Safety Assessment of Major Mining Hazards

Stage 1 – Identification of Major Mining Hazards

International Power Hazelwood

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EXECUTIVE SUMMARY

International Power Hazelwood ("IPRH") have commissioned Qest Consulting to assist them in completing a Formal Safety Assessment of their mining operations. The initial need to complete a safety assessment was identified by IPRH during the planning for the expansion of their mine into a new lease area, referred to as the West Field. Such a change in operations needs to be supported by a formal safety assessment consistent with the requirements of the *Occupational Health and Safety (Mines) Regulations 2002*. IPRH have however, identified this as an opportunity to expand the scope of the safety assessment to include both their existing operations as well as the planned West Field expansion.

This report outlines the methodology and findings of the initial step in the risk assessment process, which is the identification of a list of hazards for consideration as Major Mining Hazards (referred to as HAZID). It is planned that the potential Major Mining Hazards identified through this process will be the subject of a more rigorous risk analysis. A final list of Major Mining Hazards can then be determined. A Semi-Quantitative Risk Assessment (SRQA) approach has been identified as the appropriate approach for the next level of risk analysis.

The HAZID process was completed in a workshop held at IPRH on the 15th & 16th December 2003, facilitated by an independent risk consultant from Qest Consulting. The workshop participants were made up of representatives from each relevant mine work area, including Engineering, Maintenance and Operations.

The HAZID process used a guidewords technique to develop an initial list of mining hazards. These hazards were then assessed using a Qualitative Risk Assessment approach to identify those hazards that could be considered potential Major Mining Hazards.

The hazard identification process identified 53 mining hazards, 17 of which were deemed to be potential Major Mining Hazards that will subsequently be taken through to the next stage of the risk assessment process. The resulting list of hazards is detailed in Table 1. There is no specific hazard type that dominates this list. The list represents a number of different risk sources.

Table 1: Potential Major Mining Hazards Identified

No.	ID No.	Hazard Title
1	IPRH-NO4	Dropped objects from major mining plant (onto personnel / equipment)
2	IPRH-NO24	Mobile equipment interactions on mine roads
3	IPRH-NO1	Vehicle incident while accessing worksite
4	IPRH-NO5	Toppling of major mining plant
5	IPRH-NO7	Major mining plant fire
6	IPRH-NO8	Explosion of electrical components on major mining plant
7	IPRH-NO26	Batter failure
8	IPRH-IW28	Structural failure of 220KV towers
9	IPRH-IW30	Cable incident on public road
10	IPRH-IW32	Public vehicle incident during road alterations
11	IPRH-NO36	Inrush of water into mine

No.	MMH No.	Hazard Title
12	IPRH-NO37	Field jacking of major mining plant
13	IPRH-NO38	Unplanned movement of equipment
14	IPRH-NO39	Confined spaces
15	IPRH-NO42	Fall from or tipping of EWP
16	IPRH-NO43	Building fire
17	IPRH-WF45	Vehicle / plant incident during West Field transfer

The risk for most of these hazards was estimated as Medium, with only two identified as being High risks. The High risk hazards were both considered to be a Single Fatality consequence and Possible to occur at some time in the mine life. The Risk Assessment Team did not identify any hazards as being an Extreme risk.

In addition to the above hazards, there were several hazards assessed as having a potential Major consequence (single fatality) and Unlikely to occur at some time in the mine life. Although not considered as potential Major Mining Hazards these hazards are of significance and should be referred for analysis at a later stage.

A parallel process, which needs to be completed, is aligning the register of Major Mining Hazards with the operations Safety Management System (SMS) and auditing processes. This task will help ensure that the controls identified through the HAZID process are being effectively implemented. This is also a requirement of the *OHS (Mines) Regs 2002*.

It is recommended that any further risk assessment workshops utilise as far as possible the existing Risk Assessment Team members and any other relevant IPRH personnel. This will help ensure that a comprehensive and consistent analysis is achieved.

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 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 operation.

The boundary of the risk assessment was defined by the workshop team to include all existing mining operations as well as activities associated with commissioning and mining in the new West Field area. The boundary of the existing mining operations was defined as being, all activities associated with the initial removal of overburden to coal placement into the top of the bunker.

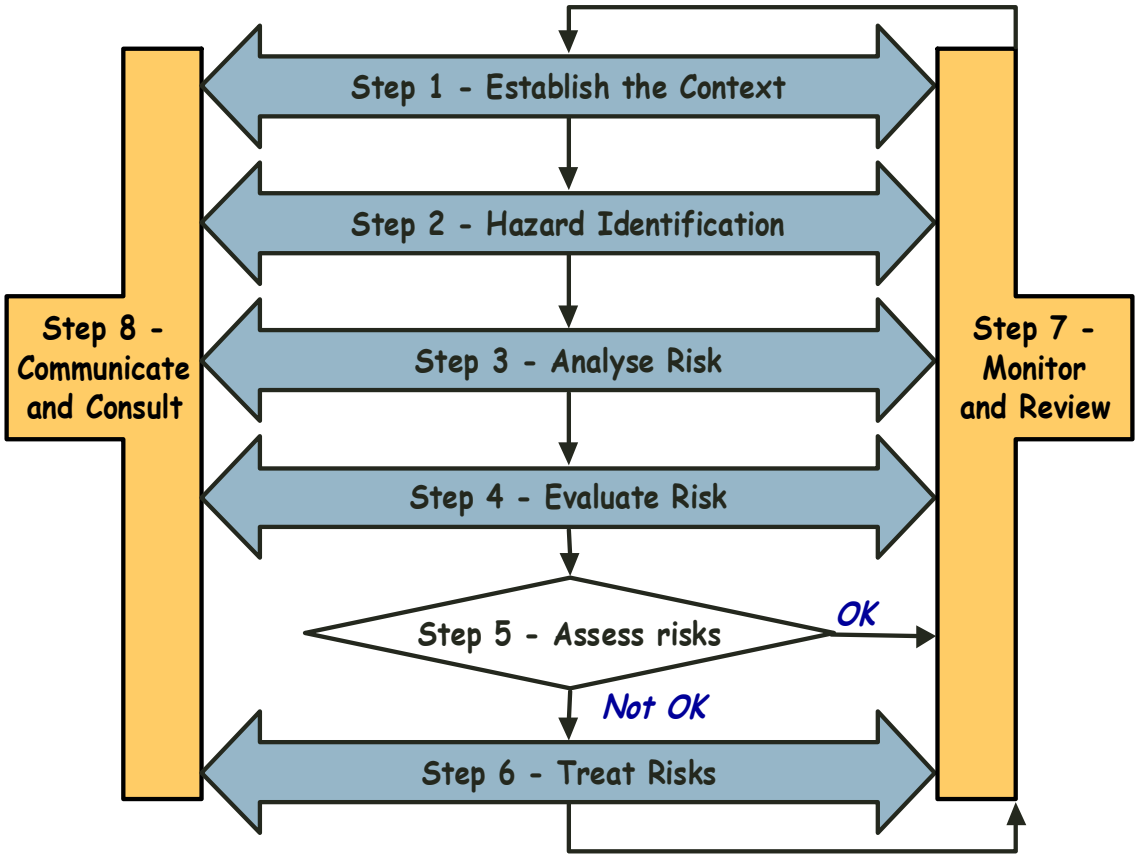
IPRH have commissioned Qest Consulting ("Qest") to assist them in completing this risk assessment work.

