



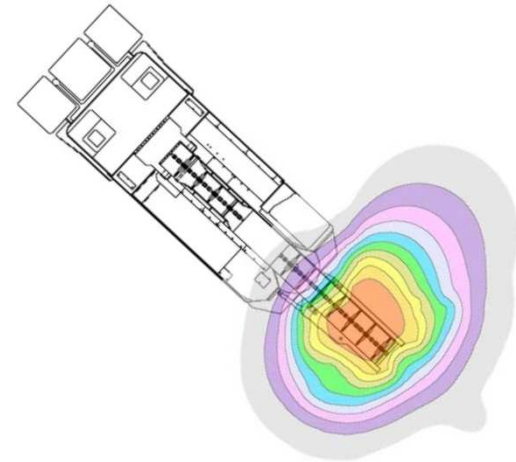
# PROXIMITY DETECTION SYSTEMS

Queensland underground coal mines - an update

Peter Herbert, Senior Inspector of Mines -Electrical

## OUTLINE

- Incident Statistics
- Controls
- Current status
- Technologies
- Way Forward



## A Legislation Proposal ?

US or AUSTRALIA?

- 1 All continuous miners, bolters and shuttle cars are to be fitted with a proximity detection system to prevent the crushing, jamming or striking of persons within the vicinity of the machine.
- 2 The machine will stop operation when a person is within one metre of any part the machine.
- 3 All new continuous miners, bolters and shuttle cars are to be fitted with a proximity detection system by 1 July 2013.
- 4 All existing continuous miners, bolters and shuttle cars are to be fitted with a proximity detection system at their first overhaul after 1 July 2013 but no later than 1 January 2016.



## OFFICE OF THE STATE CORONER

### FINDINGS OF INQUEST

CITATION: **Inquest into the death of Jason George Elliott BLEE**

TITLE OF COURT: Coroner's Court

JURISDICTION: Rockhampton

FILE NO(s): ROCK-COR- 42 / 2007

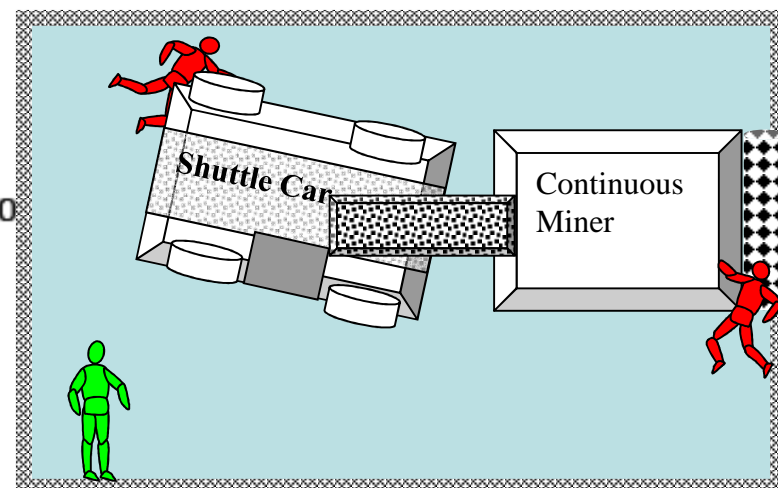
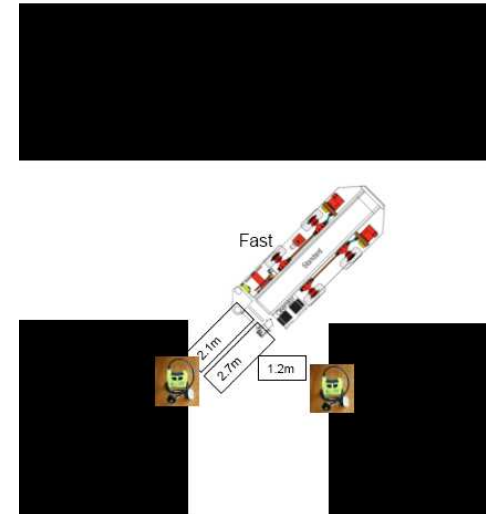
DELIVERED ON: 10 September 2009

DELIVERED AT: Mackay

HEARING DATE(s): 24/6/08-2/7/08, 8-12/9/08, 13 -17/10/08

FINDINGS OF: Ms Annette Hennessy, Coroner

9 April 2007 Easter Monday

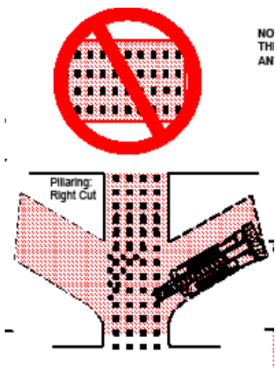


## NO GO ZONES

### ***Recommendation 4***

That underground coal mines review arrangements in relation to the **interaction between pedestrians and machinery** and, following a suitable risk assessment process, revise and to the extent necessary, **establish No Go and Restricted Zones to govern the interaction.**

Where this occurs, coal mine workers should be trained in them and they should be enforced. To assist, where appropriate, the No Go and Restricted Zones should be represented in pictorial form and made available in crib rooms and other such locations to act as a reminder for coal mine workers. **Ultimately, operators of mobile equipment must ensure that it is safe to move equipment before they do so.**

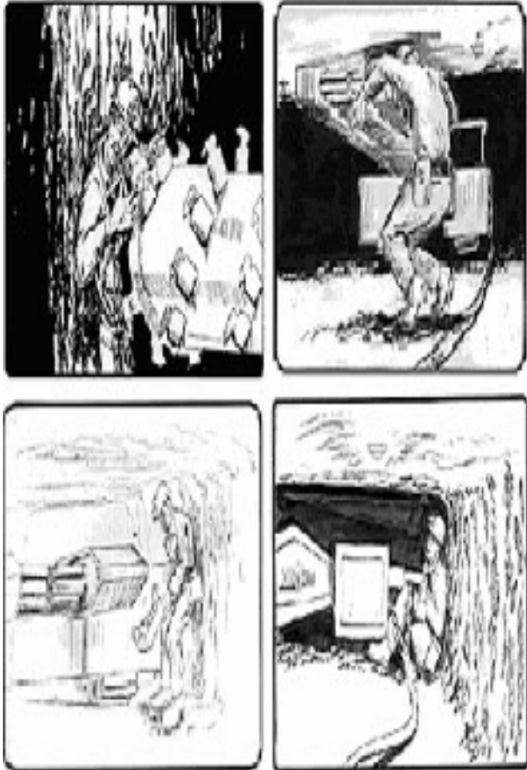




***Recommendation 7***

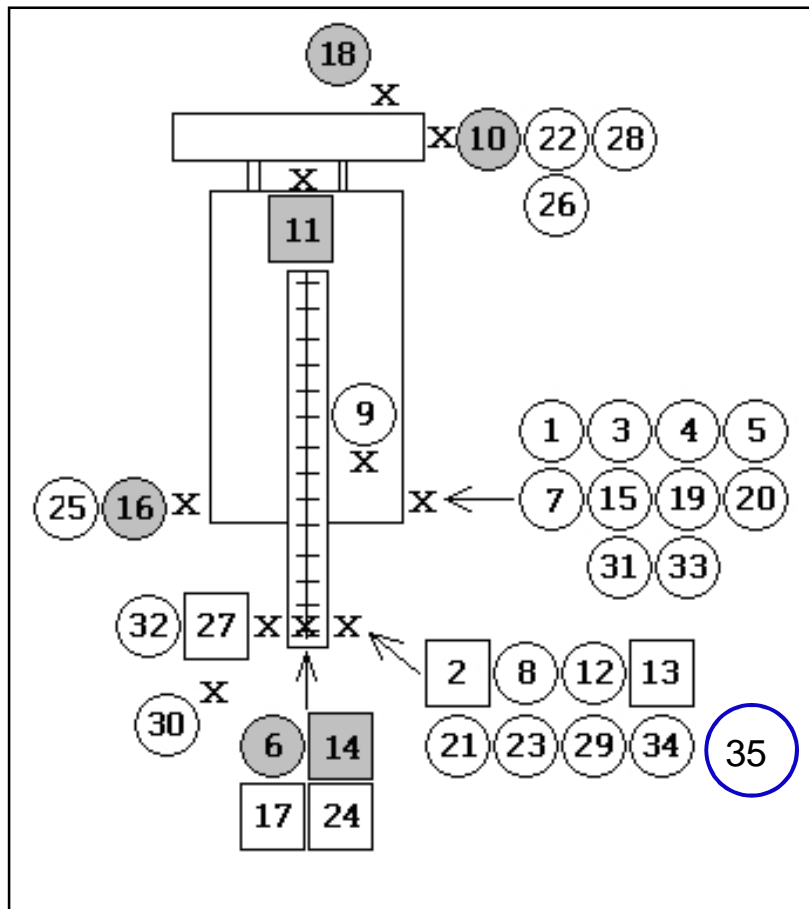
That coal mining operations and the Department (as the approval body) move quickly with manufacturers and other appropriate bodies to have developed, tested and **approved proximity detection devices** for use in underground coal mines to **detect the presence of pedestrians** in and around mobile equipment including shuttle cars.

**PROXIMITY  
DETECTION**





# US STATISTICS



Remote Controlled Continuous Mining Machine Fatal Accident Analysis Report Of Victim's Physical Location With Respect to the Machine Original Report Dated April 26, 2002 **Updated December 23, 2011** Prepared By: Chad Huntley, Electrical Engineer

"X" indicates general location of fatality.

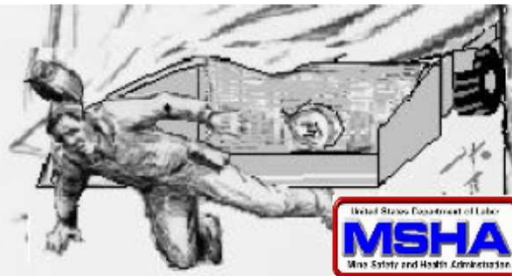
# TWO MINERS WERE KILLED IN FIVE DAYS



# PROXIMITY DETECTION SYSTEMS CAN PREVENT DEATHS!

On July 27, 2012, a midnight shift move crew member received crushing injuries when he was caught between the continuous mining machine (CM) conveyor boom and the right rib on the working section. The CM was being operated by the miner's supervisor and was being set up for production on the day shift when the accident occurred.

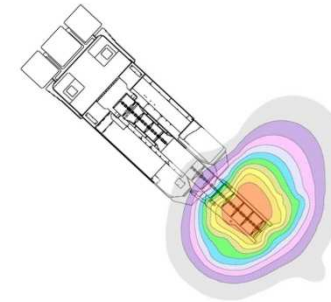
On July 31, 2012, a miner was crushed when he was struck by a battery-powered scoop. The miner was near a scoop at the battery charging station, when a second scoop struck the scoop beside the miner, causing it to slide into the miner.



