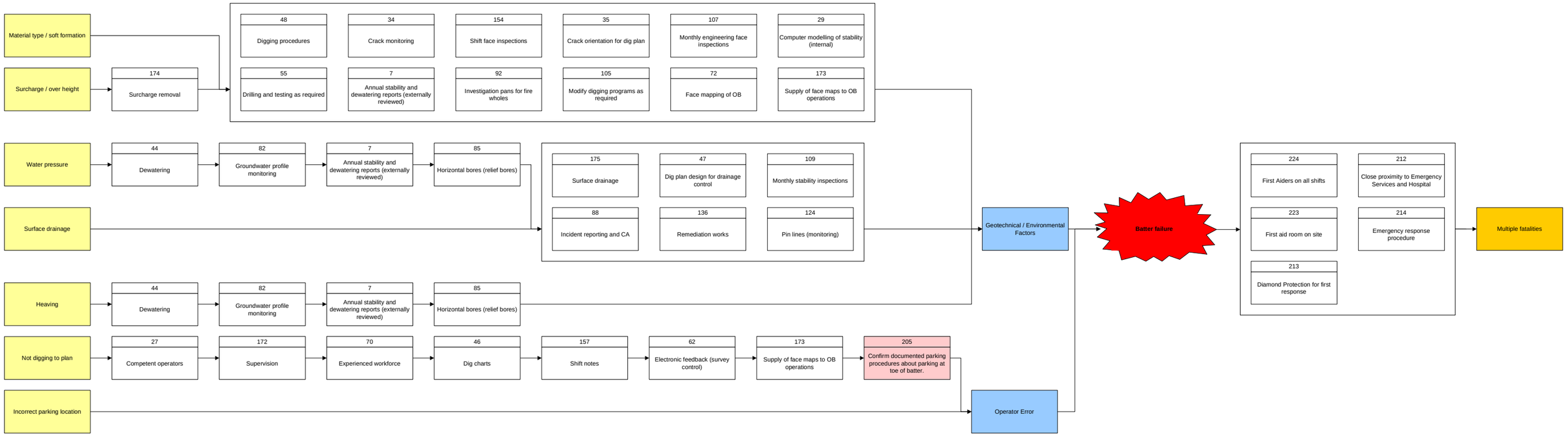


Bow-tie Diagram

Area	Normal Operations
Guideword	Structural Failure
Hazard Number	IPH-NO26
Hazard/ Incident	Batter failure

Document Revision Record

Rev	Description	Prepared by	Date	Approved by	Date	Reviewed by	Date
A B	Draft (for Qest comment) Draft (for Client comment)	Matthew Wallace	January 2004	Anthony Deakin	January 2004		

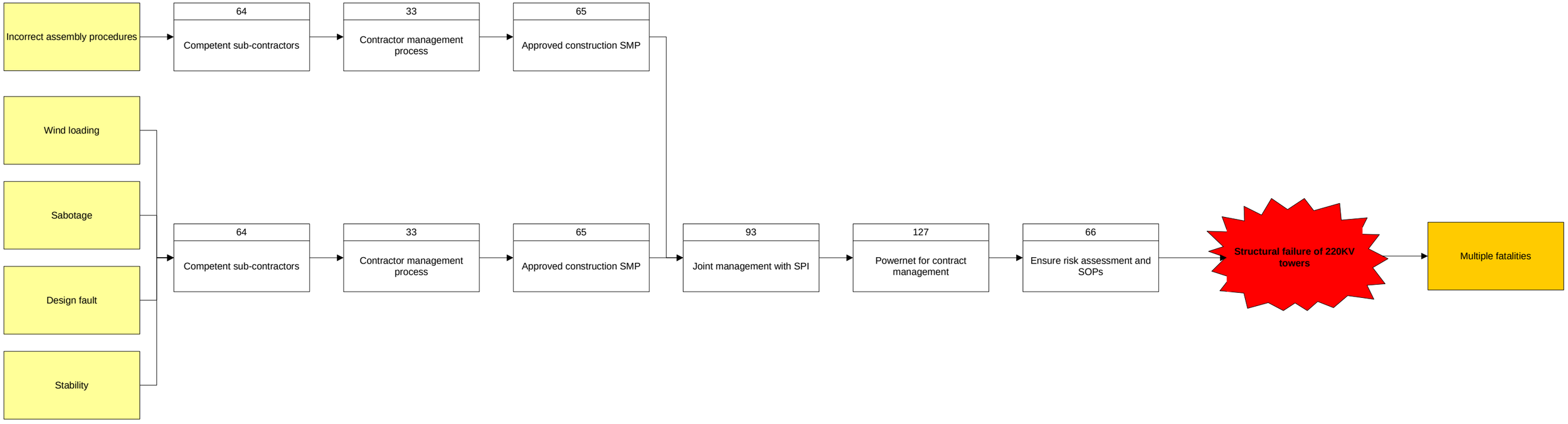


Bow-tie Diagram

Area	Infrastructure Works (Westfield)
Guideword	Structural Failure
Hazard Number	IPH-IW28
Hazard/ Incident	Structural failure of 220KV towers