This report outlines the methodology and findings of the initial step in the assessment process, which is the identification of hazards for consideration as Major Mining Hazards. This report is currently a stand-alone report, however on completion of the following stages in the risk assessment, this report would be incorporated into a comprehensive report covering all stages of the process.

2.0 OVERVIEW OF RISK ASSESSMENT PROCESS

Qest have committed to completing the risk assessment 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 1.

Figure 1 – Risk Assessment Process (as per AS 3460)



The Hazard Identification (HAZID) process is the first stage of the formal risk assessment process.

The HAZID process uses a qualitative risk assessment method to identify a list of potential Major Mining Hazards. It is planned that the higher risk hazards will then be the subject of a more detailed risk analysis. A Semi-Quantitative Risk Assessment (SQRA) process is recommended as the appropriate level of assessment for these hazards. The SQRA process is identified by Qest as the desired approach for the analysis of these higher risk hazards, as it will provide the required level of analysis including a review of the adequacy of the current and proposed controls. Furthermore the SQRA process will satisfy the specific requirements for a risk assessment of Major Mining Hazards as detailed in the *OHS (Mines) Regs 2002.*

The SQRA process includes the following steps;

1. Familiarisation with Operation and Asset Review
2. Identification of Major Mining Hazards
3. Understanding the Dynamics of Hazards (Develop Bow-tie diagrams)
4. SQRA – Base Case
5. Identification of Critical Controls
6. Assessment of Critical Control Adequacy
7. Risk Reduction Measure's Selection and SQRA - Reduced Case
8. Development of Safety Implementation Plan

Prior to the commencement of the HAZID workshop, a short presentation was provided to introduce the Risk Assessment Team to the proposed risk assessment process. This was completed by Qest and included an outline of the steps in the process, terms used and an overview of the requirements of *the OHS (Mines) Regs 2002*. This step is considered important as it ensures understanding, consistency and commitment to the following stages.

3.0 IDENTIFICATION OF MAJOR MINING HAZARDS

3.1. Overview of HAZID Process

The HAZID process is the initial step in the process and the most important, as mining hazards that are not identified, can not be assessed and therefore actively managed. As outlined in the Introduction (Section 1.0), the aim of this work is to complete a Formal Safety Assessment of the Major Mining Hazards associated with the current and planned operations. A 'Major Mining Hazard' is defined under the *OHS (Mines) Regulations 2002* as - *a mining hazard that has the potential to cause an incident that causes, or poses a significant risk of causing, more than one death.*

The identification of potential Major Mining Hazards was completed in a workshop facilitated by an independent risk consultant from Qest Consulting. The workshop participants were made up of representatives from each relevant section of the workforce. A short presentation was completed at the beginning of the workshop, to introduce the participants to the HAZID process and the definitions used. The Risk Assessment Team is detailed in Table 2.

Table 2: Risk Assessment Team

Name of Participant	Role
Richard Polmear	Mine Engineering Manager
Ian Quail	Operations Manager
Peter Sheridan	Shift Operations Manager
Bill Estrada	Maintenance Manager
Ron Bernadi	Maintenance
Ian Wilson	Shift Fitter
Peter Kelly	Mining Engineer
Anthony Deakin	Qest Consulting (Facilitator and Scribe)

The process followed a two-staged approach. Firstly, identification of mining hazards that were considered to have the potential to result in a single or multiple fatality (ie. 'Major' and 'Catastrophic' consequence, refer Table 3). And secondly, the assessment of these hazards using the IPRH Qualitative risk matrix to estimate the likelihood of occurrence of those hazards deemed as having a potential Major or Catastrophic consequence.

The steps in the HAZID process are detailed through section 3.2 to 3.5.

3.2. Identification of Hazard Activities

The first stage in the hazard identification process involved identifying the key activities or processes of the existing and planned mining activities. The areas, as identified by the workshop team, are outlined below:

Normal Operations - activities associated with the digging, transport and placement of coal:
- Maintenance activities
- Site access
- Dredger operations
- Conveyor operations
- Stacker operations
- Services (water, fire protection, electrical systems)
- Support activities

West Field Mine Area – activities associated with the commissioning of the new mine area:
- Transfer activities:
  - Relocation of equipment
  - Installation of services
  - Construction activities
- Normal operations in West Field (same activities as present however, risk assessment will need to consider any issues due to different working grades, geology, depth of north end, etc)
- Infrastructure works:
  - 6.6KV & 220KV
  - Stream diversion (three)
  - Road works

3.3. Guidewords Technique

Each of these activities / processes were then reviewed using a 'guide words approach'. The guidewords were used as a technique to identify any safety hazards for each activity. The Risk Assessment Team was asked to identify hazards that would have the potential to result in a single fatality consequence or above. The guidewords used were:
- Dropped Objects
- Collisions
- Fires & Explosions
- Aggressive Releases
- Emissions
- Natural Forces
- Structural Upsets
- Mechanical Upsets
- Electrical Upsets
- Security Failure
- Flora, Fauna & Heritage

These guidewords are further defined in Appendix 2.

To ensure completeness, the resulting list of mining hazards were then reviewed against the guidewords included in the *OHS (mines) Regs*:

- Ground control
- Slope stability
- Rock falls
- Seismic activity
- Water or semi solid inrush
- Mining plant
- Heavy transport equipment
- Fires or explosions
- Airborne dust
- Radiation / Reactive grounds
- Dangerous openings (edges)
- Tailings

The Risk Assessment Team was also asked to consider any specific hazards relating to:

- Shutdown
- Emergency Situations
- Care and maintenance
- Abnormal conditions
- Changes to current conditions

3.4. Qualitative Risk Assessment Process

The guidewords technique enabled an initial list of safety hazards to be produced. This list was then further analysed using a qualitative risk assessment approach, to identify those hazards considered as being potential "Major Mining Hazards" (ie. "a mining hazard that has the potential to cause an incident that causes, or poses a significant risk of causing, more than one death"). IPRH's existing 'Qualitative Risk Matrix' was used for this process. The risk assessment was undertaken considering the existing control measures or as planned for the new mine area.

