MINE SAFETY
INVESTIGATION UNIT

Investigation Case Studies

Proximity Detection and
Collision Avoidance Systems Workshop
8-9 February 2011

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Question to consider

Could proximity detection devices have prevented the serious injury or fatal incident from occurring in the following incident case studies ?

I&I NSW Investigation Case Studies

- *Underground coal mines*
  - Proximity to continuous miners and mobile equipment

- *Underground metal mines*
  - Proximity to remote controlled loaders

- *Surface mining operations*
  - Proximity to excavators and backhoes

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Case study 1 – Femur fracture Dec 2010 Underground coal mine
Proximity to a rubber tyred vehicle

Incident –

Leg struck by the stone dust pod as the vehicle turned into a cut through.

How would you warn the driver of the person still in proximity ?

Should you prevent the machine from moving when a person is detected ?

What system do you rely on at your site ?

Direction of machine travel

Injured person had a conversation with the driver and then was walking past the machine as it started to move

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Case study 2 – Crush injuries Sept 2008 Underground coal mine
Proximity to continuous miners

Incident – Remote control machine being reversed, the operator located out-bye of machine tripped over as a second person moved beside the machine cutting head

How do you detect a person in a machine No Go Zone?

Should the machine be shut down ?

Machine operator located outbye

2nd person moved to beside the machine head

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# Case study 3 – Fatal injury Jan 2007 Underground metal mine

Proximity to radio remote controlled loader

Incident - Operator came within 5m of the loader operation (only soft barrier controls in place)

There were tilt switches on the remote control unit which were presumed to shut down the loader.

Could the operator location have been detected earlier?

Light curtain (electronic barrier) installed post incident ?
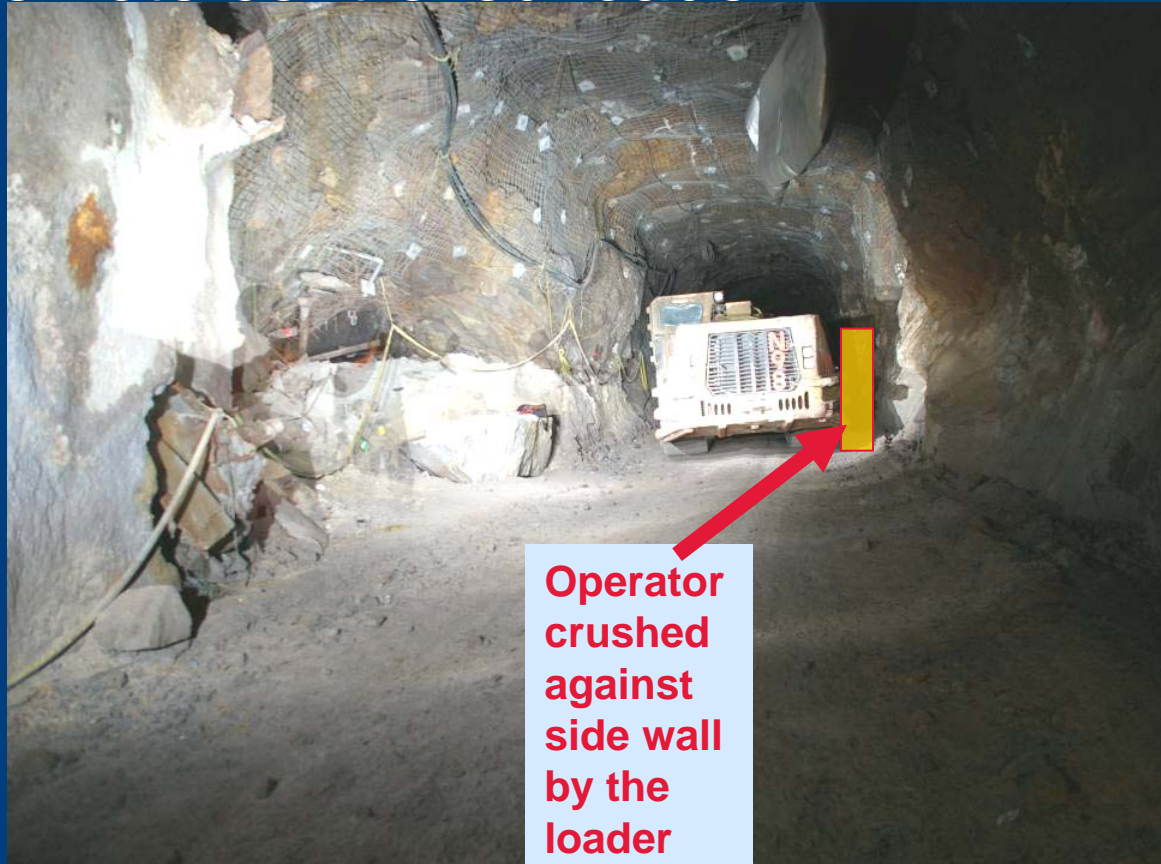
Operator crushed against side wall by the loader

