

# Mines Rescue Pty Ltd

## RISK MINIMISATION FOR MINES RESCUE TEAMS

**Mining Context**

**International Experiences**

**Mines Rescue Guidelines**

**Mines Rescue “Deployment Risk Assessment”**



# Underground Mining Environment



Photo Courtesy  
of DBT Australia

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# Underground Mining Environment



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# Mines Rescue exposure

## In Emergencies:

**Australia  
(Queensland)**

**31/7/72**

**Deployment:**

Situation control – sealing operations

**Outcome:**

**17 fatalities**, including a rescue team

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# Mines Rescue exposure

## In Exploration work:

<b>Germany</b>	13/9/1980
<b>Deployment:</b>	exploration, incline of 450m length
<b>Outcome:</b>	1 fatality

<b>Poland</b>	24/2/1998
<b>Deployment:</b>	exploration, incline of 750m length,
<b>Outcome:</b>	6 fatalities

<b>United States</b>	17/10/2002 (Storm Decline)
<b>Deployment:</b>	exploration, decline of 650m length
<b>Outcome:</b>	2 fatalities



# Storm Decline: Lessons learnt

**Of the three causal factors the first was:**

**“The risk assessment process, conducted by management, prior to sending the mine rescue team to conduct an exploration of the inactive Storm Decline was inadequate.”**

**“Procedures were not established to address all hazards affecting the safety of the rescue team members while performing this task.”**

# Storm Decline: Lessons learnt

## Corrective Action:

“A plan should be developed to establish exploration procedures.

- The plan should address the specific tasks each team is to complete.
- The procedures should include actions that must be initiated by the team to ensure their safety and limit the distance they can explore.”



# Mines Rescue NSW

Since 1999 the NSW Mines Rescue Service has had in place **Emergency Preparedness and Mines Rescue Guidelines** (developed from consultation with industry and rescue experts with due consideration to rescue protocols, incidents and experience):

- **Risk Factors**

Limit exposure to flammable gas

- **Deployment Operating Procedures**

Manning, resources, distance that may be travelled

- **Limitations**

Toxicity, Oxygen Deficiency, Smoke & Fire, Heat & Humidity, Visibility, Gas analysis,

- **Roles and Responsibilities**

Employees, rescue team/captain/member

# Emergency Preparedness Guidelines

The lessons from the Storm Decline incident teach us that guidelines are not always sufficient or situation specific.

To overcome this deficiency a Documented Risk Assessment Performa was designed, implemented and introduced into the Mines Rescue Service in 2004.



# Risk Assessment System

Is a system specifically designed to address hazards and risks pertinent to:

**Each Individual Mines Rescue Deployment.**

- Risk Assessment pro-forma
- Briefing protocol for Rescue Teams
- A management tool for the Active Team

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# Risk Assessment Example

## TEAM DEPLOYMENT RISK ASSESSMENT

Date: **June 27, 2007**

Location: **Wylie Mine, Green Panel,**

**TASK:** Report to FAB, located 2 line Main Headings  
Breach stopping at 1 line Green Panel, C to D headings  
Take atmospheric readings, and bag samples at 1, 2, 3 line – C hdg

**Risk Assessment done by (IMT):**

**Risk Assessment reviewed by (active team):**

**Fred Smith – Mine manager  
Joe Black – Local Check Inspector  
John Smith – Ventilation Officer  
Ken Gale – Mines Inspector  
Dave Shore – Mines Rescue Manager**