The steps in the qualitative risk assessment are outlined below.

Determine Consequence

The initial step is to identify the potential consequence for each hazard. The Consequences were ranked according to a five-tiered scale. The Consequence descriptions used are outlined in Table 3. The Risk Assessment Team was asked to identify the larger credible consequence for each hazard.

Table 3 – Consequence Definitions

Low	Minor	Medium	Major	Extreme
First aid / Medical Treatment	Lost Time Injury	Serious Injuries	Single Fatality or irreversible disability	Multiple Fatality

Determine Likelihood of Consequences

The likelihood of the resulting consequence was estimated. It should be noted that this is not the likelihood of the initiating event, but of the final resulting consequence. Furthermore the likelihood assessment is determined considering Existing Control Measures and Existing Contingency and Recovery Systems. The likelihood definitions used in the risk assessment are defined in Table 4.

Table 4 – Likelihood Definitions

Almost Certain	Likely	Possible	Unlikely	Rare
Expected to occur in most circumstances	Probably occur in most circumstances	Possible to occur at some time (in mine life)	Unlikely to occur at some time (in mine life)	May occur in exceptional circumstances

Estimate risks

Estimating the risk involves combining the severity of the consequence resulting from the potential incident and the likelihood of that consequence. Single hazards are positioned on the matrix by using the axis of selected consequence and the likelihood of that outcome. The matrix used is included as Figure 2.

Figure 2 – Qualitative Risk Assessment Matrix

Likelihood	Consequence Severity				
	Low	Minor	Medium	Major	Catast.
Almost Certain	Medium	High	Extreme	Extreme	Extreme
Likely	Low	High	High	Extreme	Extreme
Possible	Low	Medium	Medium	High	Extreme
Unlikely	Low	Low	Medium	Medium	High
Rare	Low	Low	Low	Low	Medium

Evaluate Risks

IPRH Risk Category action and responsibility requirements:

Extreme Risk = Management must immediately develop action plans to implement control measures to reduce this extreme risk.
High Risk = Management must review all high risks at least annually and develop action plans to implement control measures to reduce this high risk.
Medium = Management must review and reassess all medium risks annually.
Low = Management must review and reassess all low risks biannually.

3.5. Collecting Hazard Information

The collective list of Mining Hazards was then reviewed and rationalised to identify a final list of potential Major Mining Hazards. A hazard register consistent with IPRH existing format was then used to capture information about each of the hazards for use in the following stages of the process. The data collected included:

- Name of Hazardous Scenario
- Scenario description
- Identified causes
- Existing controls (Preventative and Mitigative)
- Recommended Risk Reduction Measures.

The completed Hazard and Risk Register for the hazards analysed is included as Appendix 2.

4.0 FINDINGS

The hazard identification process identified 53 mining hazards, 17 of which were deemed to be potential Major Mining Hazards. The resulting list of hazards, showing their associated risk value, is detailed in Table 5. The risk for most hazards was estimated as Medium with only two identified as being High risks. The High risk hazards were both considered to be a single fatality consequence considered to be possible to occur at some time in the mine life. The Risk Assessment Team did not identify any hazards as being an Extreme risk.

The four shaded hazards relate specifically to the transfer of equipment or infrastructure works for the West Field operations. Of particular note are hazards 28, 30 & 32, which relate to activities that will be principally undertaken by contractors. It is important that IPRH ensure the contractors have appropriate experience and effective safety management processes.

Table 5: Potential Major Mining Hazards Identified

Rank	Hazard No.	Hazard Title	Consequence	Likelihood	Risk
1	IPRH-NO4	Dropped objects from major mining plant (onto personnel / equipment)	Major	Possible	**High**
2	IPRH-NO24	Mobile equipment interactions on mine roads	Major	Possible	**High**
3	IPRH-NO1	Vehicle incident while accessing worksite	Catastrophic	Rare	**Medium**
4	IPRH-NO5	Toppling of major mining plant	Catastrophic	Rare	**Medium**
5	IPRH-NO7	Major mining plant fire	Catastrophic	Rare	**Medium**
6	IPRH-NO8	Explosion of electrical components on major mining plant	Catastrophic	Rare	**Medium**
7	IPRH-NO26	Batter failure	Catastrophic	Rare	**Medium**
8	IPRH-IW28	Structural failure of 220KV towers	Catastrophic	Rare	**Medium**
9	IPRH-IW30	Cable incident on public road	Catastrophic	Rare	**Medium**
10	IPRH-IW32	Public vehicle incident during road alterations	Catastrophic	Rare	**Medium**
11	IPRH-NO36	Inrush of water into mine	Catastrophic	Rare	**Medium**
12	IPRH-NO37	Field jacking of major mining plant	Catastrophic	Rare	**Medium**
13	IPRH-NO38	Unplanned movement of equipment	Catastrophic	Rare	**Medium**
14	IPRH-NO39	Confined spaces	Catastrophic	Rare	**Medium**
15	IPRH-NO42	Fall from or tipping of EWP	Catastrophic	Rare	**Medium**
16	IPRH-NO43	Building fire	Catastrophic	Rare	**Medium**
17	IPRH-WF45	Vehicle / plant incident during West Field transfer	Catastrophic	Rare	**Medium**

In addition to the hazards listed in Table 5, there were several hazards assessed as having a potential 'Major' consequence (single fatality) and 'Unlikely' to occur at some time in mine life. Although not considered potential Major Mining Hazards these hazards are of significance and should be referred for analysis at a later stage. These hazards are included in Table 6.

