WHITEHAVEN COAL

LEVEL 2
QUALITATIVE RISK ASSESSMENT REPORT

Site Location	Narrabri
Activity/Situation	Subsidence LW101 to LW106
Date of Assessment	29/12/2015

1 INTRODUCTION

This Risk Assessment, finalised 29th December 2015, revises the existing assessment to include the risks associated with the mining of LW106 at the Narrabri Mine. On 7th February 2012, a risk assessment was conducted of the Subsidence hazards above LW101 to LW105 for the Narrabri Mine. The purpose of the risk assessment was to identify hazards and assess the risks associated with subsidence caused by the mining of LW101 to LW105.

2 CONTEXT

The Narrabri Mine is operated by Narrabri Coal Operations Pty Ltd (NCOPL) and is located in the Gunnedah coal basin in NSW, approximately 28km south of the town of Narrabri and approximately 400km northwest of the port of Newcastle.

One of the potential risks of longwall extraction at the mine is subsidence resulting from the mining process. The mine required a risk assessment to be carried out to assess the risks from subsidence to people, structures and services, mining operations and the environment.

This risk assessment identified and assessed the subsidence impact risks and consequences arising from longwall extraction and to identify controls to reduce the subsidence impacts and environmental consequences to an acceptable level. The risk assessment concentrated on LW101 to LW105 initially but has been revised to include LW106.

The objective of the risk assessment was to facilitate a structured process to enable critical and objective challenge of the subject, to assist NCOPL to fulfil their obligations to protect the health and safety of persons on the surface and underground and prevent damage to infrastructure and natural features in accordance with the requirements of the:

- Workplace Health and Safety Act 2011;
- Workplace Health and Safety Regulation 2011;
- Workplace Health and Safety (Mines) Act 2013; and
- Workplace Health and Safety (Mines) Regulation 2014.

The original risk assessment process aimed to involve relevant Narrabri Mine personnel, external technical specialists and a qualified, experienced facilitator. This risk assessment has been revised using relevant Narrabri Mine personnel and a facilitator. The risk assessment was undertaken in accordance with the Australian & New Zealand Standard for Risk Management AS/NZS ISO 31000:2009 and MDG1010 – Risk Management Handbook for the Mining Industry.

Assumptions

The following assumptions were made originally and have been updated to include LW106:

- Maximum predicted subsidence in report DGS NAR-002/1 and DGS NAR-002/2 are as follows:
  - S max: 2.69 – 2.75m
  - Tilts: 38 – 71mm/m
  - Strains: Max Compressive – 11 – 33mm/m
  - Max Tensile – 11 – 33mm/m
- Panel width: 306.5m (supercritical)

- Risk assessment assumes worst case subsidence with no spanning of the Garrawilla volcanics
- 160-240m depth of cover
- 4.3m mining height Hoskissons Seam
- No far field subsidence impacts assumed
- Great Artesian Basin is outside the area of influence of LW101 to LW106
- Predicted water make 3.85Ml/day - 5.2Ml/day (worst case)
- Land predicted to be impacted by LW101 to LW106 is owned by the Mine except for Greylands Rd
- Public access is along Greylands Rd
- Land owned by mine is leased back to farmers who use it for agricultural activities
- Pine Creek and Pine Creek Tributary 1 pass over impact area for LW101 to LW106
- Creeks are not a water supply for the local community
- Steep slopes are defined as being a slope at an angle greater than 18º (approximately 1 in 3)

Review of Subsidence Predictions v. Measured Data

The DGS (2015) report outlines the following:

- The review of measured First Maximum Subsidence above LW101 to LW102 full centrelines indicates that the 95th percentile S_{max} along centreline for LW101 was 0.6T or 2.52 m, and 0.63T or 2.65 m for LW102 (for a mining height of 4.2m);
- The 95% UCL values of 0.63T are considered to be reasonable estimates for the partial centreline profiles for the start and finishing ends of LW103 and start end of LW104, as first goafing subsidence is usually higher than the rest of the panel once the goafing process has been established;
- The subsidence prediction model (DgS modified ACARP, 2003) used in the approved LW101-LW105 EP estimated a maximum subsidence of 2.44 m or 0.58T. Although the predicted values for LW101 to LW104 have been within 15% of the measured results, the model has now been adjusted to match to reflect the actual 95% UCLs for subsequent panels as follows:
    - Single Panel S_{max}/T increased from 0.58 to 0.60 for LW101 and 0.63 from LW102 to LW106 (see Figures 3a,b);
    - Final maximum panel S_{max}/T has been increased to 0.64 for LW101 to LW106;
- The chain pillar subsidence model appears to be conservative, with measured values to-date plotting below the mean curve;
- The empirical models used to estimate maximum tilt, curvature and strain have been reviewed, points of note include:
    - The maximum tilt database is satisfactorily captured by the empirical model;
    - Convex and concave curvature models now also capture 95% of the database with 95% UCL Curvature = 2.5 x Mean Curvature;
    - The Maximum Horizontal Strain = 10 x Maximum Curvature. Discontinuous movements such as cracking and compression humping may increase the

maximum values by 2 to 4 times. The 95% UCL Strain value has been assessed to be approximately 25 x mean curvature or 10 x U95%CL Curvature;

- o Supercritical width appears to occur at 1.2H instead of 1.4H, based on measured tilts, curvatures and strains to-date; and

- Direct hydraulic connection to the surface, due to sub-surface fracturing above the panels, is considered unlikely to occur where cover depths are > 160 m and this has not been recorded to date at the mine.

Limitations and Exclusions

The following limitations were applied to the original risk assessment and have been adopted for the LW106 revision:

- This risk assessment will concentrate on LW101 to LW106 only
- Water liberated by longwall mining will not be considered once it has been pumped out of the mine and discharged into surface storage ponds
- This risk assessment is undertaken based on subsidence predictions and measured values above LW101 to LW104

The following exclusion was applied to this risk assessment:

- Disposal of brine rich waters into LW101 to LW106 goaves will not be considered

3 HAZARD IDENTIFICATION

To successfully identify the hazards involved with subsidence impacts above LW101 to LW106 the following hazard identification techniques were adopted:

Hazard Identification Techniques		
Reviewing historical data including • inspections, surveys and audits • workplace observations and • incident report data	☑	
Reviewing information from equipment designers, manufacturers, suppliers and other parties	☑	
Brainstorming	☑	
Other *[Click here to specify]*	☐	
Scientific or historical data that identifies and/or quantifies the level of the hazard present in the work place is attached?	YES	NO

Using the above hazard identification techniques the subsidence impacts above LW101 to LW106 requirements were broken into the logical task and activity components and consideration was given to a series of hazard/ energy sources to determine if a risk existed.

Factors that were considered are outlined in Attachment 2 Hazard Prompts.

4 CONSULTATION AND COMMUNICATION

Original Risk Assessment (LW101 to LW105) – 7th February 2012

Person Contributing	Organisational Role	Experience relating to assessing the Activity	Role in Risk Assessment
1. Shane Pegg	Technical Services Manager	14	Participant
2. Emma Garraway	Environmental Engineer	9	Participant
3. Steve Ditton	Subsidence Engineer	22	Participant
4. Stephen Denner	Hydrogeologist	11	Participant
5. Richard Holland	Mining Engineer	30	Participant
6. Saul Martinez	Civil/Water Engineer	18	Participant
7. Steve Farrar	Environmental Officer	3	Participant
8. Amanda Kerr	Environmental Engineer	12	Participant
9. Peter Foster	Senior Consultant	35	Facilitator
10. Jarrod Smith	Consultant	5	Assistant

Revision to include LW106 – 29th December 2015

Person Contributing	Organisational Role	Experience relating to assessing the Activity	Role in Risk Assessment
1. Steve Farrar	Environmental Superintendent	12	Participant
2. Owen Salisbury	Technical Services Manager	34	Participant
3. Dave Ellwood	Technical Services Superintendent	9	Participant