**Red Team: Fred Sale (captain),  
John Kole  
Mark Sands  
Fred Banks  
Steve Platt  
Joe Sands**

HAZARD	RISK	CONTROLS												
Methane	Fire  Explosion  Asphyxiation	<p>Known concentrations from gas monitoring are:  <i>0.1 % at FAB</i>  <i>1.5 % in Green Panel</i></p> <p>Gas trending indicates:  <i>No change in last 24 hours, no change expected in next 24 hours</i></p> <p>Source of methane is</p> <table border="0"> <tr> <td><input checked="" type="checkbox"/> general body</td> <td><input type="checkbox"/> blowers</td> <td><input type="checkbox"/> drainage system</td> </tr> <tr> <td><input type="checkbox"/> goaf areas</td> <td><input type="checkbox"/> fire gases</td> <td><input type="checkbox"/> vent. changes</td> </tr> </table> <p>Barometer</p> <table border="0"> <tr> <td><input type="checkbox"/> steady</td> <td><input checked="" type="checkbox"/> rising</td> <td><input type="checkbox"/> dropping</td> </tr> </table> <p>Enter under the following risk category guideline:</p> <table border="0"> <tr> <td><input type="checkbox"/> Category 3 ( &lt; 40% LEL)</td> <td><input checked="" type="checkbox"/> Category 2 ( &lt; 60% LEL) ( &gt; 160% UEL)</td> <td><input type="checkbox"/> Category 1 ( &lt; 80% LEL) ( &gt; 140% UEL)</td> </tr> </table> <p><input type="checkbox"/> Nomex Clothing is required</p> <p><input checked="" type="checkbox"/> Team equipped with an electronic detector</p> <p>Atmospheric monitoring is required:</p> <p><i>X Whenever the environment changes</i>  <i>X Upon Entry of green panel</i>  <i>X At 1, 2, and 3 cut throughs</i></p> <p>Entry Limitation: <i>Methane levels above risk category</i></p>	<input checked="" type="checkbox"/> general body	<input type="checkbox"/> blowers	<input type="checkbox"/> drainage system	<input type="checkbox"/> goaf areas	<input type="checkbox"/> fire gases	<input type="checkbox"/> vent. changes	<input type="checkbox"/> steady	<input checked="" type="checkbox"/> rising	<input type="checkbox"/> dropping	<input type="checkbox"/> Category 3 ( < 40% LEL)	<input checked="" type="checkbox"/> Category 2 ( < 60% LEL) ( > 160% UEL)	<input type="checkbox"/> Category 1 ( < 80% LEL) ( > 140% UEL)
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HAZARD	RISK	CONTROLS
Ignition source	Materials/actions introduced into the environment causing an explosion	<p><b>Underground power status</b> Power is <input type="checkbox"/> off <input checked="" type="checkbox"/> on</p> <p><b>Required anti-static and non – sparking:</b></p> <ul style="list-style-type: none"> <li><input type="checkbox"/> Clothing</li> <li><input type="checkbox"/> Tools</li> <li><input type="checkbox"/> Equipment – list below</li> </ul> <p><b>Entry Limitation: Active ignition source in the area team will enter if flammable gas is also present</b></p>

HAZARD	RISK	CONTROLS
Carbon Monoxide	Explosion  Asphyxiation	<input type="checkbox"/> Recirculation is possible <input checked="" type="checkbox"/> Team equipped with an electronic detector  <b>Atmospheric monitoring is required:</b> <b>X Whenever the environment changes</b> <b>X Upon Entry of green panel</b> <b>X At 1, 2, and 3 cut throughs</b>  Monitoring of breathing apparatus levels required every <b>20 minutes</b>  <b>Entry Limitation: Recirculation &amp; failure of Breathing apparatus</b>

HAZARD	RISK	CONTROLS
Carbon Dioxide  Oxygen	Asphyxiation  Low oxygen levels causing asphyxiation	<p><b>X</b> Is the team equipped with an electronic detector</p> <p><b>X</b> Is the team equipped with an electronic detector</p> <p><b>Atmospheric monitoring is required:</b></p> <ul style="list-style-type: none"> <li><b>X</b> <i>Whenever the environment changes</i></li> <li><b>X</b> <i>Upon Entry of green panel</i></li> <li><b>X</b> <i>At 1, 2, and 3 cut throughs</i></li> </ul> <p><i>Monitoring of breathing apparatus levels required every 20 minutes</i></p> <p><b>Entry Limitation: Failure of Breathing apparatus</b></p>

HAZARD	RISK	CONTROLS
Roof	Roof falls; <ul style="list-style-type: none"> <li>on brigades, or</li> <li>limiting withdrawal of team, or</li> <li>affecting communications with team</li> </ul>	<p><b>Areas of known poor roof that may affect team:</b></p> <p><b>Poor roof</b>  <i>1 C/T A heading</i></p> <p><b>Effect on team</b>  <i>Fall on – travel via C heading</i></p> <p><b>Areas of suspected poor roof that may affect team:</b></p> <p><b>Poor roof</b>  <i>2 C/T B hdg</i></p> <p><b>Effect on team</b>  <i>Minor slabbing may injure team carefully inspect and bar down prior to access</i></p> <p><b>Entry Limitation: Area prone to roof fall</b></p>
Ribs (sides)	Weak coal ribs falling on team members	<p><b>Areas of known poor rib that may affect team:</b></p> <p><b>Poor rib</b>  <i>A heading RHS</i>  <i>All cut throughs</i></p> <p><b>Effect on team</b>  <i>Fall on – keep to centre of roadway</i>  <i>Fall on &amp; trip hazards – keep to centre of roadway</i></p>


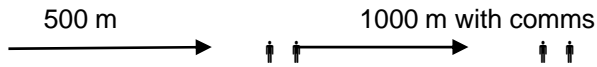
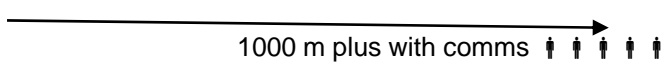