Document Revision Record

Rev	Description	Prepared by	Date	Approved by	Date	Reviewed by	Date
A B	Draft (for Qest comment) Draft (for Client comment)	Matthew Wallace	January 2004	Anthony Deakin	January 2004		

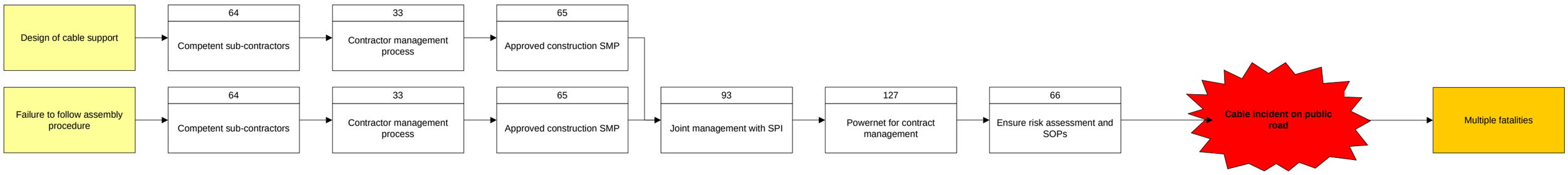


Bow-tie Diagram

Area	Infrastructure Works (Westfield)
Guideword	Dropped Object / Collision
Hazard Number	IPH-IW30
Hazard/ Incident	Cable incident on public road

Document Revision Record

Rev	Description	Prepared by	Date	Approved by	Date	Reviewed by	Date
A B	Draft (for Qest comment) Draft (for Client comment)	Matthew Wallace	January 2004	Anthony Deakin	January 2004		

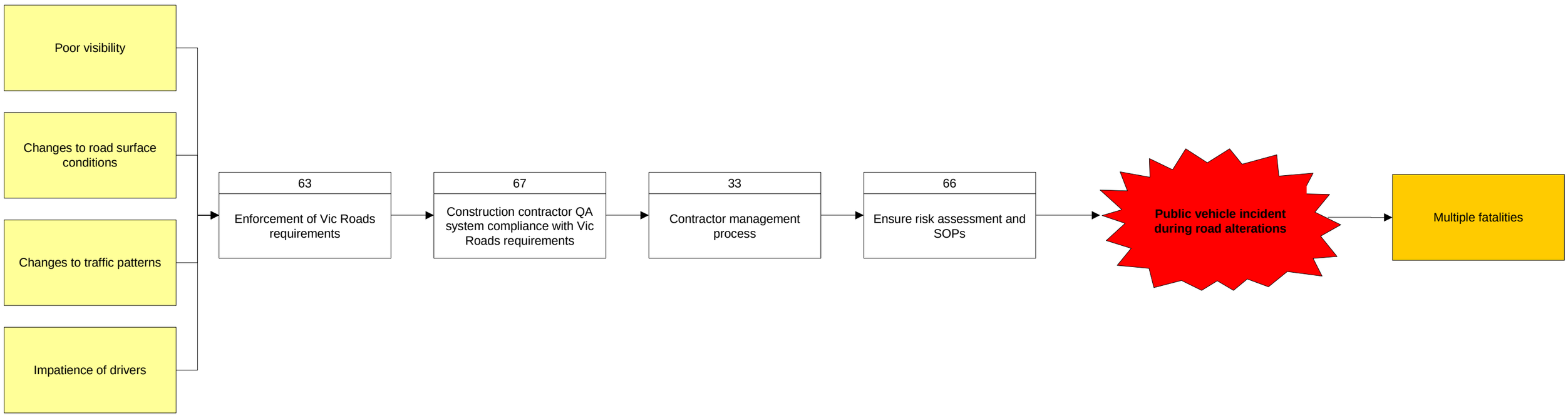


Bow-tie Diagram

Area	Infrastructure Works (Westfield)
Guideword	Collision
Hazard Number	IPH-IW32
Hazard/ Incident	Public vehicle incident during road alterations

Document Revision Record

Rev	Description	Prepared by	Date	Approved by	Date	Reviewed by	Date
A B	Draft (for Qest comment) Draft (for Client comment)	Matthew Wallace	January 2004	Anthony Deakin	January 2004		