5 LEVEL 2 QUALITATIVE RISK ASSESSMENT WORKSHEET

Task Step/ Activity (What are we about to do?)	Hazard (What could hurt me or others?)	Existing Controls (What has been done to prevent it from happening?)	Current Risk			Additional Controls (What else can I do to prevent it from going wrong?)	Residual Risk		
			C	L	R		C	L	R
1. Subsidence Impacts to Natural Features									
Natural Water Courses / Streams	Water quality (TSS and EC increased) is impacted by subsidence in Namoi River tributaries	1. Monitoring and repairing of cracks planned to be carried out - included in Land Management Plan 2. Ongoing monitoring of water quality upstream and downstream of site included in Water MP 3. Use agriculture methods to reduce salinity of ponded areas 4. Water quality monitoring undertaken	2	D	L	1. Develop and implement Gully Erosion Management Plan 2. Develop and implement Ponding Management Plan			
Natural Water Courses / Streams	Channel stability is compromised leading to increased erosion and channel realignment	1. Monitoring and repairing of cracks carried out - included in Land Management Plan which includes TARP 2. Ongoing monitoring of water quality upstream and downstream of site included in Water MP 3. Riparian subsidence monitoring line installed for Tributary 1 and Pine Creek 4. LIDAR survey used across all panels 5. Subsidence monitoring lines installed along creeks	3	D	M	1.Develop and implement Gully Erosion Management Plan	2	D	L
Natural Water Courses / Streams	In channel / over bank ponding leading to loss of farming land and / or loss of riparian vegetation	1. Monitoring and assessment of ponding carried out - included in Land Management Plan and Biodiversity MP 2. Riparian subsidence monitoring line installed for Tributary 1 and Pine Creek 3. LIDAR survey and remote sensing techniques used over extraction area	2	D	L	1. Develop and implement Ponding Management Plan			

WHC_FRM_LEVEL 2 QUALITATIVE RISK ASSESSMENT

Task Step/ Activity (What are we about to do?)	Hazard (What could hurt me or others?)	Existing Controls (What has been done to prevent it from happening?)	Current Risk			Additional Controls (What else can I do to prevent it from going wrong?)	Residual Risk		
			C	L	R		C	L	R
Natural Water Courses / Streams	Reduction in stream flow during rain events	1. No interconnection between surface and seam due to depth of cover and height of fracturing 2. Monitoring and repairing of cracking carried out - included in Land Management Plan 3. Monitoring of height of fracturing using surface extensometers and piezometers	3	D	M				
Natural Water Courses / Streams	Flooding of mine leading to stoppage of LW mining	1. No interconnection between surface and seam due to depth of cover and height of fracturing 2. Mine dewatering system 3. Monitoring of water quantities being pumped out of mine 4. Monitoring of height of fracturing using surface extensometers and piezometers 5. Monitoring and repairing of cracking planned to be carried out - included in Land Management Plan 6. Inrush MP	3	E	M				
Creek or River Catchments	Water quality (TSS and EC increased) in the Namoi River is impacted by subsidence	1. Monitoring and repairing of cracks carried out - included in Land Management Plan 2. Ongoing monitoring of water quality upstream and downstream of site included in Water MP	1	D	L				
Swamps & Water-related Ecosystems	No swamps or water related ecosystems will be impacted by subsidence in Longwalls 1 to 6 area								
Foreshores / Land Prone to	Change in flooding	1. Flood study was conducted	1	E	L				

WHC_FRM_LEVEL 2 QUALITATIVE RISK ASSESSMENT

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			C	L	R		C	L	R
Flooding or Inundation	behaviour impacting farming land, mine infrastructure or surface improvements along Pine Creek and its tributary	revealing limited impacts of flooding 2. Monitoring and assessment of ponding carried out - included in Land Management Plan and Biodiversity MP 3. Riparian subsidence monitoring line installed for Tributary 1 and Pine Creek 4. LIDAR survey and remote sensing techniques used over extraction area							
Escarpments / Cliff Lines / Steep Slopes	No Escarpments / Cliff Lines / Steep Slopes will be impacted by Longwalls 1 to 6 subsidence								
Threatened & Protected Species including Endangered Ecological Communities (EEC)	Potential loss of individuals of species or degradation of EEC and habitat	1. Ongoing monitoring and condition assessment under Biodiversity MP and Landscape MP 2. No steep slopes in Longwalls 1 to 6 area 3. Well established vegetation 4. No interconnection between surface and seam due to depth of cover and height of fracturing 5. Monitoring and repairing of cracks carried out - included in Land Management Plan 6. Depth of cover is increasing	2	D	L				
State Forests / Natural Vegetation	No state forests in Longwalls 1 to 6 area								
Native fauna	Injuries to native fauna	1. Monitoring and repairing of cracks carried out - included in Land Management Plan	1	D	L				
Native fauna	Loss of habitat	1. Ongoing monitoring and condition assessment under Biodiversity MP and Landscape MP	1	D	L				