HAZARD	RISK	CONTROLS										
<p>Energy sources:</p> <ul style="list-style-type: none"><li>Compressed air</li><li>Compressed water</li></ul>	<p>Release of this could cause injury to team</p>	<p><b>Areas of known energy sources that may affect team:</b></p> <table border="1"><thead><tr><th>Energy source</th><th>Effect on team</th></tr></thead><tbody><tr><td colspan="2"><i>All pipe in the area ranges have been de-energised</i></td></tr><tr><td colspan="2">.....</td></tr><tr><td colspan="2">.....</td></tr><tr><td colspan="2">.....</td></tr></tbody></table>	Energy source	Effect on team	<i>All pipe in the area ranges have been de-energised</i>		.....		.....		.....	
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<p>Walking conditions</p>	<p>Conditions of travel may lead to slip/trip/falls</p>	<p><b>Areas of known casual water that may affect team:</b></p> <table border="1"><thead><tr><th>Area</th><th>Effect on team</th></tr></thead><tbody><tr><td><i>2 line A hdg</i></td><td><i>Negligible</i></td></tr><tr><td><i>3 line Ahdg</i></td><td><i>Knee deep &amp; muddy – avoid</i></td></tr></tbody></table> <p><b>Grade is:</b> <i>1:30 to West , no effect on team tasks</i></p> <p><b>Visibility is:</b> <i>normal</i></p> <p><b>Guidelines in area are:</b> <i>not present</i></p>	Area	Effect on team	<i>2 line A hdg</i>	<i>Negligible</i>	<i>3 line Ahdg</i>	<i>Knee deep &amp; muddy – avoid</i>				
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HAZARD	RISK	CONTROLS
Fire	Heat causing burns.  Fire fighting causing roof falls  (Effect of fire gases as per specific gases.)	Fire location : <b>No fire is active</b> Size of fire: ..... Length of time fire has been burning; ..... Likely ventilation changes/effects: ..... ..... ..... <b>Required Personal Protective Equipment</b> ..... ..... <b>Instructions relating to specific fire fighting strategy</b> ..... ..... ..... ..... ..... <b>Entry Limitation: Heat &amp; humidity of area</b>

HAZARD	RISK	CONTROLS
Heat & humidity	Team members suffering from heat illness	<p><b>Expected environmental conditions are:</b></p> <p>Heat: <b>27 to 30 degrees Celsius</b></p> <p>Humidity: <b>85 to 90 %</b></p> <p><b>Environmental monitoring is required:</b></p> <ul style="list-style-type: none"> <li><b>X Immediately entering I/B of Stopping</b></li> <li><b>X At a frequency dictated by conditions found</b></li> <li><b>X At a frequency not exceeding 10 minutes</b></li> </ul> <p><b>Entry Limitation: Heat and humidity of area - duration of exposure to be strictly monitored</b></p>

HAZARD	RISK	CONTROLS
Communication means	Loss of communication may lead to team being unaware of changing conditions and the requirement to evacuate	<p><b>Is a communication system required;</b>  <input checked="" type="checkbox"/> Yes      <input type="checkbox"/> No</p> <p><b>Equipment to be used</b>  <b>Taiheyo Radios</b></p> <p><b>Specific requirements</b>  <i>No 1, and 6 man wear radios</i>  <i>Aerial needs to be run out by team</i>  <i>Team never to be further than 20 from end of aerial</i></p> <p>Communication must be maintained at a frequency not less than every <b>15 Minutes</b></p> <p><b>Entry limitations as below</b></p>

	STAND BY TEAM	F.A.B.	ACTIVE TEAM
PROCEDURE 1		♣	
PROCEDURE 2	♣ ♣	♣ ♣	
<input checked="" type="checkbox"/> PROCEDURE 3	♣ ♣ ♣ ♣ ♣	♣ ♣	

HAZARD	RISK	CONTROLS
Brigade Team Members	Unfit, incompetent team members placing themselves and the team at physical risk	<p><b><i>Are there team members above 0.02 blood alcohol level?</i></b>  <input type="checkbox"/> Yes      <input checked="" type="checkbox"/> No</p> <p><b><i>Do any team members have symptoms of flu?</i></b>  <input type="checkbox"/> Yes      <input checked="" type="checkbox"/> No</p> <p><b><i>Do any team members have psychological symptoms that could impair their performance?</i></b>  <input type="checkbox"/> Yes      <input checked="" type="checkbox"/> No</p> <p><b><i>Have any team members have taken medication that could impair their performance?</i></b>  <input type="checkbox"/> Yes      <input checked="" type="checkbox"/> No</p> <p><b><i>Do any team members have facial hair exceeding permitted standards</i></b>  <input type="checkbox"/> Yes      <input checked="" type="checkbox"/> No</p> <p><b><i>Do any team members exceed guidelines regarding redeployment</i></b>  <input type="checkbox"/> Yes      <input checked="" type="checkbox"/> No</p> <p><b><i>Do any team members exceed hydration limits</i></b>  <input type="checkbox"/> Yes      <input checked="" type="checkbox"/> No</p>