### Best Practices

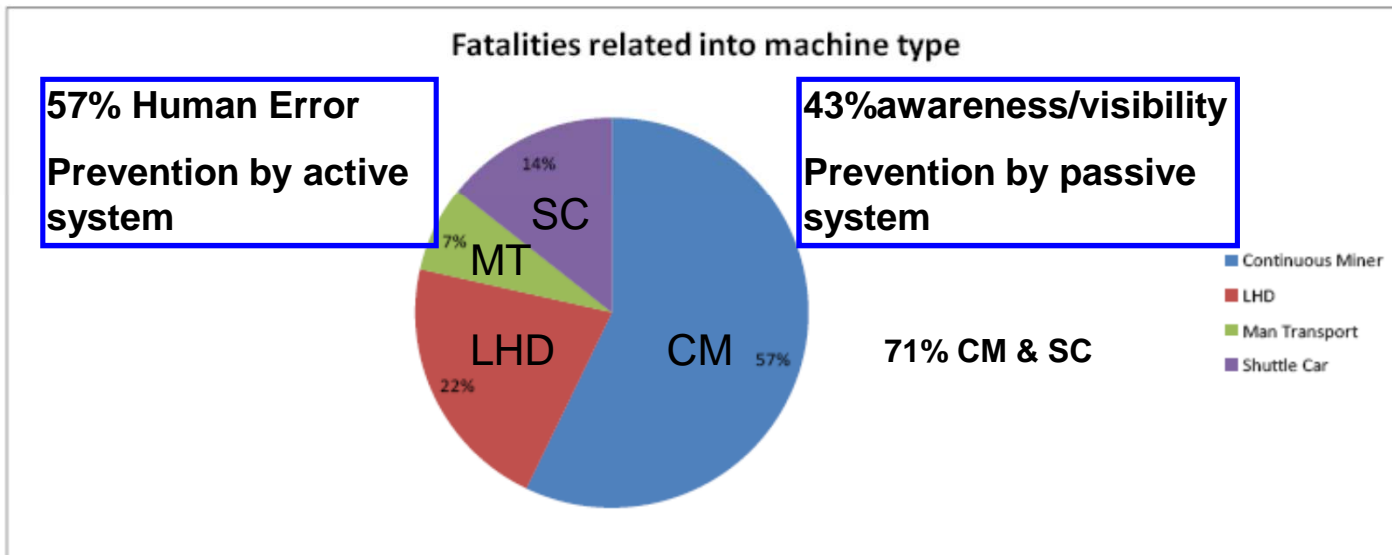
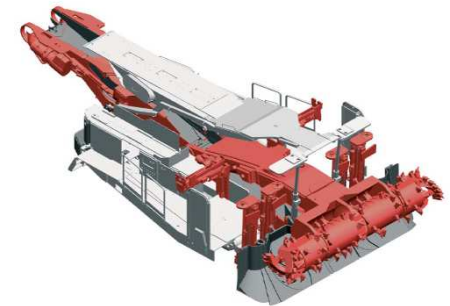
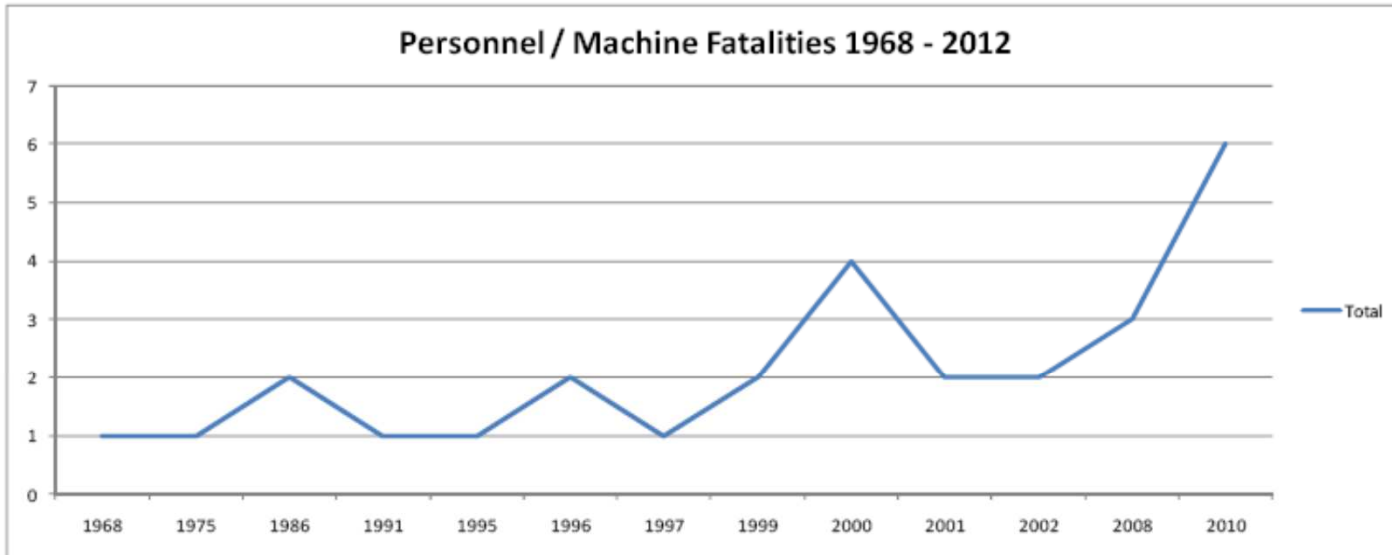
- Install Proximity Detection Systems on CMs and other face equipment. Find approved systems at [www.msha.gov](http://www.msha.gov).
- Avoid Red Zone areas. See diagram at [msha.gov](http://www.msha.gov).
- Use remote control units that have safeguards against accidental tram.
- Before tramping, ensure emergency stop and operational controls are functional.
- Ensure equipment is properly maintained and being operated safely, especially in low mining heights, and slippery and uneven floor conditions.
- See other MSHA Best Practices at:

<http://www.msha.gov/focuson/watchout/Hitby%20SHUTTLECARS.pdf>





# EQUIPMENT / PERSONNEL- AWARENESS RELATED FATALITIES



Data supplied by Sandvik

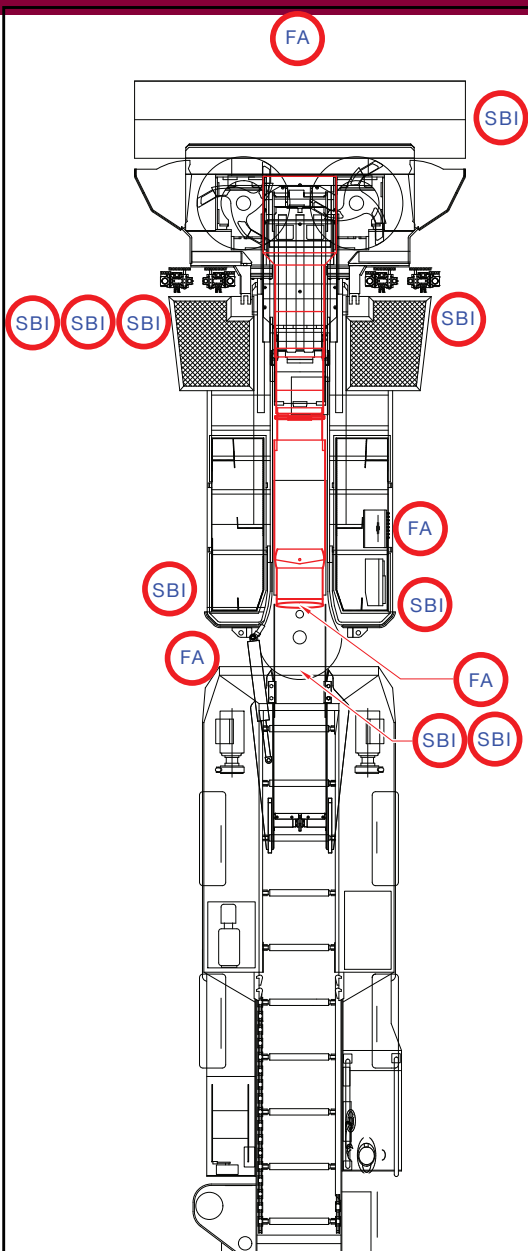


# AUSTRALIAN STATISTICS

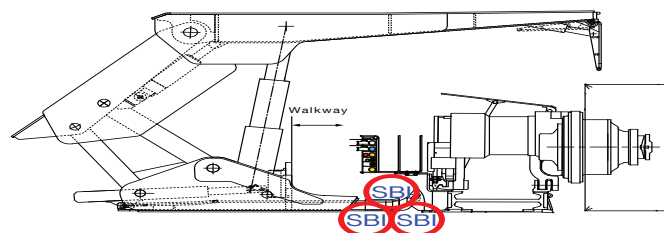
**DRAFT**

**Australian/New Zealand Standard**

Remote control systems for mining equipment  
 Part 3: Operational and maintenance for  
 underground coal mining  
 (To be AS/NZS 4240.3:2XXX)



Date	Type of injury	Details
09/04/2007	Fatality	An employee was fatally injured when he was crushed between the rib and the shuttle car. (Safety Alert SA 161)



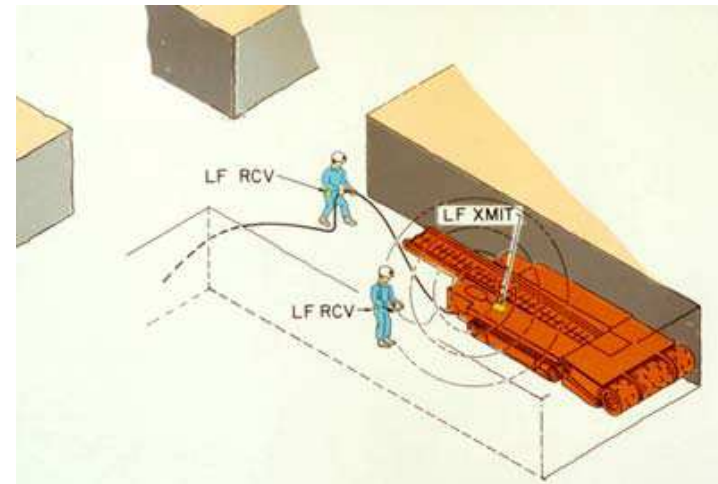


## CURRENT LEGISLATION (QLD)

### 6 Objects of Act

The objects of this Act are—

- (a) to protect the safety and health of persons at coal mines and persons who may be affected by coal mining operations; and
- (b) to require that the risk of injury or illness to any person resulting from coal mining operations be at an acceptable level; and