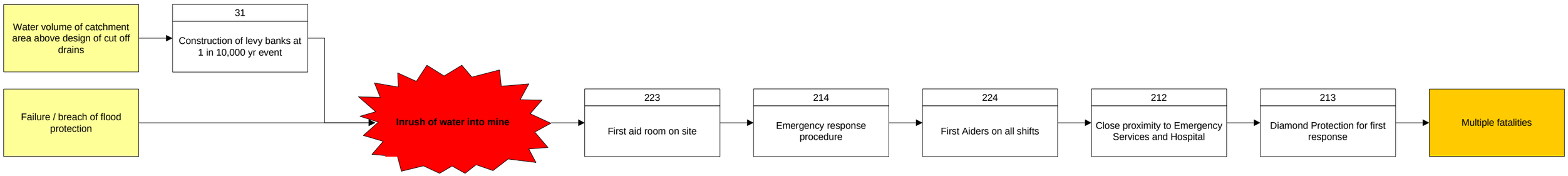


Bow-tie Diagram

Area	Normal Operations
Guideword	Natural Forces
Hazard Number	IPH-NO36
Hazard/ Incident	Inrush of water into mine

Document Revision Record

Rev	Description	Prepared by	Date	Approved by	Date	Reviewed by	Date
A B	Draft (for Qest comment) Draft (for Client comment)	Matthew Wallace	January 2004	Anthony Deakin	January 2004		



Bow-tie Diagram

Area	Normal Operations
Guideword	Dropped Object
Hazard Number	IPH-NO37
Hazard/ Incident	Field jacking of major mining plant

Document Revision Record

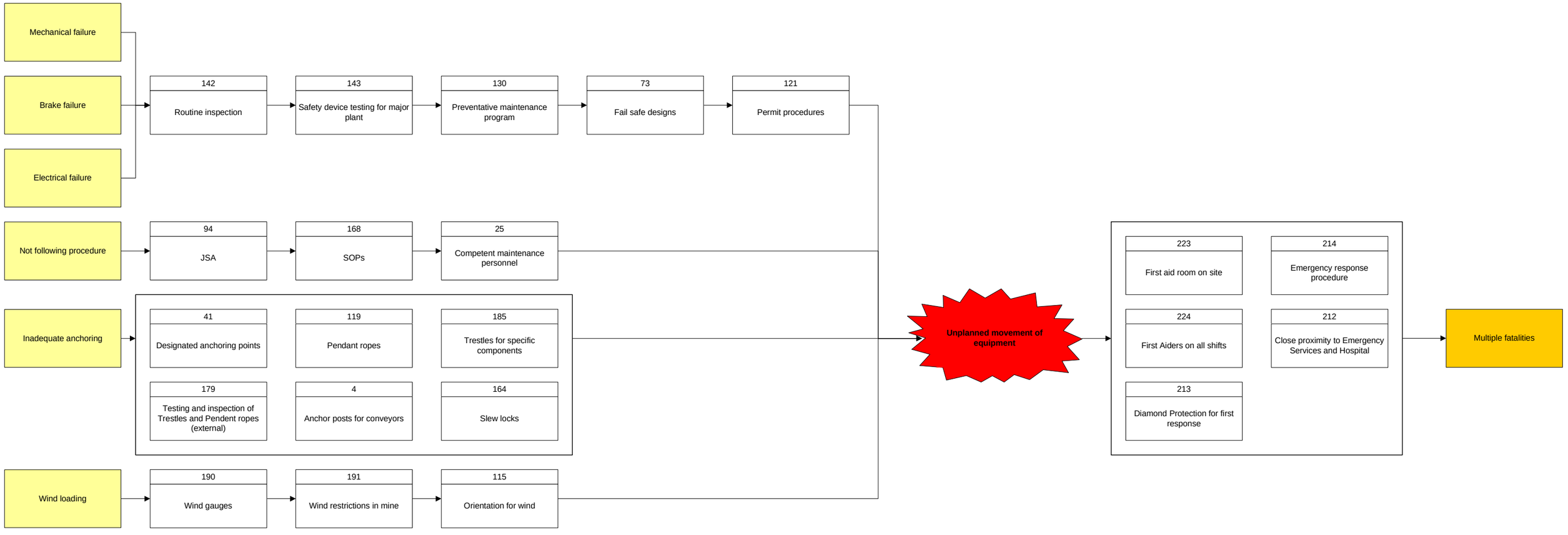
Rev	Description	Prepared by	Date	Approved by	Date	Reviewed by	Date
A B	Draft (for Qest comment) Draft (for Client comment)	Matthew Wallace	January 2004	Anthony Deakin	January 2004		