Table 6: Referred Mining Hazards

Rank	Hazard No.	Title
18	IPRH-NO2	Vehicle or personnel fall into trenches / hot spots
19	IPRH-NO11	Entanglement in mechanical components (conveyors / dredger components, etc)
20	IPRH-NO12	Fall from major mining plant
21	IPRH-NO21	Contact with overhead / damage to cables
22	IPRH-NO22	Contact with live electrical systems
23	IPRH-NO23	Mobile equipment interactions in loading areas
24	IPRH-IW29	Fall from 220KV towers during assembly
25	IPRH-IW31	Mobile equipment interactions during construction
26	IPRH-IW34	Unauthorised access to construction area
27	IPRH-WF48	Truck / spotter interaction during dumping
28	IPRH-WF49	Incident during recommissioning of plant
29	IPRH-NO051	Dropped objects from excavator or cranes
30	IPRH-NO052	Explosion of Oxyacetylene bottles
31	IPRH-NO053	Fire at bulk flammable liquid store

Appendix 1

HAZID Guideword Definitions

	MH No.	Hazard Name	Description	Causes	Consequence / Hazard Effect	Likelihood / Probability	Risk	Controls (Preventative)	Controls (Mitigation)	Risk Reduction Measures	NO	WF
1	IPH-NO4	**Dropped objects from major mining plant (onto personnel / equipment)**	Conveyors, stacker, dredger, (pieces or material) . Pieces or material, structural failure. Includes unplanned dumping from stacker. Areas of concern: Concerns about lumps of coal falling. Concern about complacency. Ensuring equipment is correctly designed and installed.	1. Equipment failure 2. Blocked chute 3. Conveyor run-on (gradient) 4. Overloaded conveyor 5. Poor Design 6. Operator / maintenance error (miss communication, dropped object, fatigue/ FFW, incorrect fitting) 7. Dirty conveyor belt 8. Poor housekeeping 9. Unauthorised access	4 Major	C Possible	**HIGH**	1. Preventative maintenance program (ISI, lubrication program, monthly / annual safety device testing, routine inspections, CM), Shiftly fault inspections, competent maintenance personnel / operators, works management system (priority for safety items) 2/3/4. Preventative maintenance, shiftly inspections, competent personnel, designed conveyor systems (chute size, gradient), block chute limits, Permit System, SOPs, overload devices, monitor weightometers on machines, sequencing of conveyors, belt alignment limit switches. 5. Competent design engineers, plant / AS regulations, past experience. 6. Hand held and fixed radios, competent operators, Communication procedures, supervision, experienced workforce. 6c. Task rotation, Shift management, Draft drug & Alcohol policy, Annual medical tests available, EAP available, Medical tests / first aid available, Leave polices, Duty of Care. 7. Finger scrapers. 8. Design to prevent spillage, PM, cleaning daily or on request (hose down / shovel clean), shiftly inspections, safety walks. 9. Permit procedure, SOPs, Competent operators, experience operators, Level 3 induction process, signage, boundary fences, security gates, security guard.	Spill trays, spill mesh. First aid room on site, Emergency response procedure, First Aiders on all shifts, Close proximity to Emergency Services (CFA, SES, Ambulance, Police) and hospital (Quick response times), Diamond Protection for first response.	2/3/4. Install dynamic braking in conveyor systems in WF to match sequence. Ensure correct barricades are erected during cleaning of major plant. 6. Introduction of Safe Work Observation Process.		
2	IPH-NO24	**Mobile equipment interactions on mine roads**	Relates to incidents during normal mobile plant operations. Issue due to sharing of roads between mobile equipment. Areas of concern: Infrequent user. External dumping closer to points of entry. Radio protocols (clear and positive coms).	1. Poor visibility (rain, dust, fog, sun) 2. Poor road conditions (construction, surfacing, drainage) 3. Driver error / not following road rules (driving to conditions, rules, unfamiliar with conditions, distracted, FFW, etc). 4. Mechanical failure 5. Over / uneven loading of trucks (spillage) 6. Poor road design 7. Unauthorised access 8. Poor communication	4 Major	C Possible	**HIGH**	1 Minimum equipment standards, road watering, fog lights, flashing lights, sun glasses supplied, wipers, Pre start checks and recording, shift changeover meeting, cease / delay task in extreme conditions, drive to conditions, remarking of road lines, guide posts and reflectors. 2. Regular grading, road maintenance program, road surfacing material (borrow areas / import rock), Safety walks (roads & walks). 3. 4wd training for IPH personnel, competent personnel, site induction process, disciplinary policy, contractor management process, shift changeover meeting and shift notes, documented road rules, signage, supervision, incident reporting and CA. 3e. Task rotation, Shift management, Draft drug & Alcohol policy, Annual medical tests available, EAP available, Medical tests / first aid available, Leave polices, Duty of Care. 4. Preventative maintenance program (regular servicing), Shiftly fault inspections, competent maintenance personnel / operators, works management system (priority for safety items), Spare vehicles, Call out service, Dry hire lease arrangements. 5. Competent operators, supervision, SOPs, road rules (passing & following). 6. Design of permanent roads & ramps to Vic Roads standard, Competent mine planner, Erection of temporary barriers, Review intersections for traffic management. 7. Induction process, security gates, security guards, sealed roads as boundary of mine, signage, access control through control centre / shift manager, Disseminate haul road info IPH wide. 8. Tool box meetings, shift changeover, hand held and fixed radios, competent personnel, road rules, PM, Disseminate haul road info IPH wide.	Seat belts in all vehicles, ROPs on mining plant, Air bags on selected LVs. Bull bars. First aid room on site, Emergency response procedure, First Aiders on all shifts, Close proximity to Emergency Services (CFA, SES, Ambulance, Police) and hospital (Quick response times), Diamond Protection for first response.	3. Consider publishing mine traffic rules handbook. 7. Security review to be completed.		
3	IPH-NO1	**Vehicle incident while accessing worksite**	All mobile vehicles used for transport to work site (eg. 4wd's). Includes off edge, rollover, collision. Areas of concern: Infrequent users. Radio protocols (clear and positive coms). Higher congestion / volume during start of shift (6:30am - 8am)	1. Poor visibility (rain, dust, fog, sun) 2. Poor road conditions (construction, surfacing, drainage) 3. Driver error / not following road rules (driving to conditions, rules, unfamiliar with conditions, distracted, FFW, etc). 4. Mechanical failure 5. Over / uneven / unsecured loading of trucks (spillage) 6. Poor road design 7. Unauthorised access 8. Poor communication 9. Inadequate windrow / guard rails	5 Catastrophic	E Rare	**MEDIUM**	1 Minimum equipment standards, road watering, fog lights, flashing lights, sun glasses supplied, wipers, Pre start checks and recording, shift changeover meeting, cease / delay task in extreme conditions, drive to conditions, remarking of road lines, guide posts and reflectors. 2. Regular grading, road maintenance program, road surfacing material (borrow areas / import rock), Safety walks (roads & walks), washing of roads. 3. 4wd training for IPH personnel, competent personnel, site induction process, disciplinary policy, contractor management process, shift changeover meeting and shift notes, documented road rules, signage, supervision, incident reporting and CA. 3e. Task rotation, Shift management, Draft drug & Alcohol policy, Annual medical tests available, EAP available, Medical tests / first aid available, Leave polices, Duty of Care. 4. Preventative maintenance program (regular servicing), Shiftly fault inspections, competent maintenance personnel / operators, works management system (priority for safety items), Spare vehicles, Call out service, Dry hire lease arrangements. 5. Current statutory licence, Competent operators, supervision, SOPs, road rules (passing & following). 6. Design of permanent roads & ramps to Vic Roads standard, Competent mine planner, Erection of temporary barriers, Review intersections for traffic management and separation of LV and HV. 7. Induction process, security gates, security guards, sealed roads as boundary of mine, signage, access control through control centre / shift manager, Disseminate haul road info IPH wide. 8. Tool box meetings, shift changeover, hand held and fixed radios, competent personnel, road rules, PM, Disseminate haul road info IPH wide. 9. Construction of windrows, program for replacing windrows, Install guard rails as required.	Seat belts in all vehicles, ROPs on mining plant, Air bags on selected LVs. Bull bars. First aid room on site, Emergency response procedure, First Aiders on all shifts, Close proximity to Emergency Services (CFA, SES, Ambulance, Police) and hospital (Quick response times), Diamond Protection for first response.			
4	IPH-NO5	**Toppling of major mining plant**	Major mining plant and cranes. Material falling onto, operator error, slip, wind, soft support, structural issue etc. Areas of concern: Jacking equipment in field during breakdown, eg. material build up, uneven and soft ground.	1. Batter collapse (depressions, water pressure) 2. Operator error (over edge, off load bucket, wheeldrop cuts, FFW) 3. Soft formation 4. Dump slip 5. Safety & electrical device failure 6. Incorrect jacking or failure 7. Equipment / rope / structure failure 8. Machine standoff	5 Catastrophic	E Rare	**MEDIUM**	1. Digging procedures, Crack monitoring, shift face inspections, Crack orientation for dig plan, Monthly engineering face inspections, Dewatering, Groundwater profile monitoring, surface drainage, Surcharge removal, Computer modelling of stability (internal), Drilling and testing as required, Annual stability and dewatering reports (externally reviewed), Investigation pans for fire wholes, Modify digging programs as required, face mapping of OB, Supply of face maps to OB operations. 2. Competency operators, supervision, experienced workforce, Dig charts, Shift notes, Electronic feedback (survey control), Working & backup limits. 2c. Task rotation, Shift management, Draft drug & Alcohol policy, Annual medical tests available, EAP available, Medical tests / first aid available, Leave polices, Duty of Care. 3. Ongoing inspection by operator / shift management, Grade control and mine planning, drainage, Remediation plan for soft areas. 4. Shifty inspection, Monthly inspection, Dump design (height), drainage in dump area, dozer maintenance of dump grades, placement of material. 5. PM Program, Six monthly routine elect. maintenance, Monthly testing of devices by operators, six monthly testing of devices by engineers, Shiftly inspection (visual). 6. Competent maintenance personnel, SOPs, Certified and rated jacking equipment, Appropriately stored equipment, Asset register of equipment, Weight / balance diagrams (weight and balance audit), cleaning of machines. 7. PM Program, Annual structural inspection, Biennial External structural and rope inspections, competent maintenance personnel, lubrication procedure, painting programs, Monthly testing of devices by operators, six monthly testing of devices by engineers, Shiftly inspection (visual).	Safety hooks, escape routes from machine. First aid room on site, Emergency response procedure, First Aiders on all shifts, Close proximity to Emergency Services (CFA, SES, Ambulance, Police) and hospital (Quick response times), Diamond Protection for first response.	1. Improve info dissemination on ground conditions to mine operators (electronic). 2. Improve electronic feedback and control for dredge operators. 6. Ensure JSA is completed for jacking activities in field. 2. Investigate installing tilt device in dredges. 8. Confirm documentation of rules for standoff of machines		
5	IPH-NO7	**Major mining plant fire**	Conveyors, stacker, dredger. Dredger considered biggest risk issue. Areas of concern: Coal build up and mechanical failure.	1. Electrical / mechanical failure 2. Grease build up 3. Coal build up 4. Hot work 5. Housekeeping 6. External fire 7. Lightning 8. Spot fire from vehicle / plant 9. Belt fire	5 Catastrophic	E Rare	**MEDIUM**	1. PM (Condition monitoring, Lubrication), Shiftly inspection, Temperature censors / protection. 2. Degreasing of plant, Shift inspections. 3. Design to prevent spillage, PM, cleaning daily or on request (hose down / shovel clean), shiftly inspections, safety walks. 4. Permit system, Follow up inspections, Training of fire man / spotter for Hot Work. 5. Cleaning daily or on request (hose down / shovel clean), shiftly inspections, safety walks. 6. Perimeter slashing, Fire brakes, On-site fire fighting tankers. 7. Lightning rods on major plant. 8. Modified exhausts, Modified braking systems, vehicle washing, PM, Ongoing inspection, Diesel powered vehicles. 9. Preventative maintenance program, Shiftly fault inspections, competent maintenance personnel / operators, works management system (priority for safety items), FRAS belts.	Fire extinguishers on all plant. Monthly visual inspection of extinguishers, Annual testing of extinguishers, Reticulated fire water protection to all major mining plant. Annual training in fire fighting. LV fitted with hoses. Escape routes from MMP, Emergency response procedures. Adequate fire water pressure and supply. Annual spray pattern testing. On-site fire fighting tankers.			