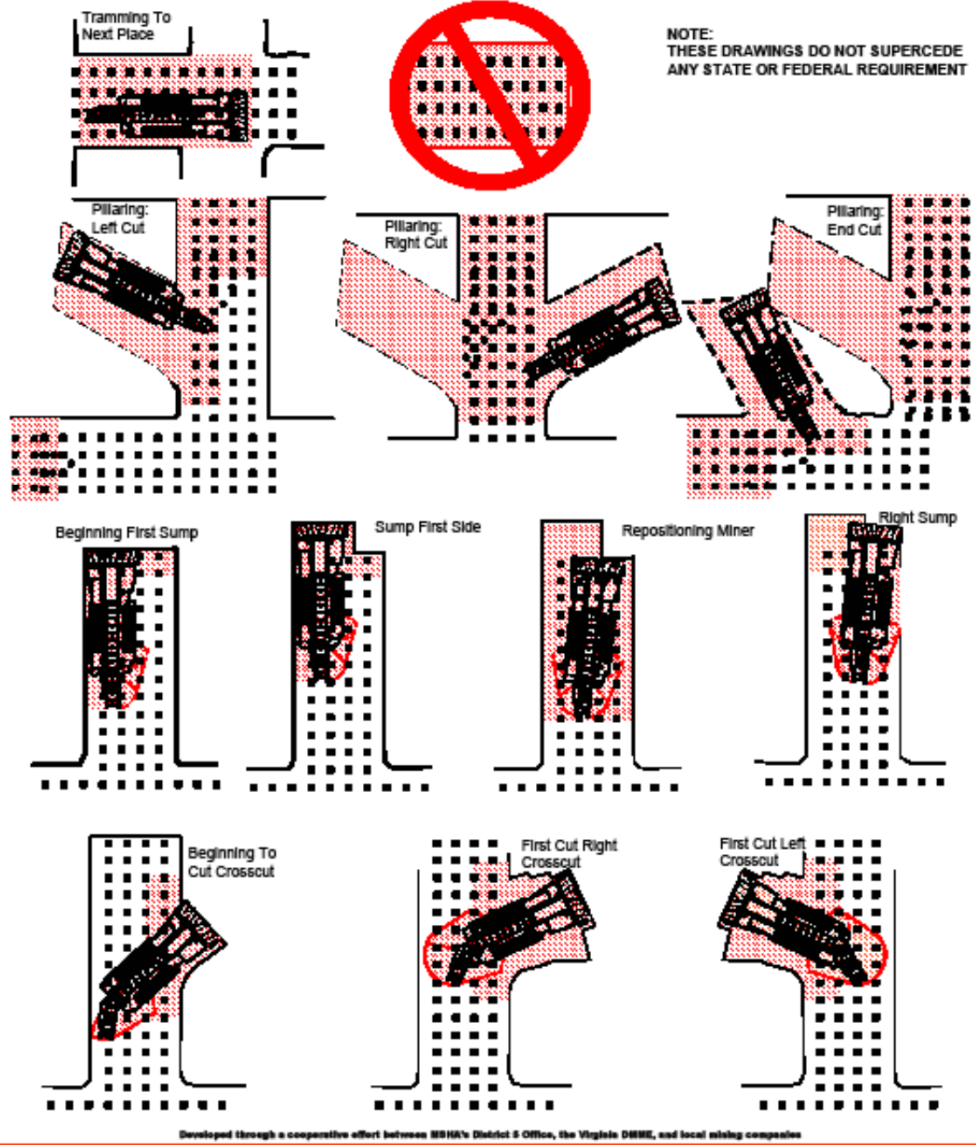


### 29 What is an acceptable level of risk

- (1) For risk to a person from coal mining operations to be at an **acceptable level**, the operations must be carried out so that the level of risk from the operations is—
  - (a) within acceptable limits; and
  - (b) as low as **reasonably achievable**.

# RED ZONES ARE NO ZONES

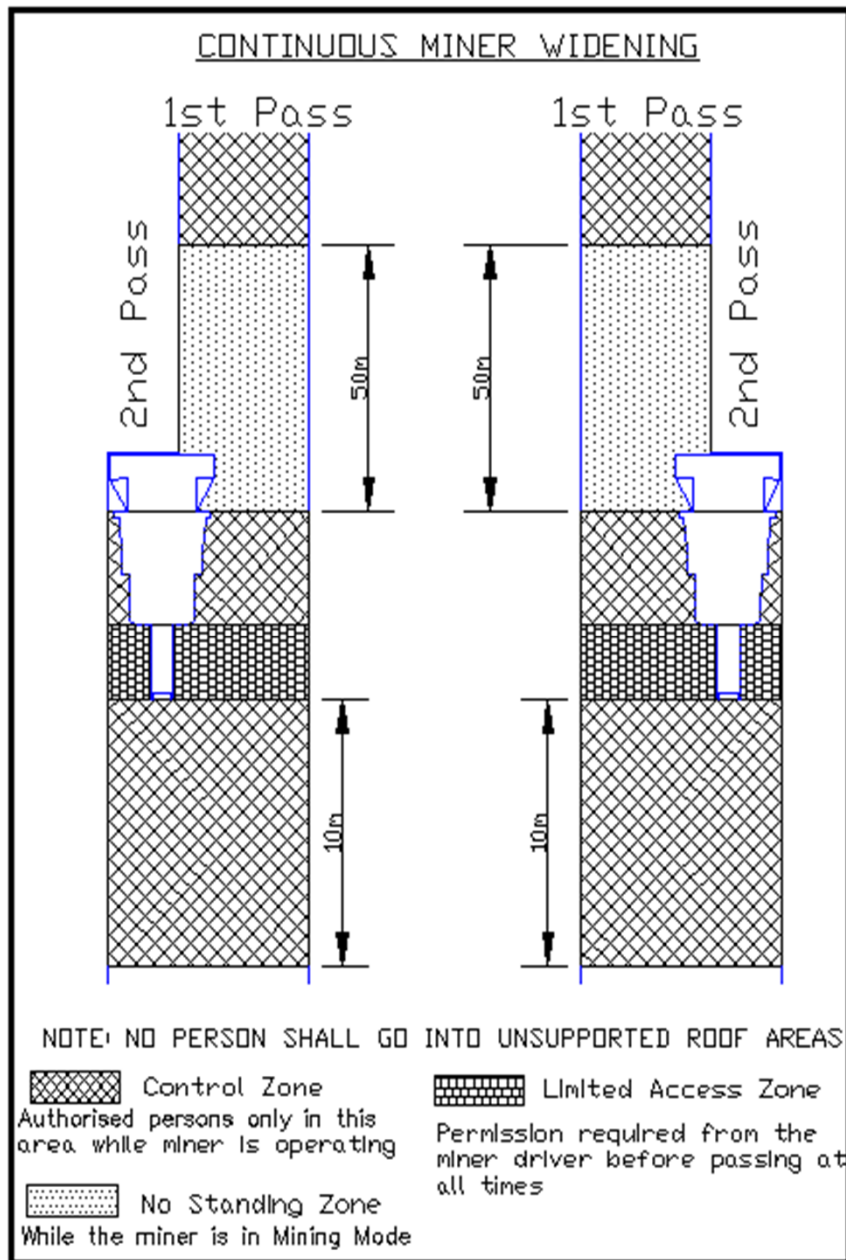
## FOR MINING WITH REMOTE CONTROL CONTINUOUS MINERS



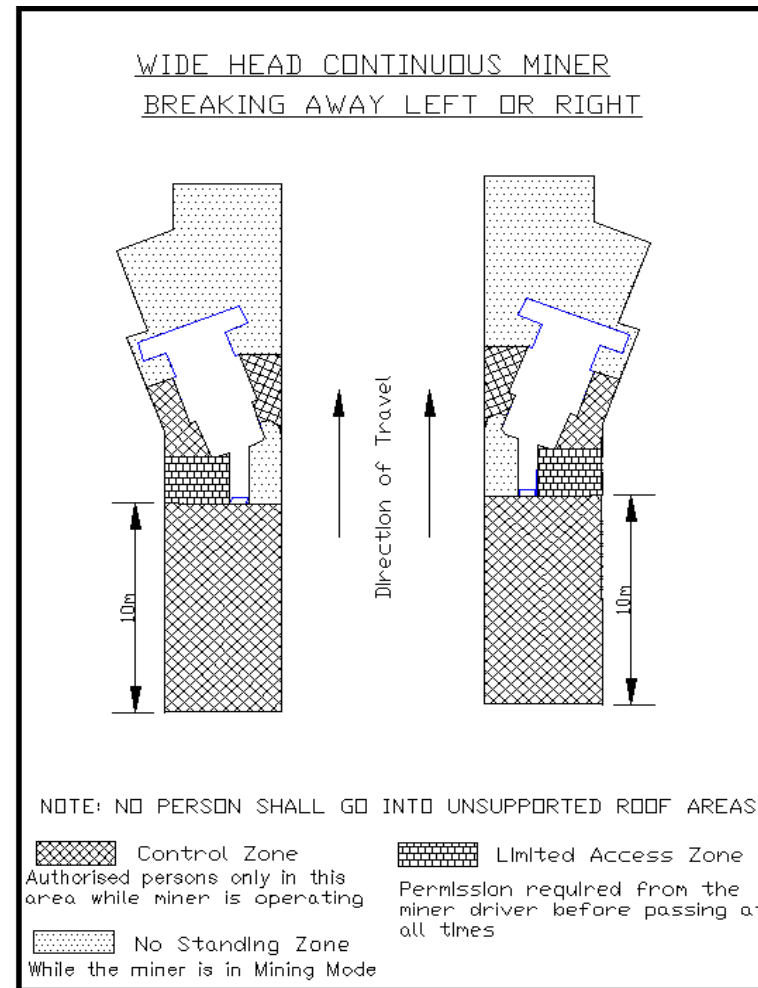
## US ADMIN CONTROLS

Multi pass machines.

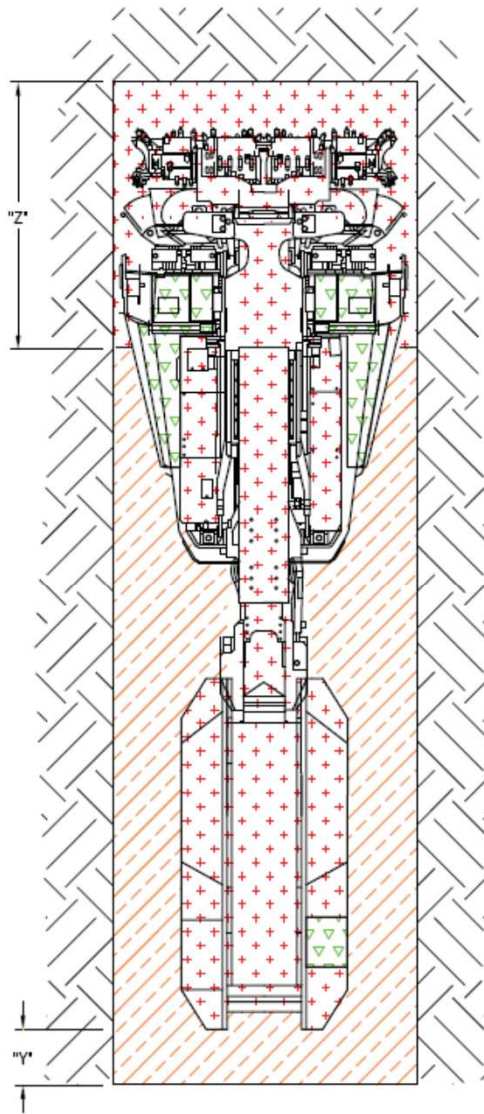




## TYPICAL DIAGRAMS IN SOP (QLD)







**EXCLUSION ZONES**

-  NO ENTRY ZONE
-  NO STANDING ZONE
-  CONTROLLED WORK AREA

**NOTES:**

1. The coal operator shall define by risk assessment the controlled work areas, taking into consideration the machine movement and work environment.
2. The controlled work areas move with the machine.