Bow-tie Diagram

Area	Normal Operations
Guideword	Mechanical Failure / Dropped Object
Hazard Number	IPH-NO38
Hazard/ Incident	Unplanned movement of equipment

Document Revision Record

Rev	Description	Prepared by	Date	Approved by	Date	Reviewed by	Date
A B	Draft (for Qest comment) Draft (for Client comment)	Matthew Wallace	January 2004	Anthony Deakin	January 2004		

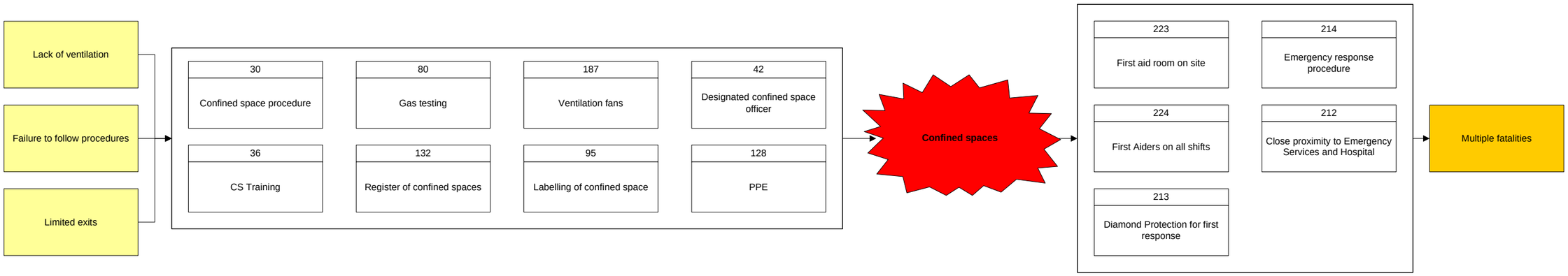


Bow-tie Diagram

Area	Normal Operations
Guideword	Emissions
Hazard Number	IPH-NO39
Hazard/ Incident	Confined spaces

Document Revision Record

Rev	Description	Prepared by	Date	Approved by	Date	Reviewed by	Date
A B	Draft (for Qest comment) Draft (for Client comment)	Matthew Wallace	January 2004	Anthony Deakin	January 2004		

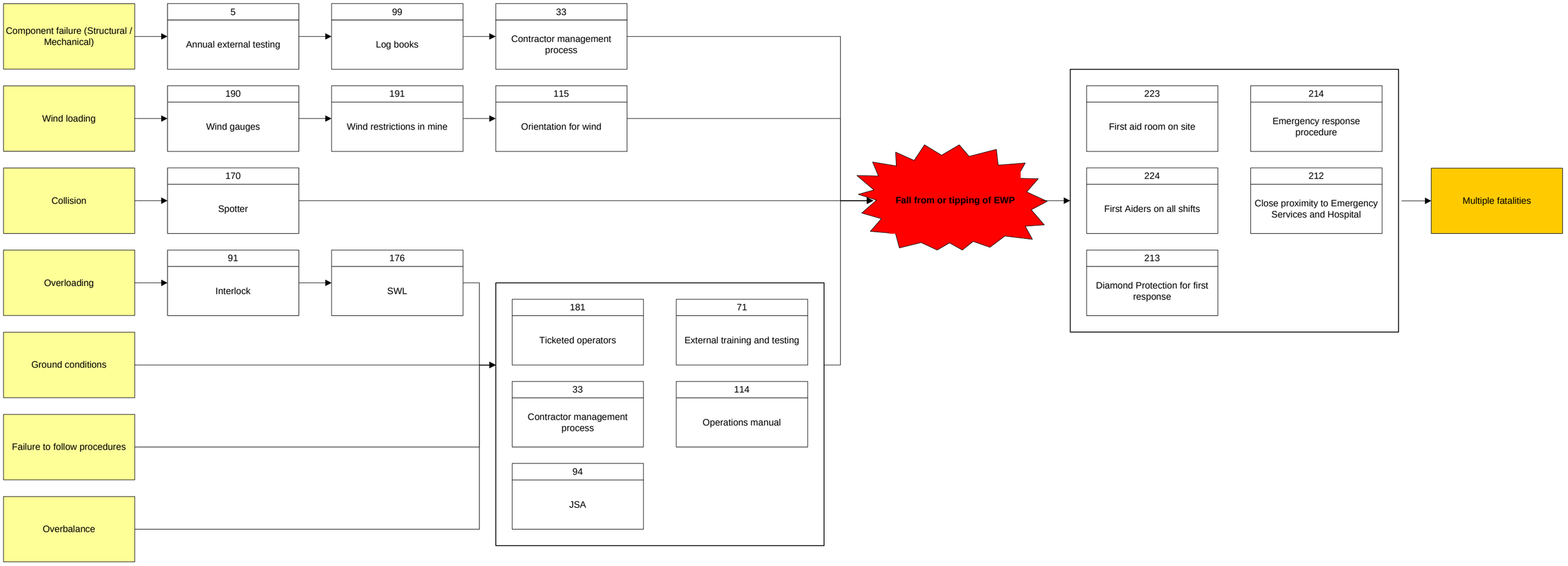


Bow-tie Diagram

Area	Normal Operations
Guideword	Dropped Object
Hazard Number	IPH-NO42
Hazard/ Incident	Fall from or tipping of EWP