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Case study 4 – Paraplegia July 2004 Underground coal mine
Proximity to continuous miner

Incident – Persons riding on continuous miner boom handling power cable during machine relocation

Which person is in a No Go Zone for the task?

Complex No Go Zones – Can the person be detected and then shut the machine down ?

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Surface mining operations
Proximity to excavators and backhoes

- *73 reportable incidents* involving backhoe and excavator type equipment (4 year period - August 2005 to 2009)

- *19 (average of 1 in 4)* of the reportable incidents resulted in injury to either the operator or person in the vicinity of the equipment.

- *Significant injuries* - one fatality, multiple skull fractures, fractures to the spine, pelvis, arms and crush injuries.

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Types of work task resulting in injury for excavators and backhoes

4 year period - August 2005 to 2009 reported incidents

Proximity detection may have prevented these types of injuries

- Operation/machine collisions   4 injuries

- Handling logs and trees   3 injuries

- Handling polypropylene pipe   2 injuries

- Using arm as a lifting device   2 injuries

Proximity detection would not prevent these types of incidents

- Operator access/egress   3 injuries

- Maintenance activity   5 injuries

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Case study 5 – crushed pelvis August 2008

Incident

- Lifting steel plate into position
- Person moved and relocated in between two steel structures in front of a backhoe arm.
- Backhoe operator not aware the person had entered into backhoe arm work zone
- Unplanned slip and forward movement of the backhoe due to slope of ground

Could proximity detection have warned the operator of the location of persons?

Would other risks be created to fully shut a backhoe down if persons are detected in the No Standing Zone?

Or only isolate the swing arm or the bucket ?

2nd person location

Injured person location

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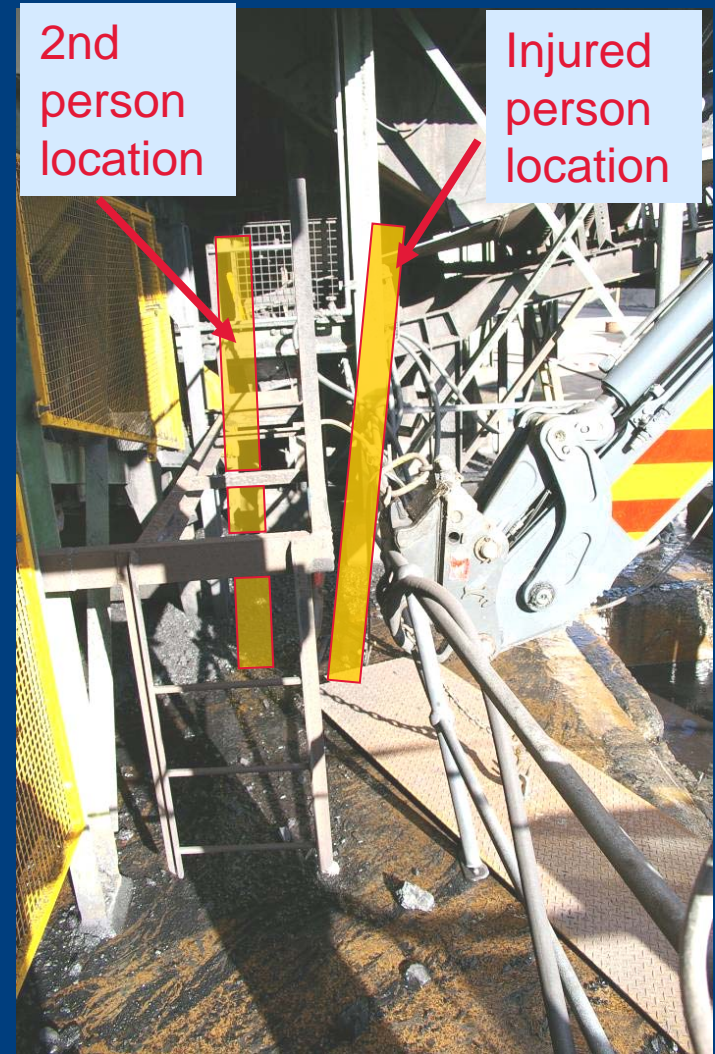
Case study 6 – fractured skull August 2008

Incident

- Person walked into the work area of a backhoe excavator arm whilst levering out a log from a pile of timber logs.