Task Step/ Activity (What are we about to do?)	Hazard (What could hurt me or others?)	Existing Controls (What has been done to prevent it from happening?)	Current Risk			Additional Controls (What else can I do to prevent it from going wrong?)	Residual Risk		
			C	L	R		C	L	R
		2. No steep slopes in LW1-6 area 3. Well established vegetation 4. No interconnection between surface and seam due to depth of cover and height of fracturing 5. Monitoring and repairing of cracks carried out - included in Land Management Plan 6.Increasing depth of cover							
2. Subsidence Impacts to Surface Improvements									
Tracks / Roads / Bridges	Damage to machinery	1. Monitoring of cracks and remediation 2. Warning signage erected in subsidence area 3. Communication with landholders 4. Greylands Road closed to the public. Purchase of road progressing and should be finalised 2016 5. Daily inspections during active subsidence of Greylands Road, remediated as required	2	D	L				
Tracks / Roads / Bridges	Injury to personnel	1. Monitoring of cracks and remediation 2. Warning signage erected in subsidence area 3. Communication with landholders 4. Greylands Road closed to the public. Purchase of road progressing and should be finalised 2016 5. Daily inspections during active subsidence of Greylands Road,	2	D	L				

Task Step/ Activity (What are we about to do?)	Hazard (What could hurt me or others?)	Existing Controls (What has been done to prevent it from happening?)	Current Risk			Additional Controls (What else can I do to prevent it from going wrong?)	Residual Risk		
			C	L	R		C	L	R
		remediated as required							
Transmission lines	Interruption to supply	1. Narrabri owns the two properties that are fed by the power line with no tenants 2. Consultation with Essential Energy 3. Built Features MP contains a requirement for a pre and post survey of power lines 4. Power line disconnected	1	E	L	1. Power line planned to be removed 2016			
Transmission lines	Person receives electric shock	1. Consultation with Essential Energy 2. Public Safety MP includes visual inspections 3. Built Features MP contains a requirement for a pre and post survey of power lines 4. Power line disconnected 5. Sheaves and rollers installed	1	E	L	1. Power line planned to be removed 2016			
Transmission lines	Grass fires leading to property damage	1. Consultation with Essential Energy 2. Public Safety MP includes visual inspections 3. Built Features MP contains a requirement for a pre and post survey of power lines 4. Electrical protection on transmission lines 5. Easement cleared of trees 6. Mine Fire fighting capability including water truck with cannon 7. Rural Fire Service 8. Power line disconnected	1	E	L	1. Power line planned to be removed 2016			

Task Step/ Activity (What are we about to do?)	Hazard (What could hurt me or others?)	Existing Controls (What has been done to prevent it from happening?)	Current Risk			Additional Controls (What else can I do to prevent it from going wrong?)	Residual Risk		
			C	L	R		C	L	R
		9. Sheaves and rollers installed							
Transmission lines	Damage to poles, wires and conductors	1. Consultation with Essential Energy 2. Public Safety MP includes visual inspections 3. Built Features MP contains a requirement for a pre and post survey of power lines 4. Sheaves and rollers installed	3	D	M	1. Power line planned to be removed 2016			
Pipelines	No hazard identified to gas drainage pipelines from subsidence No other pipelines in this area								
Mine Infrastructure	Damage to goaf gas drainage boreholes	1. Steel cased boreholes 2. Flexible connection from borehole top to gas drainage surface pipeline 3. Goaf drainage plant can be located outside active subsidence area or with has the ability to be re-levelled if within active subsidence area	4	E	M				
Mine Infrastructure	Damage to PED cable buried on surface	1. PED cable is largely located outside LW panel area 2. PED cable has sufficient slack to accommodate subsidence when undermining LW105	2	D	L				
Mine Infrastructure	Far field impacts on mine buildings not considered a credible risk								
Survey Control Stations	No survey control stations will be undermined by Longwalls 1 to 6								