**DRAFT**  
**Australian/New Zealand Standard**  
**Remote control systems for mining equipment**  
**Part 3: Operational and maintenance for underground coal mining**

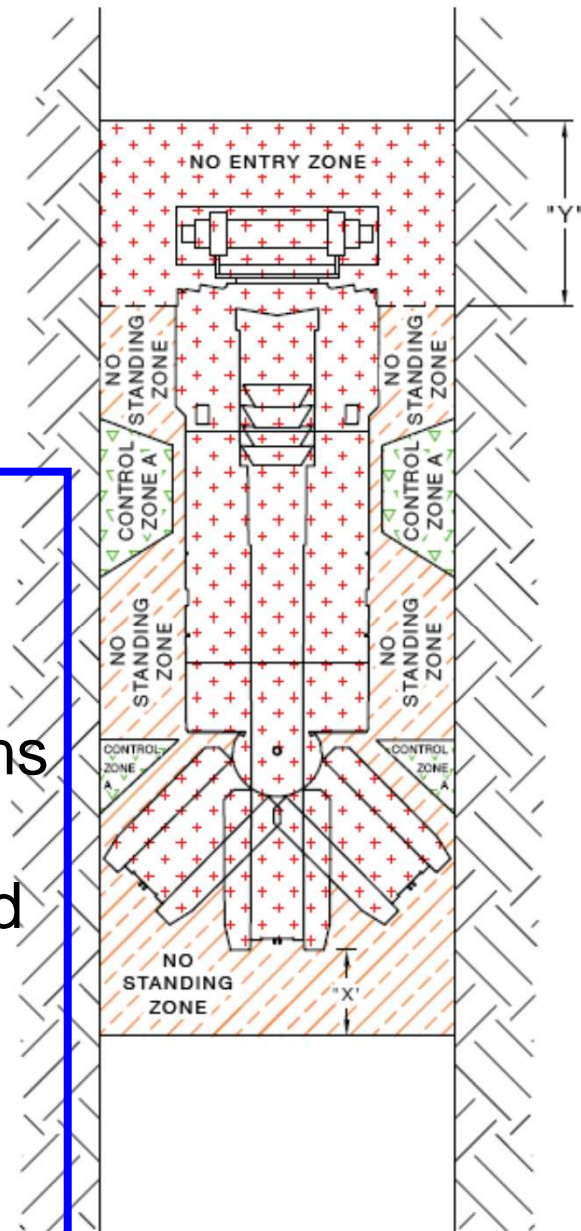
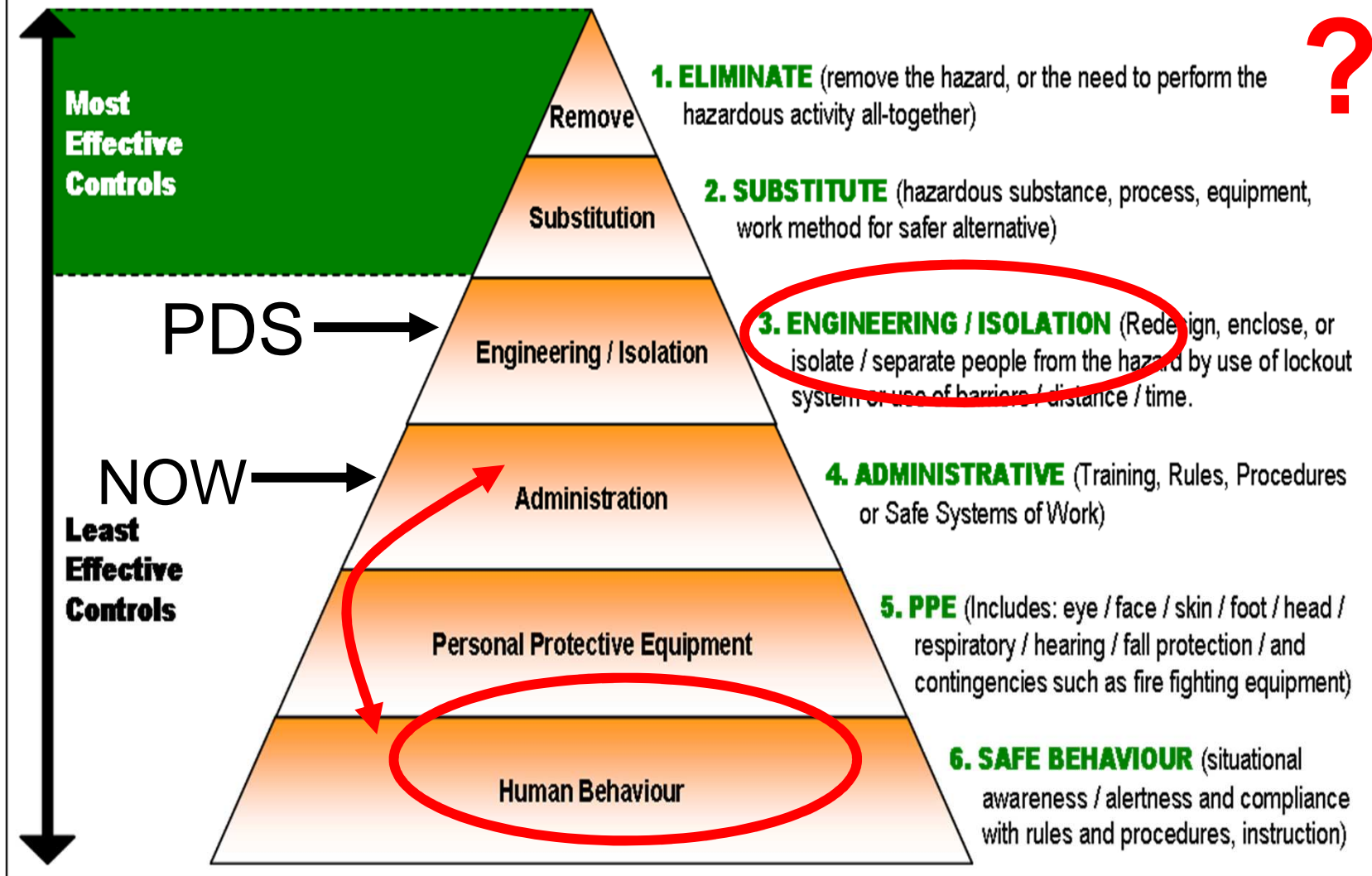
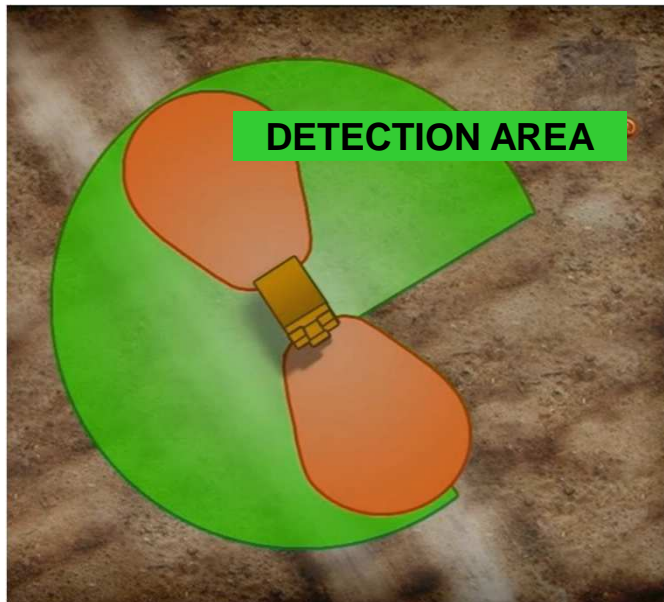
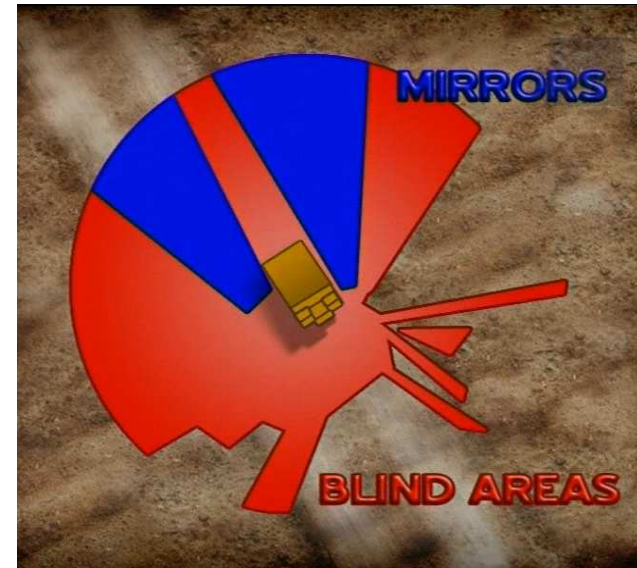
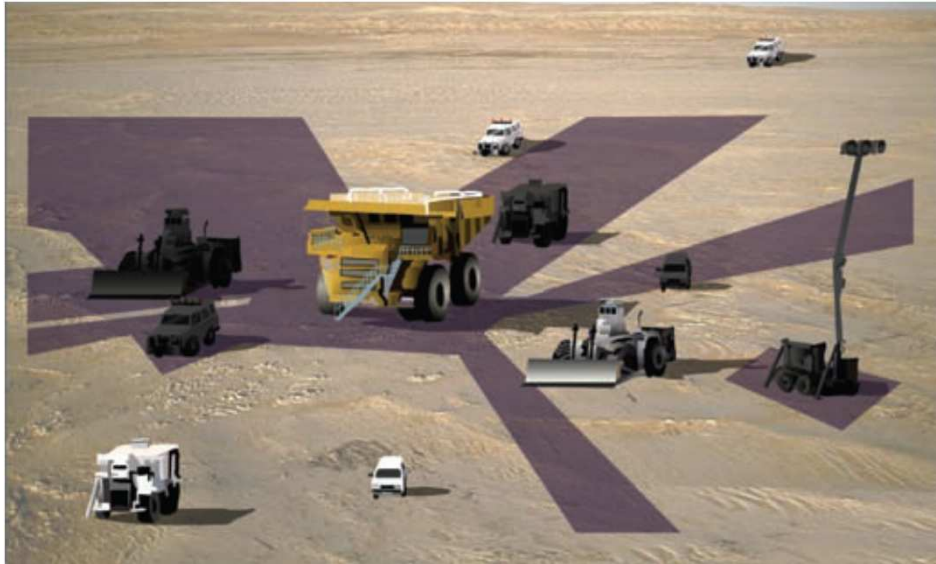