Document Revision Record

Rev	Description	Prepared by	Date	Approved by	Date	Reviewed by	Date
A B	Draft (for Qest comment) Draft (for Client comment)	Matthew Wallace	January 2004	Anthony Deakin	January 2004		

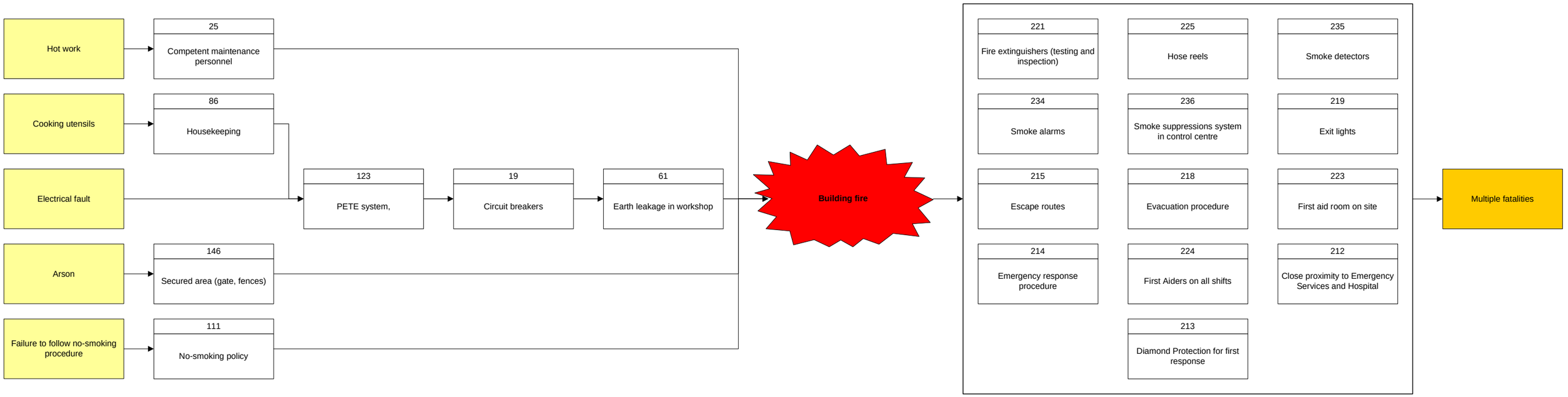


Bow-tie Diagram

Area	Normal Operations
Guideword	Fire and Explosion
Hazard Number	IPH-NO43
Hazard/ Incident	Building fire

Document Revision Record

Rev	Description	Prepared by	Date	Approved by	Date	Reviewed by	Date
A B	Draft (for Qest comment) Draft (for Client comment)	Matthew Wallace	January 2004	Anthony Deakin	January 2004		