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Task Step/ Activity (What are we about to do?)	Hazard (What could hurt me or others?)	Existing Controls (What has been done to prevent it from happening?)	Current Risk			Additional Controls (What else can I do to prevent it from going wrong?)	Residual Risk		
			C	L	R		C	L	R
Public Facilities / Amenity / Users	No Public Facilities / Amenity / Users will be undermined by Longwalls 1 to 6								
Environmental Monitoring Stations	Damage to piezometers	1. Life-of-mine groundwater monitoring network installed outside of LW mining area 2. Replace piezometers as required	1	E	L				
Drainage structures	Flooding and erosion of road	1. Monitoring and repairing drains as required 2. Visual inspection of roads and carrying out repairs as required 3. Signage	2	D	L				
Drainage structures	Injury to personnel due to flooding and erosion of road	1. Monitoring and repairing drains as required 2. Visual inspection of roads and carrying out repairs as required 3. Signage	3	D	M				
Farm Houses / Sheds	Damage to farm house and sheds resulting in injury to person	1. House/shed are vacated 2. Mine owns house 3. Dilapidation survey 4. Remediation if cost effective and practical 5. Built Features MP 6. Public Safety MP requires property to be secured for safety prior to subsidence 7. Mine recognises house will be damaged and is planning for the house to be demolished following subsidence	1	E	L	1. Ensure house/shed are secured prior to impact with subsidence to prevent access			
Farm Houses / Sheds	Damage to septic tanks from subsidence resulting in	1. Septic tank at “Barton Hedge” drained	2	D	L				

Task Step/ Activity (What are we about to do?)	Hazard (What could hurt me or others?)	Existing Controls (What has been done to prevent it from happening?)	Current Risk			Additional Controls (What else can I do to prevent it from going wrong?)	Residual Risk		
			C	L	R		C	L	R
	release of effluent								
Industrial / Commercial / Business Establishments	No Industrial / Commercial / Business Establishments impacted by Longwall 1 to 6 subsidence								
Prescribed Dams and / or other Dams Safety Act 1978 structures	No prescribed dams and / or other Dams Safety Act 1978 structures								
Other Surface Improvements	Breaching of farm dam walls resulting in personal injury	1. Monitor dams and drain / remediate as required 2. Low capacity dams 3. Earthen dams 4. Each dam is to be assessed as to need to lower water level in dam based on impacts to farm dams from previous LW subsidence	2	D	L				
Other Surface Improvements	Drainage of farm dams into mine workings resulting in flooding of mine	1. No interconnection between surface and seam due to cover depth and height of fracturing 2. Monitor dams and drain / remediate as required 3. Low capacity dams 4. Large depth of cover 5. Mine inflow monitoring through water being discharged from mine	2	E	L				
Other Surface Improvements	Breaching of water storage dam resulting in personal injury	1. Dam near ventilation shaft site and at “Rosevale”, i.e. the only significant dams, have been drained	2	E	L				
Other Surface Improvements	Drainage water storage dam into mine workings	1. No interconnection between surface and seam due to cover depth and	2	E	L				

Task Step/ Activity (What are we about to do?)	Hazard (What could hurt me or others?)	Existing Controls (What has been done to prevent it from happening?)	Current Risk			Additional Controls (What else can I do to prevent it from going wrong?)	Residual Risk		
			C	L	R		C	L	R
	resulting in flooding of mine	height of fracturing 2. Dam near ventilation shaft site and at “Rosevale”, i.e. the only significant dams, have been drained							
Other Surface Improvements	Damage to drainage contour banks	1. Pre and post mining survey and remediate as required	2	C	M				
Other Surface Improvements	Damage to fences releasing livestock and impacting with vehicles	1. Built Features MP requires destocking of paddocks in active subsidence zone and repair of fences post subsidence	2	E	L				
Telecommunications	Damage to Telstra copper cable	1. Cable is not in use	1	E	L				
Railway	Far field impacts to railway not expected								
3. Subsidence Impacts to Subsurface									
Groundwater Resources (Quantity & Quality)	Drawdown or base flow reduction in Namoi River alluvials	1. Life-of-mine groundwater monitoring program installed 2. Western edge of the Namoi alluvium to the eastern edge of the longwall panels is approximately 4.5 – 5km 3. Conservative groundwater prediction model predicted minimal influence 4. Periodic recalibration of groundwater model using observed data whilst longwall is being extracted 5. Significant barrier of low permeability strata between the Namoi River alluvium and the mine 6. Neither the Hoskissons Seam nor the other rocks of the Black Jack Group are directly in contact with the	3	E	M	1. Finalise monitoring requirements that have been agreed to by DPI - Water			