	MH No.	Hazard Name	Description	Causes	Consequence / Hazard Effect	Likelihood / Probability	Risk	Controls (Preventative)	Controls (Mitigation)	Risk Reduction Measures	NO	WF
6	IPH-NO8	**Explosion of electrical components on major mining plant**	Relates to 6.6KV switch gear.	1. Failure to follow procedures / operator error 2. Faulty equipment 3. Housekeeping (dust build up leading to flash over)	5 Catastrophic	E Rare	MEDIUM	1. Competent maintenance personnel, Ticketed electricians to AS. SOP (Isolation / set up sequence). 2/3. HV Routine Maintenance (Insulator Cleaning, inspection and servicing)	Explosion vents, Procedure for electrically isolating personnel, PPE. First aid room on site, Emergency response procedure, First Aiders on all shifts, Close proximity to Emergency Services (CFA, SES, Ambulance, Police) and hospital (Quick response times), Diamond Protection for first response.			
7	IPH-NO26	**Batter failure**	Onto personnel, plant or vehicle	1. Material type / soft formation 2. Water pressure 3. Operator error (not digging to plan, incorrect parking location) 4. Surcharge / over hight 6. Surface drainage 7. Heaving	5 Catastrophic	E Rare	MEDIUM	1/4. Digging procedures, Crack monitoring, shift face inspections, Crack orientation for dig plan, Monthly engineering face inspections, Computer modelling of stability (internal), Drilling and testing as required, Annual stability and dewatering reports (externally reviewed), Investigation pans for fire wholes, Modify digging programs as required, face mapping of OB, Supply of face maps to OB operations 2/7. Dewatering (pumping from boreholes), Groundwater profile monitoring, Annual stability and dewatering reports (externally reviewed), horizontal bores (relief bores) 2/6. Surface drainage, Dig plan design for drainage control, Monthly stability inspections, Incident reporting, Remediation works, Pin lines (monitoring). 4. Surcharge removal 3. Competency operators, supervision, experienced workforce, Dig charts, Shift notes, Electronic feedback (survey control), Supply of face maps to OB operations	First aid room on site, Emergency response procedure, First Aiders on all shifts, Close proximity to Emergency Services (CFA, SES, Ambulance, Police) and hospital (Quick response times), Diamond Protection for first response.	3. Confirm documented parking procedures about parking at toe of batter.		
8	IPH-IW28	**Structural failure of 220KV towers**	Structural failure, ground failure, incorrect design, natural forces	1 Design fault 2 Sabotage 3 Wind loading 4 Incorrect assembly procedures 5 Stability	5 Catastrophic	E Rare	MEDIUM	Ensure owner of asset to use standard construction procedures and recognised and competent sub-contractors. Joint management with SPI Powernet for contract management. Ensure risk assessment and SOPs.				
9	IPH-IW30	**Cable incident on public road**	During installation or failure during operations. Activity will be completed by sub-contractor.	1 Design of cable support 2 Failure to follow assembly procedure	5 Catastrophic	E Rare	MEDIUM	Ensure owner of asset to use standard construction procedures and recognised and competent sub-contractors. Joint management with SPI Powernet for contract management.Ensure risk assessment and SOPs.				
10	IPH-IW32	**Public vehicle incident during road alterations**	Traffic Management Plan. Activity will be completed by sub-contractor.	1. Changes to traffic patterns 2. Changes to road surface conditions 3. Poor visibility 4. Impatience of drivers	5 Catastrophic	E Rare	MEDIUM	Enforcement of Vic Roads requirements. Ensure selected of road construction contractor has QA system for achieving compliance with Vic Roads requirements. Ensure effective contract management.Ensure risk assessment and SOPs.				
11	IPH-NO36	**Inrush of water into mine**	Main control is design of flood mitigation to 1:10,000 yr /evnt	1. Water volume of catchment area above design of cut off drains 2. Failure / breach of flood protection	5 Catastrophic	E Rare	MEDIUM	1. Construction of levy banks at 1 in 10,000 yr event.	First aid room on site, Emergency response procedure, First Aiders on all shifts, Close proximity to Emergency Services (CFA, SES, Ambulance, Police) and hospital (Quick response times), Diamond Protection for first response.			
12	IPH-NO37	**Field jacking of major mining plant**		1. Equipment failure 2. Failure to follow procedure 3. Ground conditions 4. Incorrect procedure 5. Ground vibration (seismic, plant movements)	5 Catastrophic	E Rare	MEDIUM	1/2/4 Competent maintenance personnel, SOPs, 1/4 Certified and rated jacking equipment, Appropriately stored equipment, Asset register of equipment, Weight / balance diagrams (weight and balance audit), cleaning of machines. 3. Ballast (excavation and backfill) 5. Separation of plant from activity, SOP (Jack & Pack)	First aid room on site, Emergency response procedure, First Aiders on all shifts, Close proximity to Emergency Services (CFA, SES, Ambulance, Police) and hospital (Quick response times), Diamond Protection for first response.			
13	IPH-NO38	**Unplanned movement of equipment**	Equipment runaway, slip, belt runaway	1. Brake failure 2. Mechanical failure 3. Electrical failure 4. Not following procedure 5. Inadequate anchoring 6. Wind loading	5 Catastrophic	E Rare	MEDIUM	4. JSA process, SOPs, competent maintenance personnel. 1/2/3 Routine inspection, Safety device testing for major plant, PM, fail safe designs, Permit procedures. 5. Designated anchoring points, Pendant ropes, Trestles for specific components. Testing and inspection of Trestles and Pendent ropes (external), anchor posts for conveyors. Slew locks. 6. Wind gauges, Wind restrictions in mine, Orientation for wind.	First aid room on site, Emergency response procedure, First Aiders on all shifts, Close proximity to Emergency Services (CFA, SES, Ambulance, Police) and hospital (Quick response times), Diamond Protection for first response.			
14	IPH-NO39	**Confined spaces**	Hot work, irrespirable atmosphere	1. Failure to follow procedures 2. Lack of ventilation 3. Limited exits	5 Catastrophic	E Rare	MEDIUM	1/2/3 Confined space procedure, Gas testing, Ventilation fans, Designated confined space officer, CS Training, Register of confined spaces, Labelling of confined space, PPE.	First aid room on site, Emergency response procedure, First Aiders on all shifts, Close proximity to Emergency Services (CFA, SES, Ambulance, Police) and hospital (Quick response times), Diamond Protection for first response.			
15	IPH-NO42	**Fall from or tipping of EWP**	EWP, Cherry picker, JLG, Boom lift, Scissor lifts	1. Failure to follow procedures 2. Ground conditions 3. Component failure (Structural / Mechanical) 4. Overloading 5. Wind loading 6. Collision 7. Overbalance	5 Catastrophic	E Rare	MEDIUM	1/2/4/7. Ticketed operators, External training and testing, Contractor management, Operations manual, JSA. 3. Annual external testing, Log books. Contract management 4. Interlock, SWL 5. Wind gauges, Wind restrictions in mine, Orientation for wind. 6. Spotter	First aid room on site, Emergency response procedure, First Aiders on all shifts, Close proximity to Emergency Services (CFA, SES, Ambulance, Police) and hospital (Quick response times), Diamond Protection for first response.			
15	IPH-NO43	**Building fire**	Control room, workshop, office.	1. Hot work 2. Cooking utensils 3. Electrical fault 4. Arson 5. Failure to follow no-smoking procedure	5 Catastrophic	E Rare	MEDIUM	1. Competent maintenance personnel 2. housekeeping 2/3. PETE system, circuit breakers, earth leakage in workshop. 4. Secured are (gate, fences) 5. no-smoking policy	Fire extinguishers (testing and inspection). Hose reels, Smoke detectors, smoke alarms, smoke suppressions system in control centre, Exit lights, Escape routes, Evacuation procedure. First aid room on site, Emergency response procedure, First Aiders on all shifts, Close proximity to Emergency Services (CFA, SES, Ambulance, Police) and hospital (Quick response times), Diamond Protection for first response.			
17	IPH-WF45	**Vehicle / plant incident during West Field transfer**	Relates to major truck and shovel programs. includes interaction or other incident eg. off edge, into hole. Watering of roads effect LV traction. Areas of concern: Dynamic changing nature of work areas (internal roads and dig and dump sites / routes / infrastructure works / patterns).	1. Poor visitbility (rain, dust, fog, sun) 2. Poor road conditions (construction, surfacing, drainage) 3. Driver error / not following road rules (driving to conditions, rules, unfamiliar with conditions, distracted, FFW, etc). 4. Mechanical failure 5. Over / uneven loading of trucks (spillage) 6. Poor road design 7. Unauthorised access 8. Poor communication 9. Dynamic changing environment (internal roads and dig and dump sites / routes / infrastructure works / patterns)	5 Catastrophic	E Rare	MEDIUM	1 Minimum equipment standards, road watering, fog lights, flashing lights, sun glasses supplied, wipers, Pre start checks and recording, shift changeover meeting, cease / delay task in extreme conditions, drive to conditions, remarking of road lines, guide posts and reflectors. 2. Regular grading, road maintenance program, road surfacing material (borrow areas / import rock), Safety walks (roads & walks). 3. 4wd training for IPH personnel, competency personnel, site induction process, disciplinary policy, contractor management process, shift changeover meeting and shift notes, documented road rules, signage, supervision, incident reporting and CA. 3e. Task rotation, Shift management, Draft drug & Alcohol policy, Annual medical tests available, EAP available, Medical tests / first aid available, Leave polices, Duty of Care. 4. Preventative maintenance program (regular servicing), Shiftly fault inspections, competent maintenance personnel / operators, works management system (priority for safety items), Spare vehicles, Call out service, Dry hire lease arrangements. 5. Competent operators, supervision, SOPs, road rules (passing & following). 6. Design of permanent roads & ramps to Vic Roads standard, Competent mine planner, Erection of temporary barriers, Review intersections for traffic management. 7. Induction process, security gates, security guards, sealed roads as boundary of mine, signage, access control through control centre / shift manager, Disseminate haul road info IPH wide. 8. Tool box meetings, shift changeover, hand held and fixed radios, competent personnel, road rules, PM, Disseminate haul road info IPH wide. 9. Traffic management plans, Toolbox meetings, Communication via pay dockets / notice boards, additional traffic controls (signage, bollards, gates, lights, etc) as required, escorting of infrequent visitors to WF operational areas.	Seat belts in all vehicles, ROPs on mining plant, Air bags on selected LVs. Bull bars. First aid room on site, Emergency response procedure, First Aiders on all shifts, Close proximity to Emergency Services (CFA, SES, Ambulance, Police) and hospital (Quick response times), Diamond Protection for first response.			

