Resources Regulator
Department of Regional NSW

NSW GOVERNMENT

Open cut drill and blast forum

NSW Resources Regulator

regional.nsw.gov.au

May 2023

The Department of Regional New South Wales acknowledges that it stands on Country which always was and always will be Aboriginal land. We acknowledge the Traditional Custodians of the land and waters, and we show our respect for Elders past, present and emerging. We are committed to providing places in which Aboriginal people are included socially, culturally and economically through thoughtful and collaborative approaches to our work.

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Mining, Exploration and Geoscience
Department of Regional NSW

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Resource Regulator Open Cut Drill and Blast Forum 2023 Misfires and Incidents

Presenter name:- Steven Kohler
Presenter title:- Inspector of Mines

24 May 2023

Contents

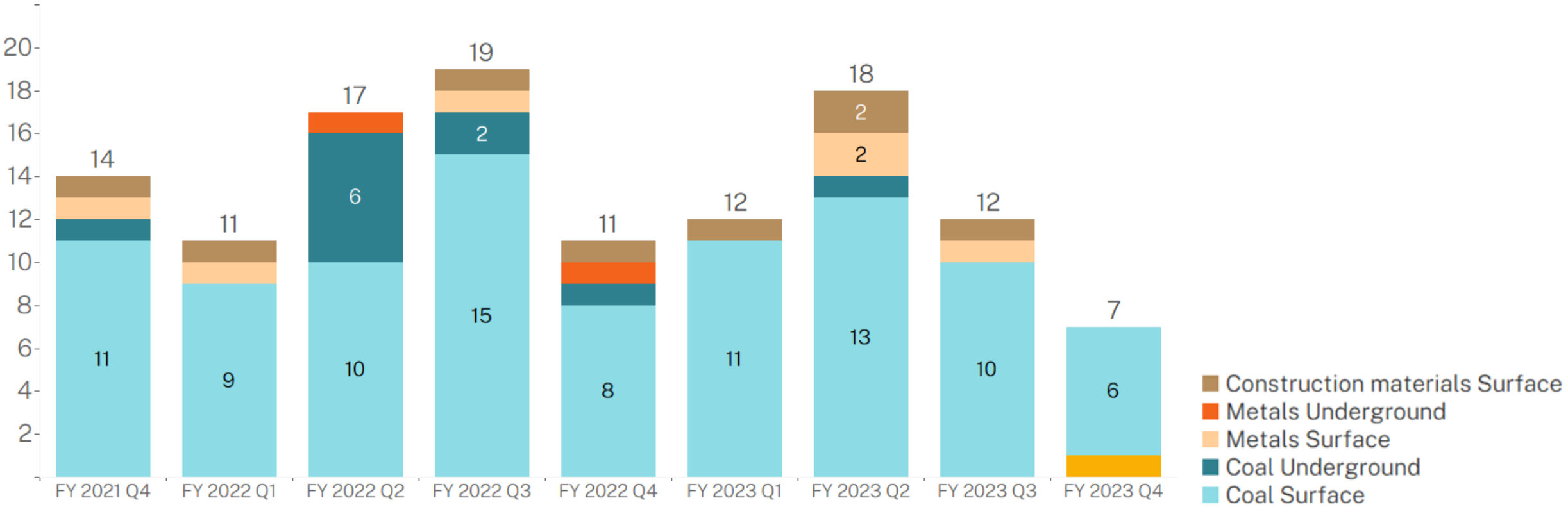
KEY POINTS - data from 01 April 2021 to 21 May 2023

- Types of Misfires
- Misfire incidents
- Summary of Explosives incidents
- Explosives incidents
- Questions