FIGURE 8 PLATFORM/BOLTER MINER IN PRODUCTION

# Hierarchy of Controls

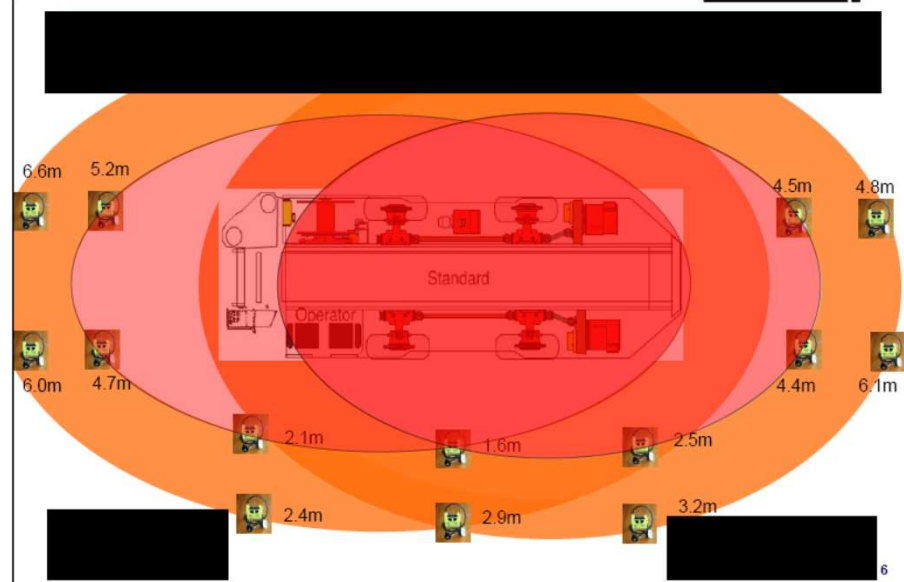
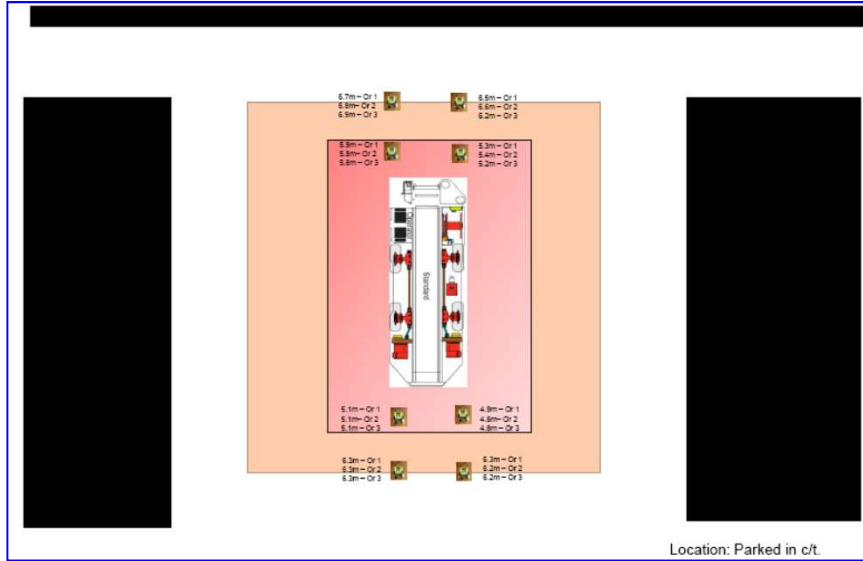




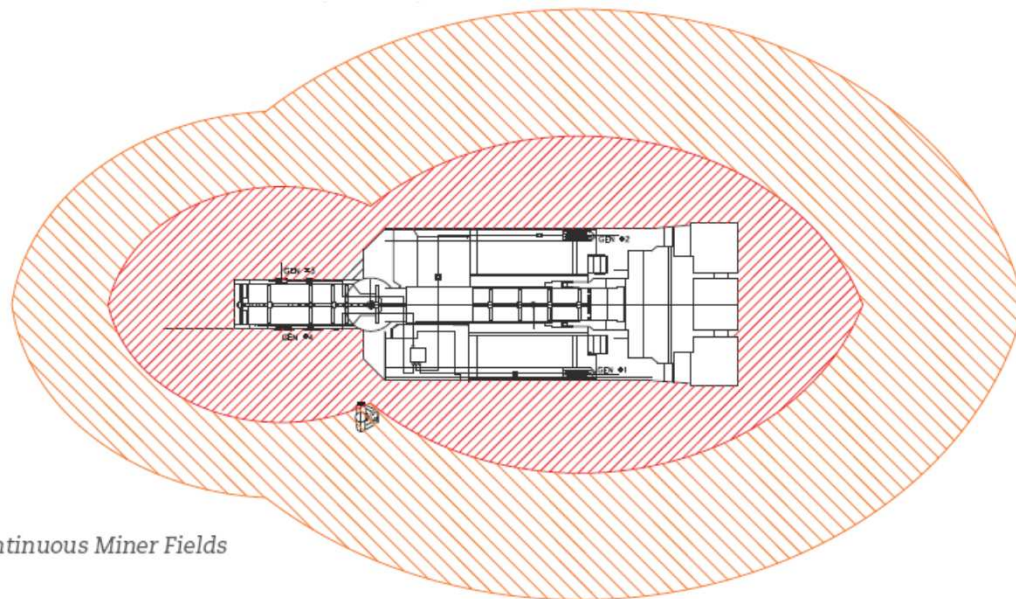
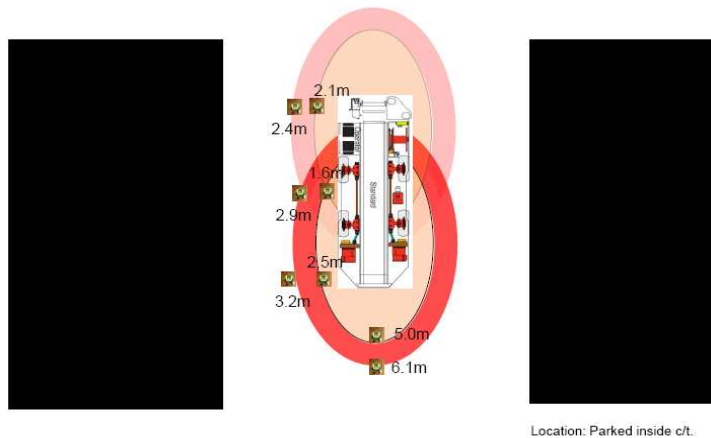