	MH No.	Hazard Name	Description	Causes	Consequence / Hazard Effect	Likelihood / Probability	Risk	Controls (Preventative)	Controls (Mitigation)	Risk Reduction Measures	NO	WF
18	IPH-NO2	**Vehicle or personnel fall into trenches / hot spots**	Any open trench , drains, excavations		4 Major	D Unlikely	**MEDIUM**					
19	IPH-NO11	**Entanglement in mechanical components (conveyors / dredger components, etc)**			4 Major	D Unlikely	**MEDIUM**					
20	IPH-NO12	**Fall from major mining plant**	Access, egress, maintenance, cleaning, inspections, etc		4 Major	D Unlikely	**MEDIUM**					
21	IPH-NO21	**Contact with overhead / damage to cables**			4 Major	D Unlikely	**MEDIUM**					
22	IPH-NO22	**Contact with live electrical systems**			4 Major	D Unlikely	**MEDIUM**					
23	IPH-NO23	**Mobile equipment interactions in loading areas**			4 Major	D Unlikely	**MEDIUM**					
24	IPH-IW29	**Fall from 220KV towers during assembly**			4 Major	D Unlikely	**MEDIUM**					
25	IPH-IW31	**Mobile equipment interactions during construction**	Stream construction has potential for multiple dumps and excavation sites. Road construction has interface with public traffic.		4 Major	D Unlikely	**MEDIUM**					
26	IPH-IW34	**Unauthorised access to construction area**			4 Major	D Unlikely	**MEDIUM**					
27	IPH-WF48	**Truck / spotter interaction during dumping**			4 Major	D Unlikely	**MEDIUM**					
28	IPH-WF49	**Incident during recommissioning of plant**			4 Major	D Unlikely	**MEDIUM**					
29	IPH-NO051	**Dropped objects from excavator or cranes**			Major	Unlikely	**MEDIUM**					
30	IPH-NO052	**Explosion of Oxyacetylene bottles**			Major	Unlikely	**MEDIUM**					
31	IPH-NO053	**Fire at bulk flammable liquid store**	Bulk diesel stores (four areas) and two bulk oil stores		Medium	Unlikely	**MEDIUM**					
32	IPH-NO6	**Interaction of major mining plant**	Dredger with mobile slew / stacker, cranes, excavators into vehicle, mobile plant, batter, hopper, etc. Issue due to close proximity.		4 Major	E Rare	**LOW**					
33	IPH-NO9	**Hydraulic injection**			4 Major	E Rare	**LOW**					
34	IPH-NO13	**Fall from batter**			4 Major	E Rare	**LOW**					
35	IPH-NO16	**Fall into bunker**	Includes material being dumped onto or personnel falling through		4 Major	E Rare	**LOW**					
36	IPH-NO18	**Dump face failure**	Stacker slipping away		4 Major	E Rare	**LOW**					
37	IPH-NO20	**Uncontrolled release of fire water**	Equipment failure / personnel error. Over pressure		4 Major	E Rare	**LOW**					
38	IPH-IW27	**Power pole collapse**	Power pole collapse,		4 Major	E Rare	**LOW**					
39	IPH-NO35	**Exposure to extreme elements**	Heat, cold, wind, rain, fog, frost		4 Major	E Rare	**LOW**					
40	IPH-NO40	**Tyre explosion**			4 Major	E Rare	**LOW**					