Task Step/ Activity (What are we about to do?)	Hazard (What could hurt me or others?)	Existing Controls (What has been done to prevent it from happening?)	Current Risk			Additional Controls (What else can I do to prevent it from going wrong?)	Residual Risk		
			C	L	R		C	L	R
		Namoi Valley alluvium in the project area.							
Groundwater Resources (Quantity & Quality)	Decreased volume of groundwater available for other users	1. Groundwater monitoring program 2 No interconnection between surface and seam due to cover depth and height of fracturing 3. Conservative groundwater prediction model predicted minimal influence 4. Periodic recalibration of groundwater model using observed data whilst longwall is being extracted 5. Groundwater take for the mine is licenced and periodically reviewed	2	C	M	1. Identify potential properties that could be impacted and develop a water monitoring program for wells			
Increased mine water discharge	Increased water make into the mine workings due to fracturing the aquifer above the goaf resulting in flooding of mine workings	1. Groundwater monitoring program 2. No interconnection between surface and seam due to cover depth and height of fracturing 3. Conservative groundwater prediction model predicted minimal influence 4. Periodic recalibration of groundwater model using observed data whilst longwall is being extracted 5. Appropriate capacity of surface water dams 6. Contingency for construction of additional storages 7. Inrush MP	4	D	M	1. Consider dewatering mine through boreholes if mine pumping system is inadequate to handle inflows			
4. Subsidence Impacts to Areas of Archaeological & Heritage Significance									
European heritage	No heritage sites identified								
Cultural heritage sites	Damaging, defacing or destruction of	1. Surveys completed and identified sites have been fenced	3	D	M				

Task Step/ Activity (What are we about to do?)	Hazard (What could hurt me or others?)	Existing Controls (What has been done to prevent it from happening?)	Current Risk			Additional Controls (What else can I do to prevent it from going wrong?)	Residual Risk		
			C	L	R		C	L	R
	archaeological sites	2. Cultural Heritage MP for site identifies grinding grooves are on sandstone floaters that have not been damaged by subsidence							
5. Subsidence Impacts to Agriculture									
Agricultural Suitability / Productivity	Reduction in agricultural capability of land	1. Land Management Plan with TARP includes ongoing monitoring and remediation - Remote sensing - Agriculture plots 2. Rehabilitation MP includes weed management	2	D	L				

No.	Action Required	Person Responsible	Due Date	Completion Date	Signature
1.	Develop and implement Gully Erosion Management Plan	SF	31/03/2016		
2.	Develop and implement Ponding Management Plan	SF	31/03/2016		
3.	Remove power line	CB	31/01/2016		
4.	Ensure house/shed are secured prior to impact with subsidence to prevent access	SF	31/01/2016		
5.	Finalise monitoring requirements that have been agreed to by DPI - Water	SF	30/06/2016		
6.	Identify potential properties that could be impacted and develop a water monitoring program for wells	SF	Ongoing		
7.	Consider dewatering mine through boreholes if mine pumping system is inadequate to handle inflows	OS	Ongoing		

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No.	Action Required	Person Responsible	Due Date	Completion Date	Signature

CONSENSUS MATTERS	Are there any matters where consensus has not been reached on the method to achieve acceptable level of risk?	YES	NO

Matter	Dissenting Person	Concern

SIGN-OFF on FINAL REPORT of RISK ASSESSMENT

Person Contributing	Signature	Date	Person Contributing	Signature	Date
1. Steve Farrar	Farrar	22/12/15	2. Owen Salisbury	O Salisbury	29/12/15
3. Dave Ellwood	D Ellwood	22/12/15.	4.		
5.			6.		
7.			8.		
9.			10.		

AUTHORISATION of RISK ASSESSMENT

Note: The Authoring person must be the Manager or a position higher in the organisational structure.