Could proximity detection have provided warning of a person walking into the work zone before being visually seen by the operator ?

Person walked into work Zone.

Struck by log

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Case study 7 – fractured pelvis Nov 2008

Incident

- – Person located in the No Go Zone of an excavator moving logs.

Can a proximity detection device detect and differentiate persons located at various distances?

At what distance proximity should the machine be shut down?

Injured person location

2nd person in proximity

20 NOV 2008

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Causal issue observations

Refer to I&I NSW Safety Bulletin 08-08

- Failure of risk assessments to identify and control behaviour of persons in and around machinery

- Failure of plant operators and supervisors to identify and control behaviour of persons in and around machinery

- Failure to establish and maintain no-go zones, control zones and barricading around machinery

- Failure to maintain line of sight, and communications with persons working around mobile plant and machinery

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Consideration of;

OHS legislation
Australian Standards
Codes of Practice
Published information

OHSR 2001 clauses 5 ,9,10,11,12

Identify, Assess, Control & Review to minimise the risk to the lowest level reasonably practicable

clause 5 - "Hierarchy of Control"

- *Eliminate the risk* — Remove the offsider from the work zone and place hard barrier controls

- *Substitute the risk*

- ***Engineering controls*** — Consider proximity detection systems to warn the operator of a person entering the work zone

- *Administration controls* — Safe work method statement, training and supervision

- *PPE*

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AS 2550-2002
Cranes, hoist, winches - Safe Use

- 'Where personnel are required to enter crane's operating area during normal operation the <u>operator shall be made aware of their presence</u>, for example, establish voice or visual contact. Barricades or guarding shall be provided where necessary'

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Code of Practice
Amenity Tree Industry
NSW Workcover

- 'A safe working zone should be set up around the work site using flags, barriers or fencing. Ensure that unauthorised persons do not enter the safe working zone. If necessary appoint an observer to ensure that people do not enter the area and to **warn the machinery operator** if they do. This may be particularly necessary in public areas'

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I&I NSW published recommendations to industry

- **I&I NSW Safety Bulletin <u>November 2008</u>**
  Mine workers injured in machinery crush zones

  - Review the working relationship between persons and machinery
    'Vehicle to Person' interaction (V to P)

- **I&I NSW Safety Bulletin <u>October 2009</u>**
  Human interaction with backhoes and excavators

Coroner published recommendations to industry

- Qld Coroners Inquest findings <u>September 2009</u>

  Jason Blee fatality on 9 April 2007

  - Coroners Recommendation No. 4

    - Review interaction between pedestrians and machinery
    - Training and enforcement of 'No Go/ Restricted Zones'
    - 'No Go/ Restricted Zones' shown in pictures in the crib room and other locations
    - Operators of mobile equipment must ensure it is safe to move equipment before they do so

  - Coroners Recommendation No. 7
    - Develop proximity detection devices for use in coal mines for pedestrians in and around mobile equipment

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The paradigm shift in thinking

- Can proximity detection technology assist to prevent incidents from occurring ?

- Once a person is detected what happens next ?

  - Visual and/or audible warning to the operator ?
  - Increasing volume and intensity of audio warning ?
    - » similar to car seat belt audio warnings
  - Warning acknowledgement button activated by the operator ?
  - Machine or part of machine prevented from operating ?
  - Logging of the detection event ?
  - Auditing the machine operations ?
  - Control of non compliant behaviour ?

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I&I NSW published resources

- **Investigation Unit reports and power point presentations**

    – http://www.dpi.nsw.gov.au/minerals/safety/major-investigations/investigation-reports

- **Safety Alerts and Safety Bulletins**

    – http://www.dpi.nsw.gov.au/minerals/safety/safety-alerts

    – http://www.dpi.nsw.gov.au/minerals/safety/safety-bulletins

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