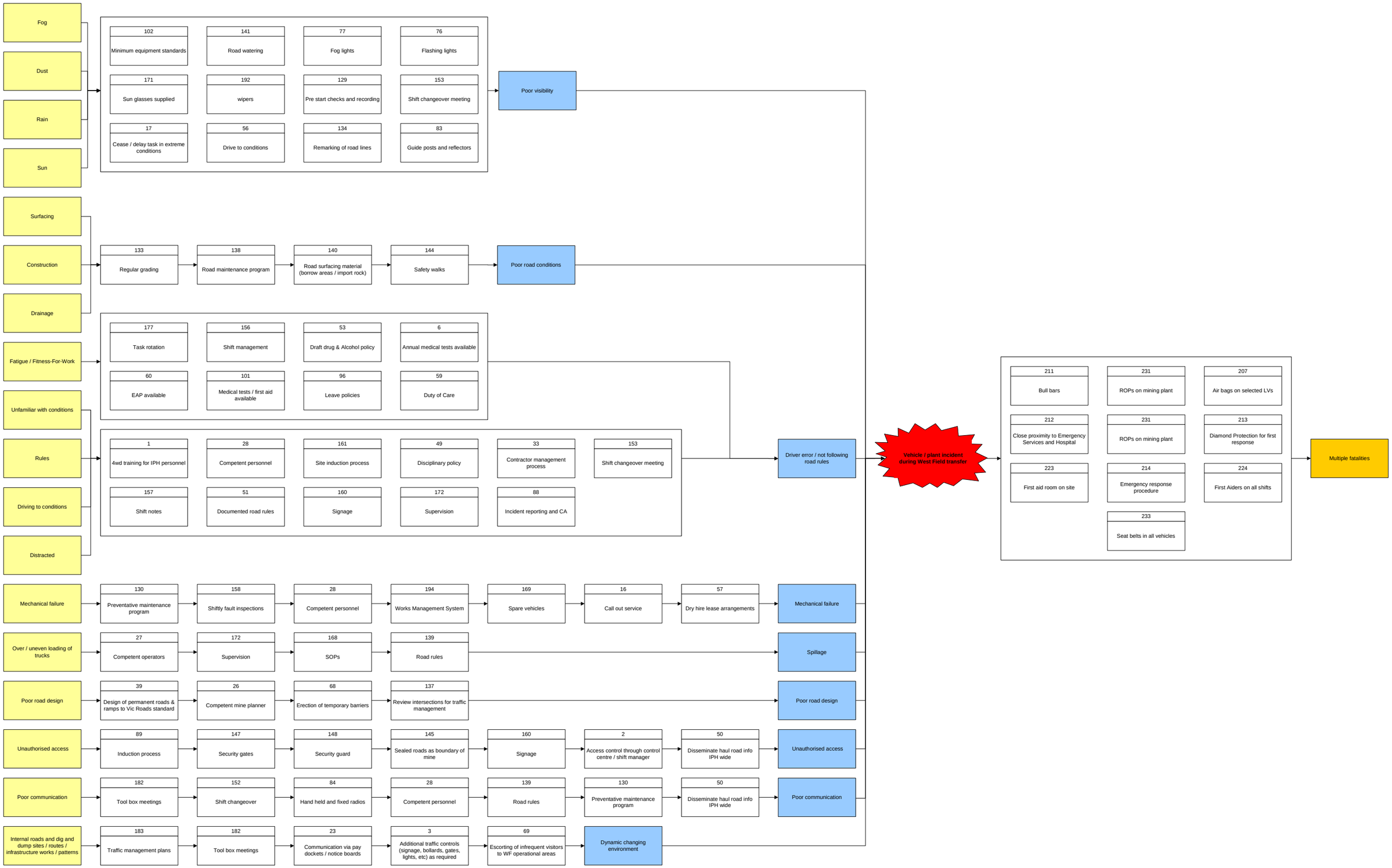


Bow-tie Diagram

Area	West Field
Guideword	Collisions
Hazard Number	IPH-WF45
Hazard/ Incident	Vehicle / plant incident during West Field transfer

Document Revision Record

Rev	Description	Prepared by	Date	Approved by	Date	Reviewed by	Date
A B	Draft (for Qest comment) Draft (for Client comment)	Matthew Wallace	January 2004	Anthony Deakin	January 2004		



Appendix 3

SQRA Worksheets

IPRH-IW28 220KV tower incident, including construction activities.

								SQRA 1	2.50E-03
Date	Frequency	Sample Size	10+	6 - 10	3 - 5	2	1	Neg	PLL
3/02/2004	2.50E-02	1,000	0	0	0	0	100	900	2.50E-03

IPRH-IW30 Cable incident on public road

								SQRA 1	1.40E-04
Date	Frequency	Sample Size	10+	6 - 10	3 - 5	2	1	Neg	PLL
3/02/2004	1.00E-02	1,000	0	0	1	1	8	990	1.40E-04

IPRH-IW32 Public vehicle incident during road alterations

								SQRA 1	1.00E-02
Date	Frequency	Sample Size	10+	6 - 10	3 - 5	2	1	Neg	PLL
4/02/2004	1.00E-01	1,000	0	0	0	0	100	900	1.00E-02

IPRH-NO24 Heavy Mobile equipment interactions on mine roads

								SQRA 1	6.67E-03
Date	Frequency	Sample Size	10+	6 - 10	3 - 5	2	1	Neg	PLL
3/02/2004	1.33E-01	1,000	0	0	0	0	50	950	6.67E-03
								SQRA 2	6.00E-03
Date	Frequency	Sample Size	10+	6 - 10	3 - 5	2	1	Neg	PLL
5/03/200	1.20E-01	1,000	0	0	0	0	50	950	6.00E-03