## POLAR DIAGRAM OF SURFACE TECHNOLOGY

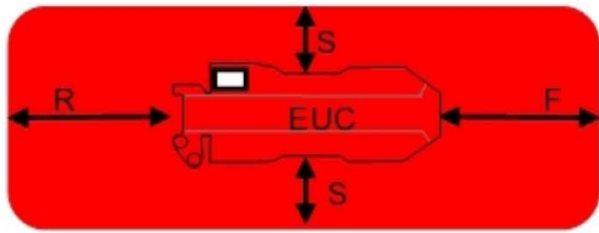
# POLAR DIAGRAM OF UNDERGROUND TESTS



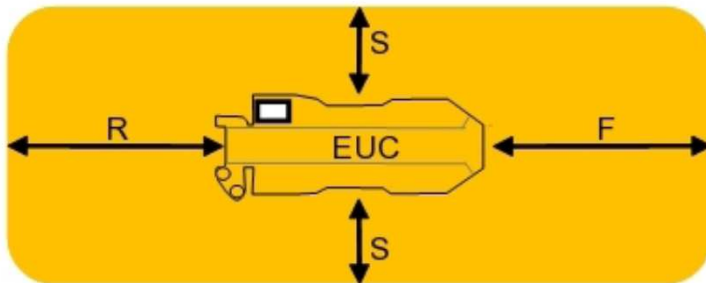
## Scenario 2 – Warning and Trip Map



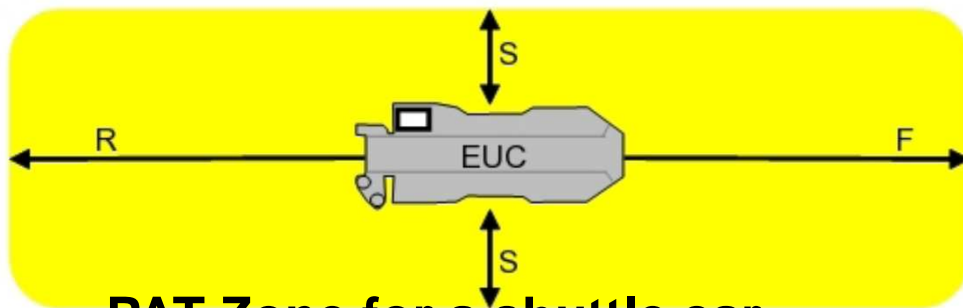
## DIAGRAMS FROM DRAFT MDG



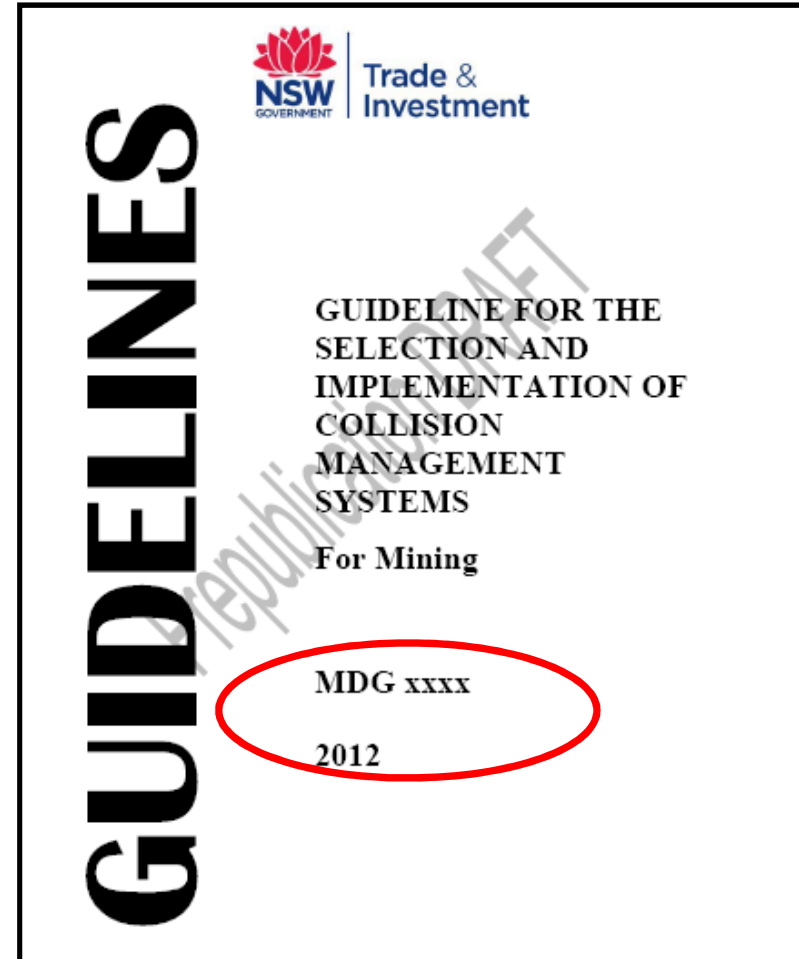
**CAT Zone for a shuttle car**



**PDT Zone for a shuttle car**



**PAT Zone for a shuttle car**

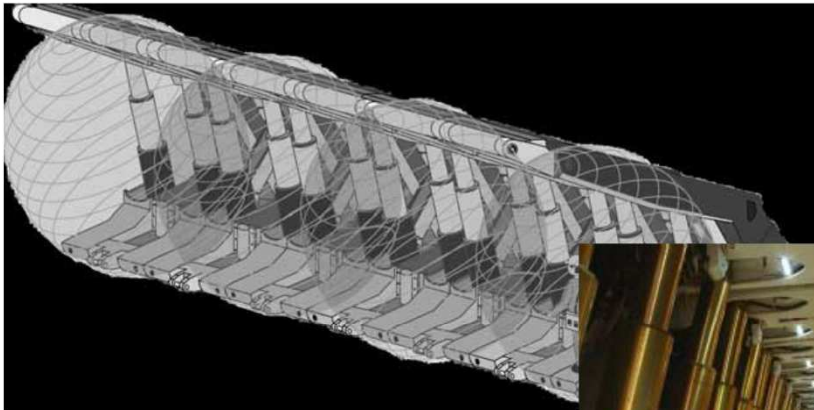


The cover of the draft guideline document features the NSW Government logo and 'Trade & Investment' in the top right. The word 'GUIDELINES' is written vertically in large, bold, black letters on the left side. The title 'GUIDELINE FOR THE SELECTION AND IMPLEMENTATION OF COLLISION MANAGEMENT SYSTEMS For Mining' is centered. Below the title, 'MDG xxxx' and '2012' are written and circled in red. A large, faint watermark 'Public Draft' is visible across the center.



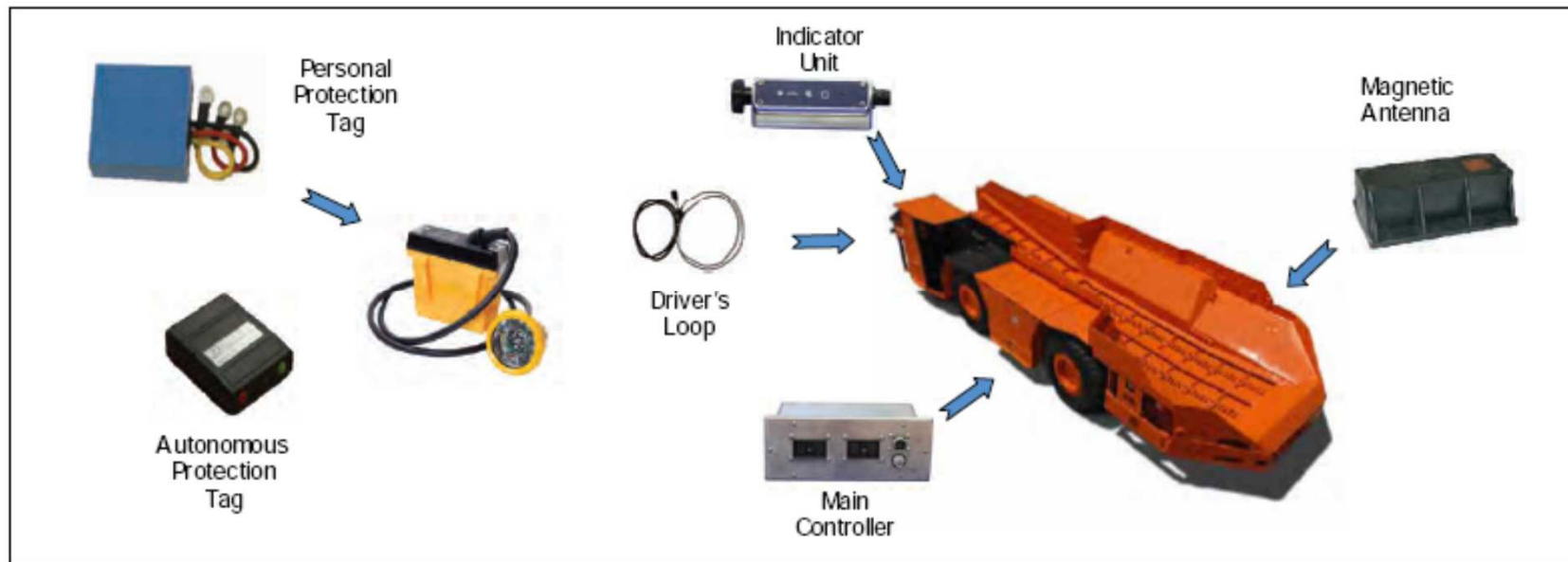
# PROXIMITY DETECTION SYSTEMS

MACHINE CM/SC SUPPLIER	OWN SYSTEM	FIT OR ASSIST THIRD PARTY	MACHINE CONTROL
<i>JOY</i>	NO	YES	YES
<i>CATERPILLAR</i>	NO	YES	YES
<i>SANDVIK</i>	NO	YES	NO



# TYPICAL SHUTTLE CAR INSTALLATION – InfoTronix CWS

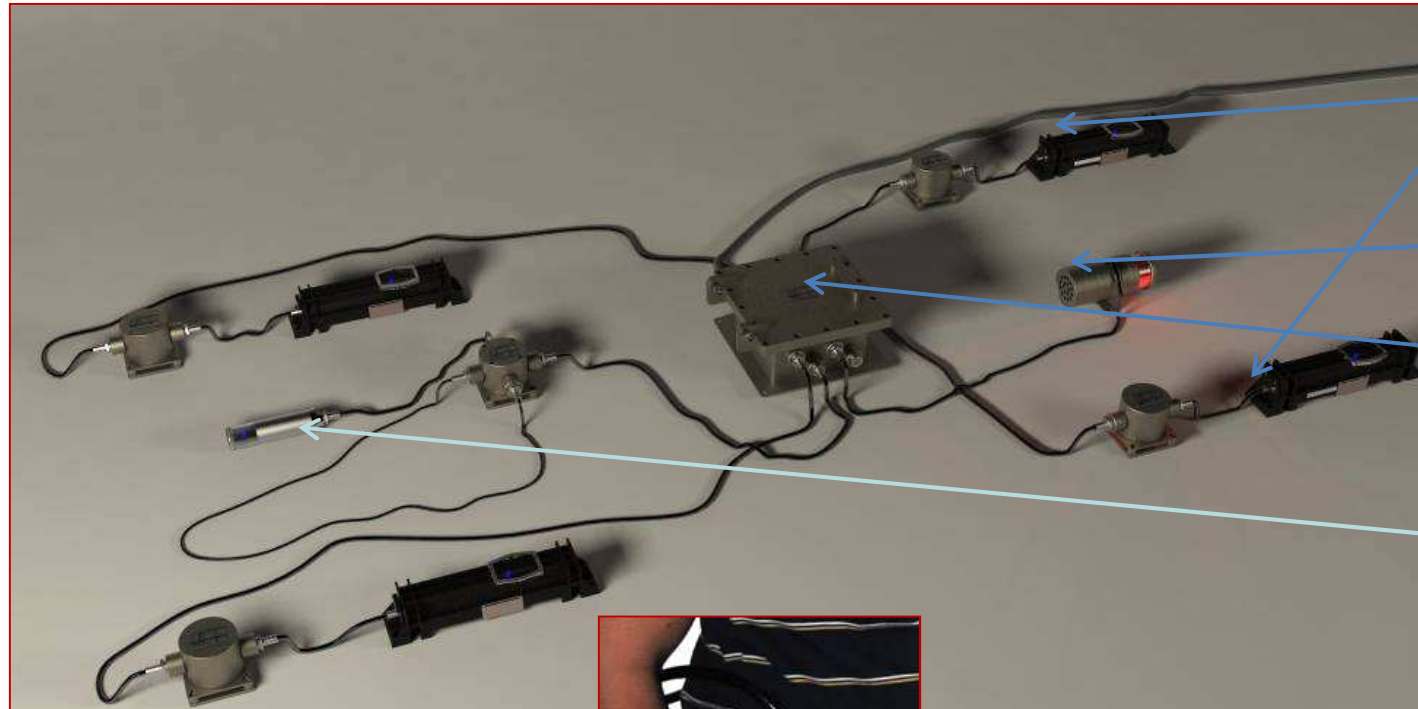
Fully certified IECEx Exi I for use in Qld Coal mines



- RFID
- MAGNETIC BUBBLE



# TYPICAL COMPONENTS OF MST/STRATA HazardAvert SYSTEM



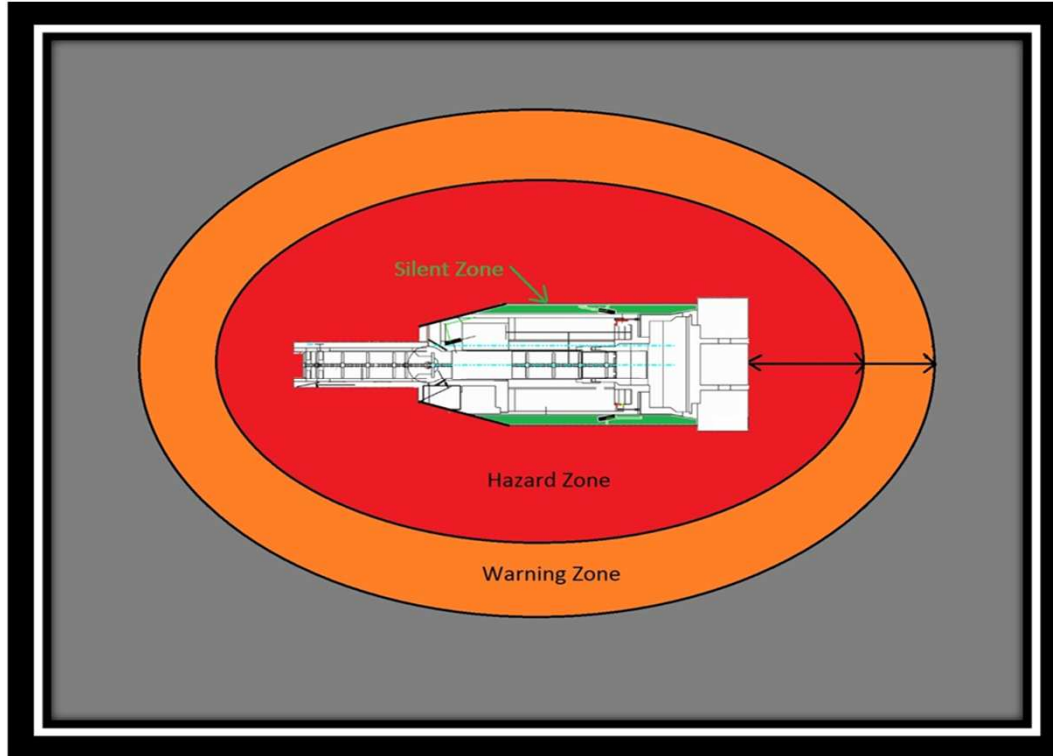
Generators  
in XP  
housing  
Silent zone  
generator  
Control  
Box