Risk Assessment Review and Authorised by	O SALISBURY	Signature	O Salisbury	Date	29/12/15

ATTACHMENT 1: RISK MATRIX

CONSEQUENCE

LIKELIHOOD		Insignificant 1	Minor 2	Medium 3	Major 4	Catastrophic 5
Almost Certain (once per day to one week)	A	Moderate	High	High	Critical	Critical
Likely (Once per week to one month)	B	Moderate	Moderate	High	High	Critical
Occasional (Once per month to one year)	C	Low	Moderate	High	High	High
Unlikely (Once in one to five years)	D	Low	Low	Moderate	Moderate	High
Rare (Once in five to ten years)	E	Low	Low	Moderate	Moderate	High

First Aid	Medical	LTI	Disability	Fatality	Injury
<$10K	$10K -<$100K	$100K -<$1M	$1M -<$10M	>$10M	Business Impact
Minor Non-Conformance	Minor Impact	Moderate Impact	Major Impact	Catastrophic Impact	Environment

Critical	Risks that significantly exceed the risk acceptance threshold. Immediate attention needed, stop the job.
High	Risks that exceed the risk acceptance threshold. Additional risk control measures required. If further risk control measures are not practicable the responsible Manager must sign off.
Moderate	Risk acceptance threshold. Additional control measures could be implemented to control risks further. Active monitoring of risk control measures required.
Low	Risks that are below the risk acceptance threshold. No additional control measures required. Monitoring of risks may be needed.

ATTACHMENT 2: HAZARD PROMPTS & DAMAGING ENERGIES

Hazard Prompts				
People	**Equipment**	**Environment**	**Process & Procedures**	**Permits**
• Awkward working posture? • Manual handling (lifting, lowering, pushing, pulling) • Electrical circuitry energised • Can the machine be accidentally started? • Can the machine roll? • Can I hurt someone? • Is anyone in the Line of Fire?	• Tapping into cooling systems? • Breaking hydraulic lines or components? • Set off fire suppression system? • Using lifting slings or cranes? • Jacking machine up? • Stored energy sources (air, hydraulic etc)?	• Hazardous chemicals? • Rotating components nearby? • Operator assistance required? • Noise, Compressed air? • Task performed alone in a remote area (eg. in the field)? • Follow MSDS? • Chance of spills or pollution?	• Using electrical equipment? • People working below? • Falling objects? • Exposure to exhaust fumes / gases? • Working at heights? • Working near hot surfaces (eg. turbo or exhaust)? • Have I done this in the last 3mths?	• Hot work (welding, grinding, oxy cutting, brazing)? • Live work task? • Confined space entry? • Working at Height? • Digging or drilling?
Damaging Energies				
Human	**Machine**	**Gravitational**	**Object**	**Thermal**
• Heavy pushing and pulling which requires large effort or poor/difficult postures; • Repetitive tasks involving the same muscle groups; • Lifting heavy objects.	• A vehicle crashing into another vehicle (including cars, forklifts, loaders, trucks, mobile cranes etc). • A vehicle hitting a person. • Exposure to ongoing vibration – jolts. • A vehicle hitting some fixed object ie building, face wall etc. • Getting caught by or in or struck by a part of a fixed machine or moving machinery ie conveyor, hand held power tool.	• Fall from a high level ie ladder, scaffold, pipe, duct, mobile crane platform. • Slips, trips, overbalancing on slippery and uneven surfaces ie walkways, platforms, outside yards, underground tunnels. • Climbing “up” or “down” steps, stairs, ladders ie accessing vehicles, large gearboxes, conveyors. • Hit by falling rocks, tools, objects etc.	• Inadvertent release of stored energy from such things as accumulators in pneumatic or hydraulic systems. • Some object on the road being flipped into a pedestrian as a vehicle passes. • A shackle breaking under load and flying through the air and striking a person. • A fan disintegrating on a motor and pieces of fan flying through the air and striking a person.	• Coming into contact with hot material (solid, liquid or gas) • Fires or explosions.
Electrical	**Chemical**	**Noise**	**Biological**	**Radiation**
• Electric shock or burns.	• Breathing in or coming into contact with dangerous chemicals (acids, corrosives etc)	• Exposure to noise levels in excess of 85 dBA.	• Risk of infections, animal bites • Entering enclosed spaces that are oxygen deficient or contaminated	• Exposure to dangerous radiation.