IPRH-NO26 Batter failure

								SQRA 1	1.00E-03
Date	Frequency	Sample Size	10+	6 - 10	3 - 5	2	1	Neg	PLL
3/02/2004	1.00E+00	10,000	0	0	0	0.01	9.99	9,990	1.00E-03
								SQRA 2	8.51E-04
Date	Frequency	Sample Size	10+	6 - 10	3 - 5	2	1	Neg	PLL
5/03/200	8.50E-01	10,000	0	0	0	0.01	9.99	9,990	8.51E-04

IPRH-NO36 Inrush of water into mine

								SQRA 1	1.60E-05
Date	Frequency	Sample Size	10+	6 - 10	3 - 5	2	1	Neg	PLL
4/02/2004	1.00E-03	1,000	0	0	1	3	6	990	1.60E-05

IPRH-NO37 Failure whilst field jacking of major mining plant

								SQRA 1	4.40E-03
Date	Frequency	Sample Size	10+	6 - 10	3 - 5	2	1	Neg	PLL
3/02/2004	2.00E-01	1,000	0	0	0	2	18	980	4.40E-03
								SQRA 2	3.15E-03
Date	Frequency	Sample Size	10+	6 - 10	3 - 5	2	1	Neg	PLL
6/03/200	1.43E-01	1,000	0	0	0	2	18	980	3.15E-03

IPRH-NO38 Unplanned movement of equipment

								SQRA 1	1.37E-03
Date	Frequency	Sample Size	10+	6 - 10	3 - 5	2	1	Neg	PLL
3/02/2004 Unsecured equipment	3.30E-02	1,000	0	0	0	0	5	995	1.65E-04
3/02/2004 Remote Startup	2.00E-02	1,000	0	0	0	0	50	950	1.00E-03
3/02/2004 Parked equipment runaway	2.00E-01	10,000	0	0	0	0.1	9.9	9,990	2.02E-04

IPRH-NO38 Unplanned movement of equipment

								SQRA 2	1.23E-03
Date		Frequency	Sample Size	10+	6 - 10	3 - 5	2	1	Neg	PLL
26/03/2004	Parked equipment runaway	1.80E-01	10,000	0	0	0	0.1	9.9	9,990	1.82E-04
26/03/2004	Unsecured equipment	2.97E-02	1,000	0	0	0	0	5	995	1.49E-04
26/03/2004	Remote Startup	1.80E-02	1,000	0	0	0	0	50	950	9.00E-04

IPRH-NO39 Confined/registered spaces

								SQRA 1	3.00E-04
Date		Frequency	Sample Size	10+	6 - 10	3 - 5	2	1	Neg	PLL
3/02/2004		3.00E+00	10,000	0	0	0	0	1	9,999	3.00E-04

IPRH-NO4 Dropped objects from major mining plant (onto personnel or equipment)

								SQRA 1	6.00E-03
Date		Frequency	Sample Size	10+	6 - 10	3 - 5	2	1	Neg	PLL
3/02/2004	Lumps From Conveyors	1.00E+00	1,000	0	0	0	0	5	995	5.00E-03
3/02/2004	Pieces of plant	2.00E-01	1,000	0	0	0	0	5	995	1.00E-03
								SQRA 2	5.49E-03
Date		Frequency	Sample Size	10+	6 - 10	3 - 5	2	1	Neg	PLL
25/03/2004	Pieces of plant	1.96E-01	1,000	0	0	0	0	2.5	998	4.90E-04
25/03/2004	Lumps from conveyors	5.00E-01	1,000	0	0	0	0	10	990	5.00E-03

IPRH-NO42 Fall from or tipping of EWP

								SQRA 1	1.10E-03
Date		Frequency	Sample Size	10+	6 - 10	3 - 5	2	1	Neg	PLL
3/02/2004		2.00E-02	1,000	0	0	0	5	45	950	1.10E-03

IPRH-NO43 Building fire

								SQRA 1	2.20E-04
Date		Frequency	Sample Size	10+	6 - 10	3 - 5	2	1	Neg	PLL
4/02/2004		2.00E-02	1,000	0	0	0	1	9	990	2.20E-04

IPRH-NO5 Uncontrolled Movement of major mining plant.

								SQRA 1	1.65E-03
Date		Frequency	Sample Size	10+	6 - 10	3 - 5	2	1	Neg	PLL
3/02/2004		2.00E-01	1,000	0	0	0	0.75	6.75	993	1.65E-03

IPRH-NO7 Major mining plant fire

								SQRA 1	1.00E-04
Date		Frequency	Sample Size	10+	6 - 10	3 - 5	2	1	Neg	PLL
3/02/2004		1.00E+00	10,000	0	0	0	0	1	9,999	1.00E-04
								SQRA 2	1.00E-04
Date		Frequency	Sample Size	10+	6 - 10	3 - 5	2	1	Neg	PLL
25/03/2004	No risk reduction was anticipated for this hazard	1.00E+00	10,000	0	0	0	0	1	9,999	1.00E-04