Tracking  
Display POD



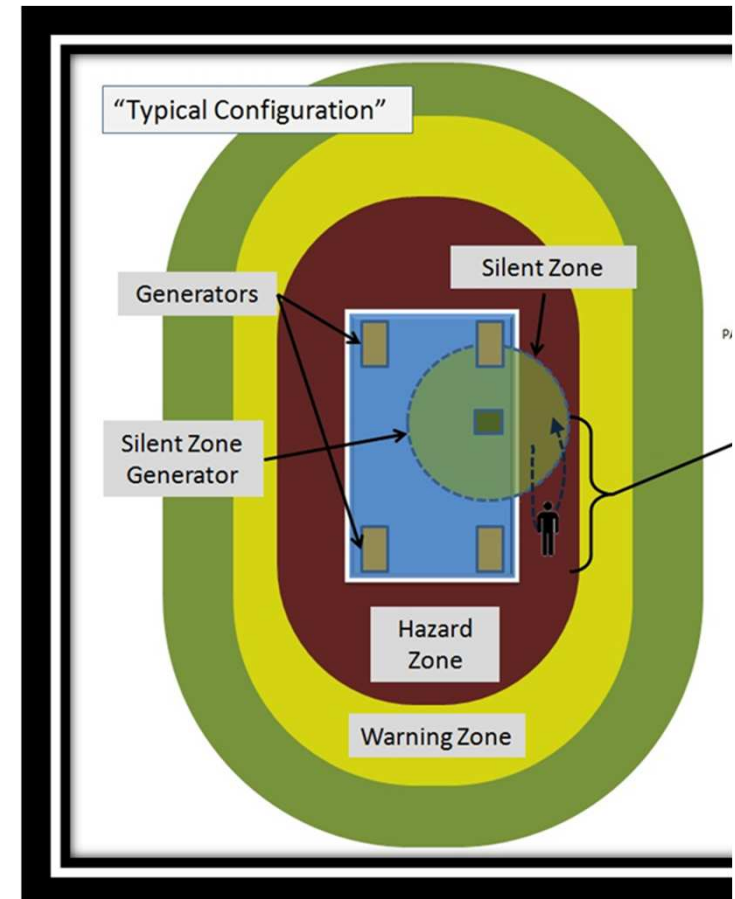
PAD





## MST/STRATA

- RFID
- MAGNETIC BUBBLE





# TYPICAL MINER SYSTEM - Becker UCAS 430 •RFID •MAGNETIC BUBBLE

Operator Interface



Power supply & RS 485 bus interface



DPOD430 RFID UHF



Electromagnetic/  
Radar  
antenna EPOD 300



Omni UHF



Electromagnetic/  
Radar  
antenna EPOD 300



Electromagnetic/  
Radar  
antenna EPOD 300



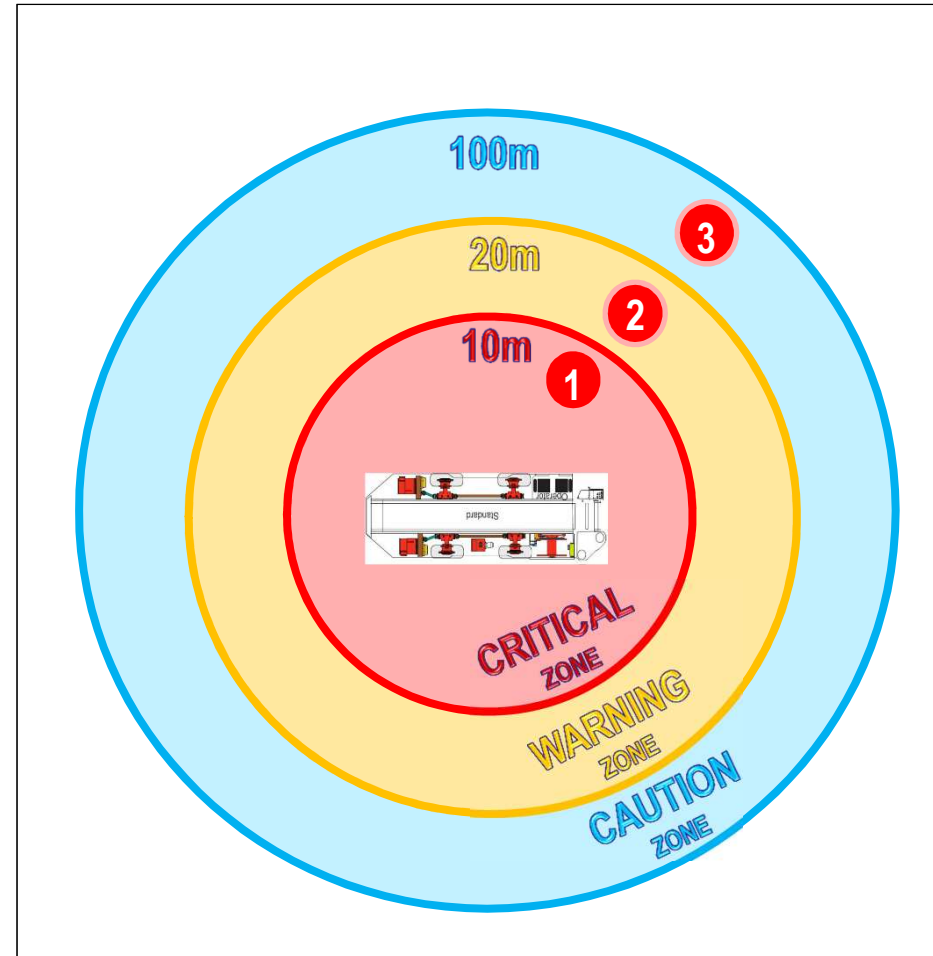
Electromagnetic/  
Radar  
antenna EPOD 300





## ZONE VALUES CONFIGURABLE BY MINE - Becker.

Zone	Range	Proximity
Critical Zone	0m – 10m	In the Critical Zone the configured vehicle will be forced to stop
Warning Zone	10m – 20m	In the Warning Zone both parties are warned of the potential collision.
Caution Zone	20m - 100m	Miners are cautioned to take note and to stay clear of the operating vehicles in their proximity. The vehicle operator is notified when a new tag is detected.



## PROXIMITY DETECTION SYSTEMS (CM &SC)

MACHINE SUPPLIER	OWN SYSTEM	FIT OR ASSIST THIRD PARTY	MACHINE CONTROL
<i>JOY</i>	NO	YES	YES
<i>CATERPILLAR</i>	NO	YES	YES
<i>SANDVIK</i>	NO	YES	NO

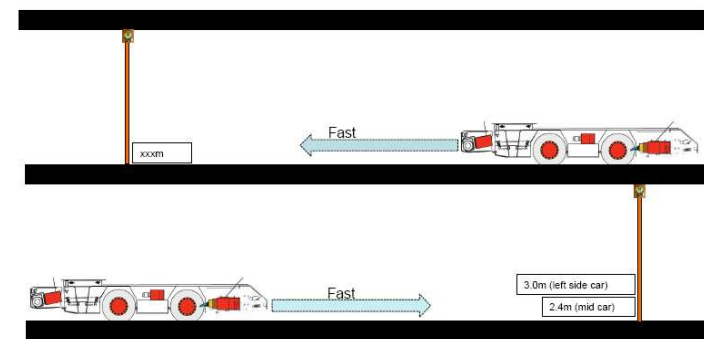
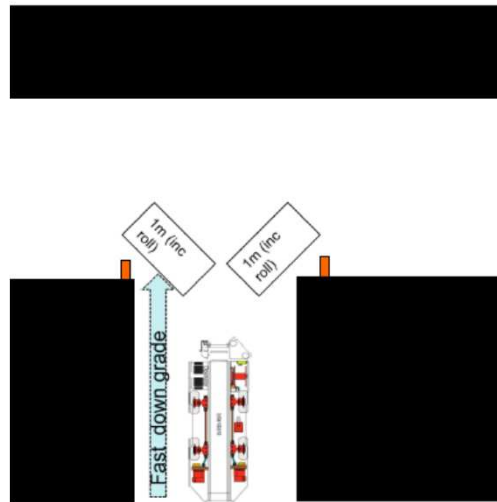
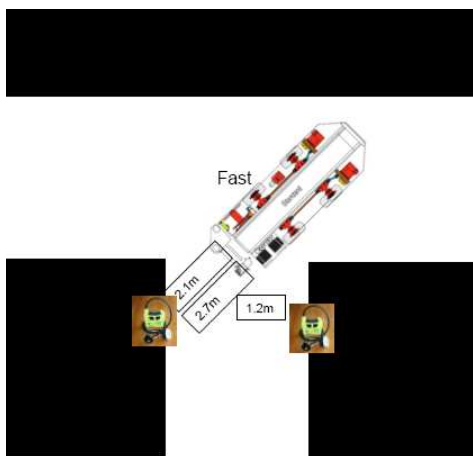
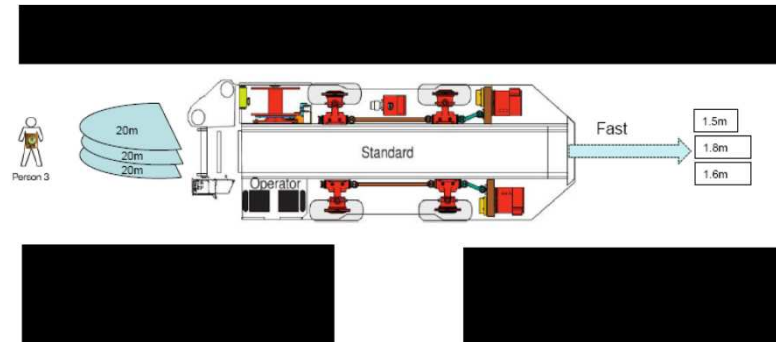
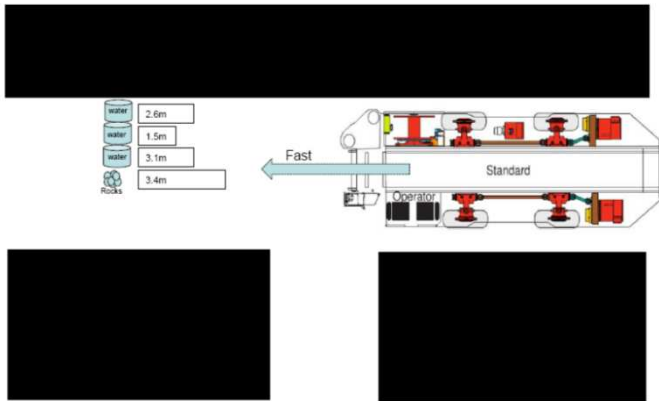
COMPANY	TECHNOLOGY	APPROVAL STATUS	MACHINE SHUTDOWN
<i>STRATA/MST HazardAvert</i>	RFID Magnetic bubble	Not complete	Yes
<i>BECKER UCAS430</i>	RFID Magnetic bubble	Not complete	Yes
<i>INFOTRONIX CWS</i>	RFID Magnetic bubble	Australian certification EX Ia I	Yes