	MH No.	Hazard Name	Description	Causes	Consequence / Hazard Effect	Likelihood / Probability	Risk	Controls (Preventative)	Controls (Mitigation)	Risk Reduction Measures	NO	WF
41	IPH-NO44	**Vehicle / pedestrian interaction in mine admin area**	Includes workshops, office, control room etc		4 Major	E Rare	**LOW**					
42	IPH-WF46	**Incident during transfer of major mining plant**	Long, wide, heavy. Infrequent activity		4 Major	E Rare	**LOW**					
43	IPH-WF47	**Dump failure during truck dumping**			4 Major	E Rare	**LOW**					
44	IPH-NO14	**Fall from mobile equipment**			3 Medium	C Possible	**HIGH**					
45	IPH-NO3	**Mobile equipment fire**	Grease or coal build up, etc		3 Medium	D Unlikely	**MEDIUM**					
46	IPH-NO10	**Struck by conveyor tails**			3 Medium	D Unlikely	**MEDIUM**					
47	IPH-NO15	**Fire / explosions in bunker**			3 Medium	D Unlikely	**MEDIUM**					
48	IPH-NO19	**Runaway of hoppers and trippers**			3 Medium	D Unlikely	**MEDIUM**					
49	IPH-NO25	**Snake or spider bite**			3 Medium	D Unlikely	**MEDIUM**					
50	IPH-NO41	**Pneumatic tool failure**			3 Medium	D Unlikely	**MEDIUM**					
51	IPH-NO50	**External ingress of fire**	Bush fire, cigarette butt, arson		3 Medium	D Unlikely	**MEDIUM**					
52	IPH-NO17	**Overflow of loading points**	Snow-in		2 Minor	E Rare	**LOW**					
53	IPH-IW33	**Flooding during construction**			1 Insignificant	E Rare	**LOW**					