IPRH-NO8 Explosion of electrical components on major mining plant

								SQRA 1	2.20E-04
Date		Frequency	Sample Size	10+	6 - 10	3 - 5	2	1	Neg	PLL
3/02/2004		4.00E-02	1,000	0	0	0	0.5	4.5	995	2.20E-04

IRPH-NO1 Vehicle incident while accessing worksite

								SQRA 1	1.15E-02
Date	Frequency	Sample Size	10+	6 - 10	3 - 5	2	1	Neg	PLL
3/02/2004	4.43E+00	1,000	0	0	0.02292	0.2292	2.0399	998	1.15E-02
								SQRA 2	1.02E-02
Date	Frequency	Sample Size	10+	6 - 10	3 - 5	2	1	Neg	PLL
5/03/200	3.95E+00	1,000	0	0	0.02292	0.2292	2.0399	998	1.02E-02

IRPH-WF45 Vehicle / plant incident during West Field opening up phase.

								SQRA 1	0.00E+00
Date	Frequency	Sample Size	10+	6 - 10	3 - 5	2	1	Neg	PLL
4/02/2004	0.00E+00	0	0	0	0	0	0	0	0.00E+00

Appendix 4

Quantitative Risk Estimate of Selected Vehicle Hazards –

IPH-NO1 - Vehicle incident while accessing worksite
IPH-NO24 - Heavy Mobile equipment interactions on mine roads

Risk Estimate for IPH Light Vehicle accessing worksites (NO01)

Data:			
FORS Light vehicle fatal accident rate	5.20E-09	fatalities per km travelled	
Distance travelled by IPH LV fleet	947500	km per year	
Calculation:			
IPH LV fatal accident rate	4.93E-03	fatalities per year	
No. of people exposed	1		
Fatality Rate	100%		
PLL for IPH LV Incident	**4.93E-03**	**fatalities per year**	
or 1 fatality every	203	years	
Key Assumptions:			
1. One occupant per vehicle (driver).			
2. IPH mine roads are of the same condition and utilise the same traffic controls as public roads.			
3. Traffic conditions for the mine roads are similar to traffic conditions for public roads.			

Reference: Table 2 of Monograph 17, Federal Office of Road Safety. 1995. Fatalities per 100 km travelled for all crashes involving a passenger vehicle.

Data supplied by IPH. Distance travelled by IPH's normal operational fleet (comprising of mostly 4 wheel drive vehicles) and excluding Contractors 4x4's and trucks was 947,500 km in the 12 months to Dec 2003.

Risk Estimate for IPH Heavy Mobile equipment interactions on mine roads (NO24)

Data:			
FORS Heavy vehicle fatal accident rate	5.20E-09	fatalities per km travelled	
Distance travelled by IPH OB HV fleet 04	1695000	km per year	
Calculation:			
IPH HV fatal accident rate	8.81E-03	fatalities per year	
No. of people exposed	1		
Fatality Rate	100%		
PLL for IPH OB HV Incident for o4 period	**8.81E-03**	**fatalities per year**	
or 1 fatality every	113	years	
Data:			
FORS Heavy vehicle fatal accident rate	5.20E-09	fatalities per km travelled	
Distance travelled by IPH OB HV fleet 03 /04	250000	km per year	
Calculation:			
IPH HV fatal accident rate	1.30E-03	fatalities per year	
No. of people exposed	1		
Fatality Rate	100%		
PLL for IPH OB HV Incident for normal operations	**1.30E-03**	**fatalities per year**	
or 1 fatality every	769	years	

Key Assumptions:

1. One occupant per vehicle (driver).
2. IPH mine roads are of the same condition and utilise the same traffic controls as public roads.
3. Traffic conditions for the mine roads are similar to traffic conditions for public roads.

Reference: Table 2 of Monograph 17, Federal Office of Road Safety. 1995. Fatalities per 100 km travelled for all crashes involving a rigid truck.

Data supplied by IPH. The OB contract for the 2003 / 2004 summer period (approx Nov 2003 - May 2004) involves approximately 2,450,000 kms of truck movement. This figure includes water trucks and graders, but not light vehicles or maintenance vehicles. This has been annualised for 04 period considering 3 of the 7months of the contract has been completed and the trucks would normally travel an estimated 250,000kms during normal operations.

IPH LV FAR = FORS FAR x Distance travelled by IPH LV fleet.

PLL = Frequency x N x FR

Fatality rate is 100% because the fatal vehicle accident rate already allows for a fatality having occurred.

Data supplied by IPH for estimated kms travelled during normal operations being 250,000kms per annum. This figure includes water trucks and graders, but not light vehicles or maintenance vehicles.