## UG MINES QUEENSLAND - STATUS

Number of mines with <u>fitted</u> operating systems	<b>Nil</b>
Number of mines <u>triallying</u> any system on the surface	<b>2</b>
Number of mines trial any system in <u>UG</u>	<b>2</b>
Number of mines relying on <u>corporate</u> fix	<b>6</b>
Number of mines <u>relying</u> on other mines	<b>5</b>



# TYPICAL TEST/INCIDENT SCENARIOS *(Peabody NGC)*



**NGC Trial**



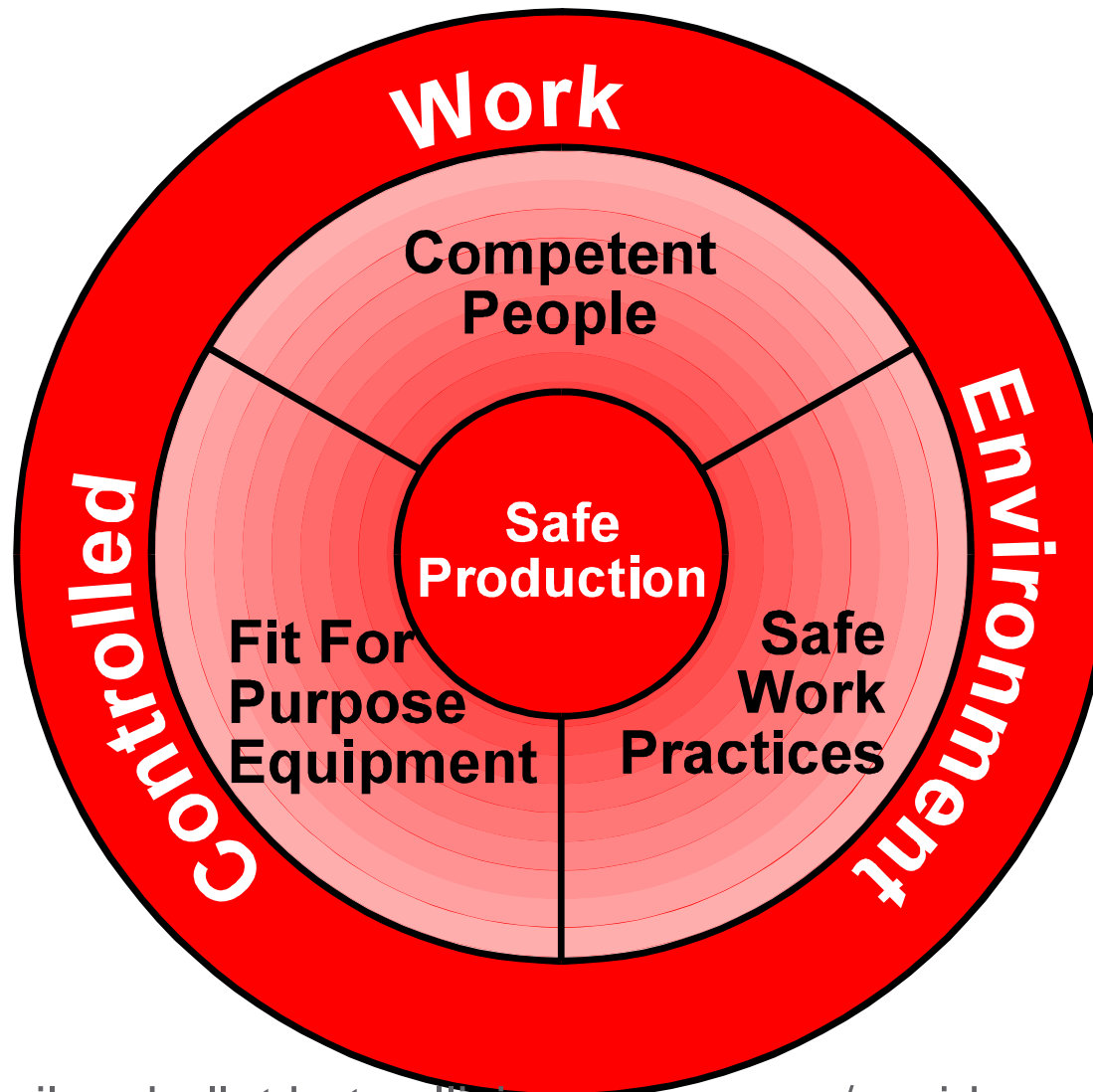


## XSTRATA TRIAL



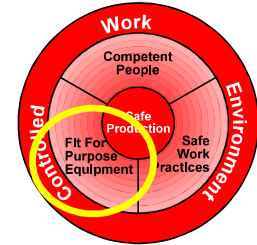
**GREAT EFFORT!!!**





No silver bullet but collision awareness/avoidance systems will help in creating a higher level of safety

# FIT FOR PURPOSE EQUIPMENT



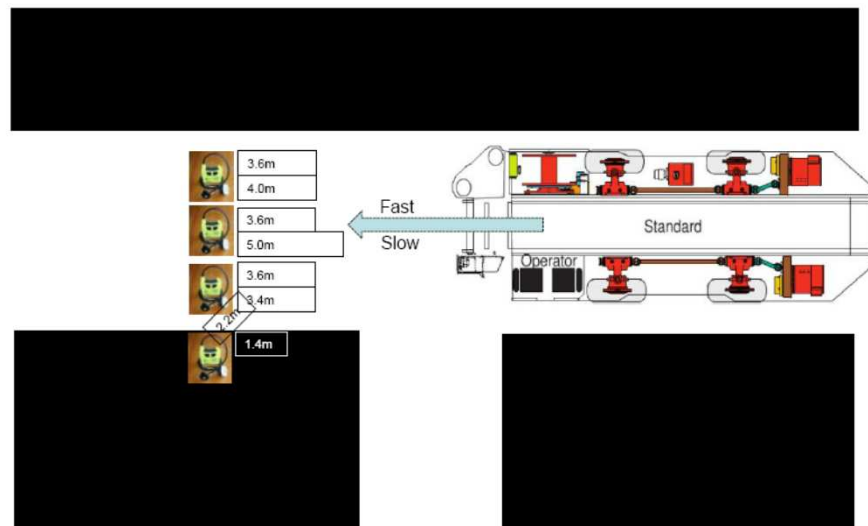
- *Analyse* the vehicle-vehicle-person incidents at your site
- *Document* all of your vehicle-vehicle-person interaction scenarios
- *Understand* the operation of the technology and its limitations
- *Establish* the ergonomics of the system-What impact will the warnings, alarms and false alarms have on the operators.
- *Document* any assumptions by the manufacturer and yourselves
- *Identify* what the system will not do
- *Determine* how to measure system performance
- *Ensure* the system software can be upgraded - emerging technology
- Is machine brake operation critical to successful proximity detection
- *Establish* how to extract a person if jammed and the machine shutdown

# FIT FOR PURPOSE EQUIPMENT Cont

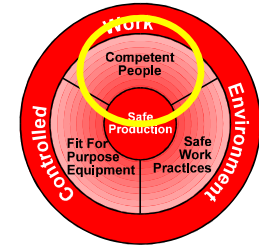


## After installation

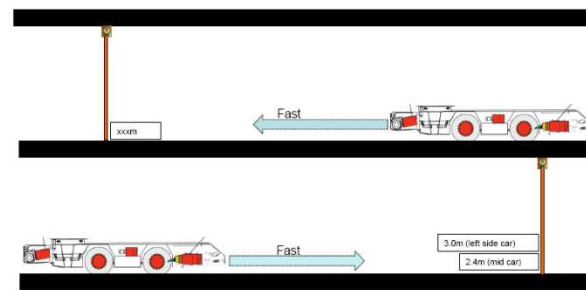
- *Review* your risk assessment and interaction scenarios
- *Follow* the recognised change management procedures for modifications
- *Confirm* actual polar diagrams of the protection zones are as specified
- Assess the ergonomics of the system
- *Confirm* system will limit hazardous vehicle-vehicle-person interactions



# COMPETENT PEOPLE



- Establish operational rules-Critical safety system-what does it mean when it is not working
- Site champions are critical to the successful implementation of the system.
- In all likelihood the systems will require a cultural change
- During training ensure system is understood
- **Get the success stories and spread them**



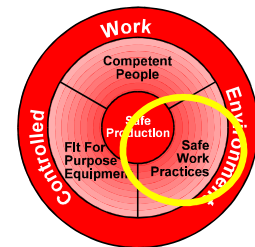


## SAFE WORKING PROCEDURE

- Ensure all procedures are updated-maintenance checks, calibration checks, prestart checks
- In the event of failure establish the rules If a person is trapped what happens?

## CONTROLLED WORK ENVIRONMENT

- The system should not become the primary mitigation strategy





## CONCLUSIONS

- Proximity detection systems do protect persons.
- Qld Inspectorate will continue to support and encourage the fitment of proximity detection systems
- NO GO Zones will continue to be enforced
- Substantial commitment is required to get systems operating effectively.
- Operator acceptance will be critical to success
- Regular testing of the system performance will be a critical operations process.
- Look for the positive injury prevention experiences and share them.
- ***At this stage it is not envisaged that legislation will mandate the fitment of PD systems. However the principle of a reasonably achievable and acceptable level of risk will be applied.***
- End users who have conducted trials of various systems-the mines - inspectorate applauds you.



# FOR A FATAL ACCIDENT THERE IS NO CURE: THERE IS ONLY PREVENTION

Further enquiries should be directed to

Tilman Rasche - Senior Inspector of Mines

[Tilman.Rasche@dnrm.qld.gov.au](mailto:Tilman.Rasche@dnrm.qld.gov.au)

Peter Herbert – Senior Inspector of Mines (Electrical)

[peter.herbert@dnrm.qld.gov.au](mailto:peter.herbert@dnrm.qld.gov.au)



**Every miner home safe and healthy every day**

***Commissioner for Mine Safety and Health - Stewart Bell***