Appendix 2

Hazard Data Sheets

Guideword Descriptions

- Dropped Objects
- Collisions
- Fires & Explosions
- Aggressive Releases
- Emissions
- Natural Forces
- Structural Upsets
- Mechanical Upsets
- Electrical Upsets
- Security Failure
- Flora, Fauna & Heritage

Dropped Objects

Where anything of substantial weight or momentum is involved in a fall.

Examples:

- Cranes & Gantries
- Elevated Structures
- Air Lifts
- Includes People Falling

The most obvious dropped objects are those being lifted by equipment or other objects dropped from high working positions.

Collisions

Where heavy and/or fast moving objects suddenly hit something.

Examples:

- Transportation
- Lifting Operations
- Manual Handling

Transportation commonly figures here, but think of other moving objects like crane booms, handling systems, heavy doors etc. Where as a dropped object involves vertical movement, collisions involve the other two dimensions.

Fires & Explosions

Examples:

- Solid Fires
- Pool Fires
- Jet Fires
- Flash Fires
- Gas Explosions
- Explosives Upset

Of course, all fires involve flammable products (solid, powder, liquid or gas) but explosions can be caused without them. Boiler explosions, large tyre explosions are examples of sudden pressure waves (explosion) not caused by ignition, but still destroy and kill.

Aggressive Releases

Products which are normally contained but, if released, could harm people or the environment.

Safety Examples:

- Poisonous
- Asphyxiant
- Acidic / Corrosive
- High / Low Temperature
- Chronic
- Pressure Release

Environmental Examples:

- Leakage
- Rupture
- Spillage
- Drainage
- Leachate
- Contamination

The harm may come from product characteristics (toxic, flammable, etc) or its condition (temperature, pressure, etc). Releases can travel through varying pathways (air,ground and/or in water).

Emissions

Substances that are not intended to be contained but, if contained, could harm people or the environment.

Examples:

- Product Radiation
- Heat Radiation
- Exhaust Fumes
- Noise
- Vibration
- Waste Streams

Often confused with aggressive releases, emissions can become a major hazard when they are constrained when they shouldn't be (car exhausts, battery charging gases) or when people or things are subjected to them for to long (radioactivity, sunshine, etc).

Natural Forces

Extreme natural hazardous events.

Examples:

- Excess Wet (eg. flood)
- Excess Dry (eg. drought)
- Extreme Winds (eg. cyclone)
- Seismic Activity
- Lightning
- Pestilence

Focussing on ‘extreme’ natural events where a death can be contributed directly to the event (eg. earthquakes, floods, typhoons, etc). As opposed to a hazardous event where nature has contributed, for example high winds toppling a crane during a difficult lifting operation.

Structural Upsets

Structural collapses.

Examples:

- Fixed Structure Failure
- Key Member Failure
- Formation Subsidence

The ‘structure’ could be steel, concrete or terra ferma (in the case of ground collapses and landslides).

Sometimes manmade causes are involved (failure to note corrosion, hitting a key member or structure with a vehicle, etc) and sometimes geology or bad weather can cause them.

Mechanical Upsets

When moving or constrained components suddenly become free projectiles.

Examples:

- Mechanical Handling Facilities
- Rotating and Reciprocating Equipment
- Construction Equipment

Relates to examples such as, broken propellers/fans, over speeding rotors, suddenly released tension devices.

Personnel getting their hand or hair caught in moving machinery is reserved for OHS attention rather than for major hazard assessment.

Electrical Upsets

Examples:

- High Voltage
- Low Voltage
- DC
- Static

Consider unusually high voltage or high current devices and devices that are not commonly encountered. Normal household/office electric shocks are more for OHS attention rather than for major hazard assessment.

Electrocution is commonly the consequence of the hazard, but may be used to capture events missed in Fires & Explosions, such as transformer explosion.

Security Failure

Where a security lapse poses a direct threat.

Examples:

- Terrorist / Theft
- Activist Group
- Public

Where a security lase poses a direct threat, like terrorism, extortion or armed robbery, we have a security hazard.

Security issues, like Natural Forces, are often causes. If trespassers kill themselves by falling (Dropped Object), inhaling poisonous gases (Aggressive Releases) or sinking into a stockpile (Structural Collapse), they should be listed elsewhere.

Flora, Fauna & Heritage

Humans under attack

Sometimes the local life forms pose a very significant threat to us. Some animals and plants are well capable of causing fatalities. We need to identify them.

Safety Examples:

- Water Aggressors (eg. crocodiles, sharks)
- Land Aggressors (eg. snake, spider)
- Diseases (Ross River virus)
- Poisons (eg. berries, thorns)