HAZARD	RISK	CONTROLS										
Brigade Team Members	Unfit, incompetent team members placing themselves and the team at physical risk	<p><b>Are any team members not Breathing Apparatus current</b>  <input type="checkbox"/> Yes      <input checked="" type="checkbox"/> No</p> <p><b>Entry Limitation: A YES in any category above will exclude that team member from entry</b></p> <p><b>Do any team members need training in any aspect of the equipment required for this specific task</b>  <input checked="" type="checkbox"/> Yes      <input type="checkbox"/> No</p> <table border="0"> <thead> <tr> <th><i>Equipment/topic</i></th> <th><i>Specific requirements</i></th> </tr> </thead> <tbody> <tr> <td><b>Gas sampling procedures</b></td> <td><b>10 min refresher training</b></td> </tr> <tr> <td>.....</td> <td>.....</td> </tr> <tr> <td>.....</td> <td>.....</td> </tr> <tr> <td>.....</td> <td>.....</td> </tr> </tbody> </table>	<i>Equipment/topic</i>	<i>Specific requirements</i>	<b>Gas sampling procedures</b>	<b>10 min refresher training</b>	.....	.....	.....	.....	.....	.....
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.....	.....											
.....	.....											
.....	.....											

## **ADDITIONAL FACTORS THAT HAVE BEEN CONSIDERED**

***3 Transports will be used to get to Green Panel:***

- one by each active team***
- one by standby team***
- other will carry FAB manning and all ancillary equipment***

***Team will be supplied with gas sampling equipment at FAB***

***Drinking water available at FAB***

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# Captains "Management" tool

## Captains Record Card

- Records time and BA reading
- Re-emphasises understanding of team task
- Acknowledges review of Deployment Risk Assessment
- Records time and relative Heat & Humidity reading

**Mines Rescue Service**  
**Team Captains Record Card**

Team Capt: FRED SALE Team Colour: RED Date: 27-6-07

Departure Time: 9:00 am Designated Return Time: 12:00 am

Name	Suit No	Surf	FAB	Time of reading								
				9:05	9:30	9:50	10:10	10:30	10:50	11:10	11:25	END
1. FRED SALE	16	195	195	190	165	140	115	100	85	70	60	
2. JOHN KOLE	17	200	195	190	170	145	120	105	90	75	65	
3. MARK SANDS	18	195	195	185	165	145	120	105	85	70	55	
4. FRED BANKS	19	200	200	195	160	135	110	90	75	65	55	
5. STEVE PLATT	20	200	200	195	165	140	105	90	70	60	45	
6. JOE SANDS	22	195	190	185	165	145	115	100	85	80	65	
7.												
8.												

**Task Required**

Report to FAB  
 Breach stopping - 1 Line GREEN PANEL - C-D hdy's  
 At 1, 2 & 3 Line - C hdy - take atmospheric readings & Bag samples

Location	FAB Manning	Phone Numbers
FAB 2 Line Main hdy's	1. Joe Maffias (Main hdy)	FAB 4227
SB Team at FAB	2. Peter Ross (Comm)	IMT - Not established.

**Other Information:** FAB has all required equipment

Has team deployment risk assessment been reviewed by team:  Yes  No

Deployment Times For Brigadesmen Wearing BG 4																
Wet Bulb Temp °C	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41
Time Minutes	95	85	75	65	55	50	45	40	35	30	30	25	25	20	20	15

Location	Time	Temp	Max Exposure	Location	Time	Temp	Max Exposure
1 1 Line hdy	9:35	25°C	N/A	3 3Core hdy	10:30	29°C	65 minutes
2 2 Core hdy	9:58	25°C	N/A	4			

Captains Signature Fred Sale Date 27-6-07

# Risk Assessment System

## The system achieves the following:

- Ensures that all relevant information is assessed at Incident Management Team level, risks identified and suitable controls determined
- Ensures that brigades are presented all the relevant information in a clear concise way
- Ensures fit and competent brigades clearly understand their task

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# Conclusion

**This system allows the Mines Rescue Service to practically apply a risk management principle so that specific hazards and risks likely to affect Mines Rescue teams are systematically addressed by colliery and mines rescue experts each and every time a team is deployed**