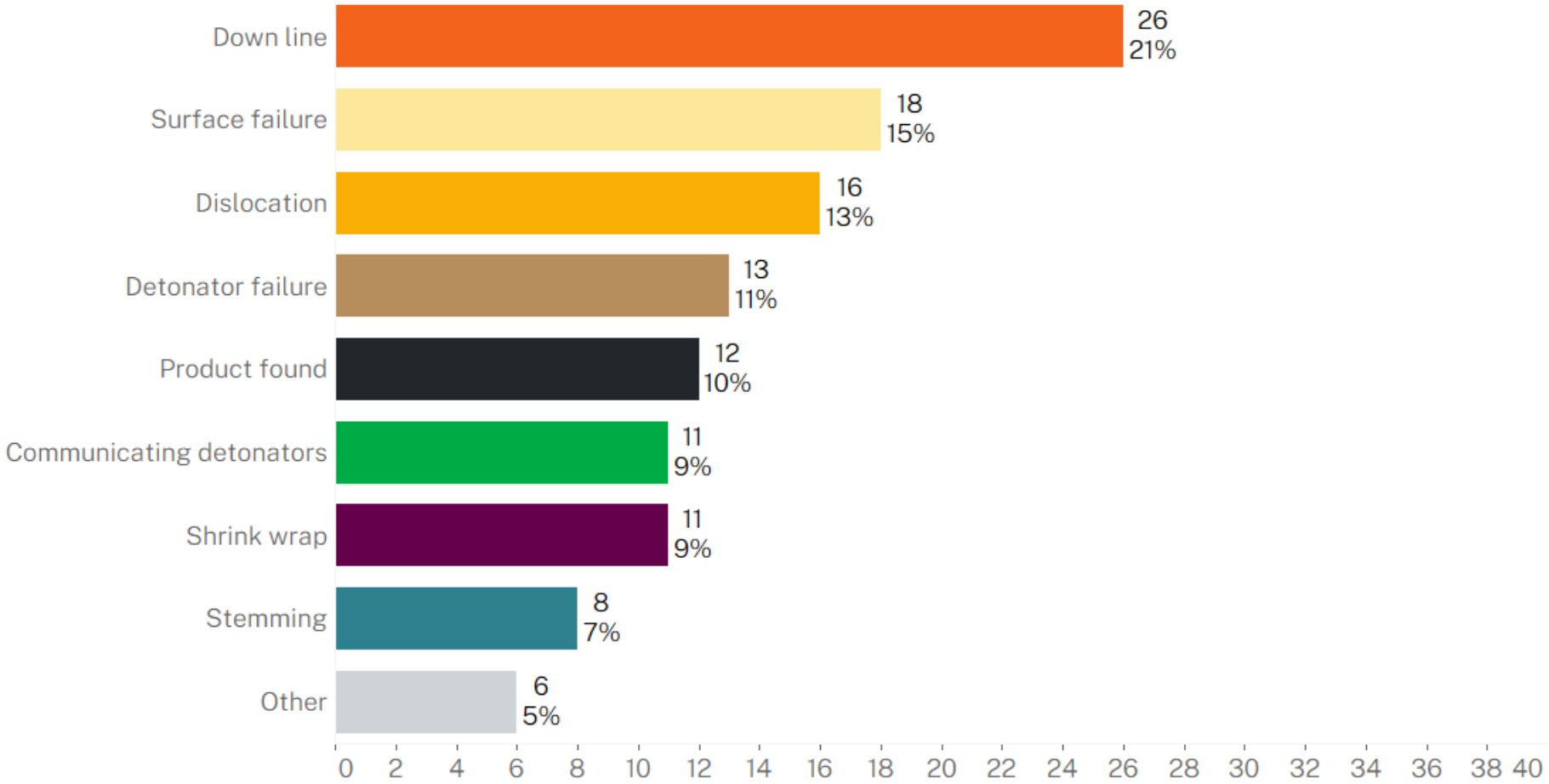
Misfires types for all mines

- Shrink Wrap
- Down line issues - non communicating detonators
- Detonator fail to fire
- Surface failure not clipping in Nonel
- Explosives desensitised fail to fire
- Dislocation
- Boosters and detonators found
- Stemming

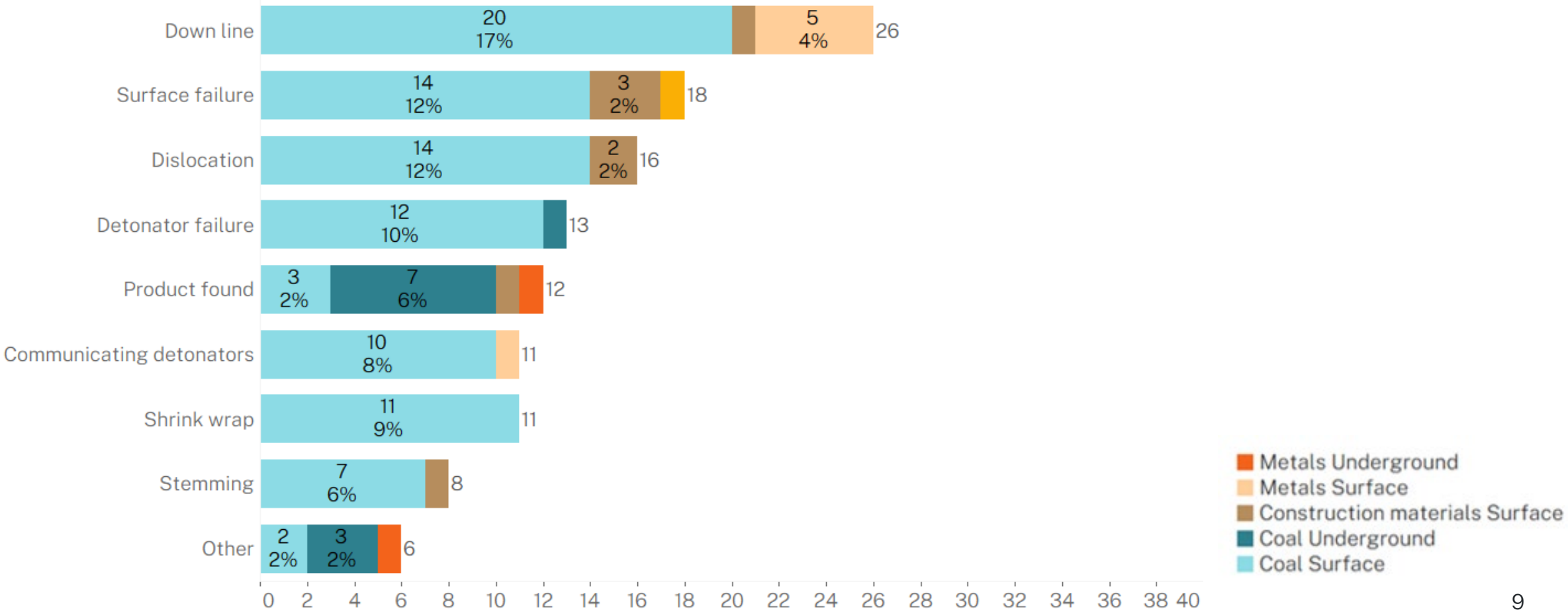
Misfires by sector, operation type and quarter
– 01 April 2021 to 21 May 2023



Misfires by type of misfire
– 01 April 2021 to 21 May 2023



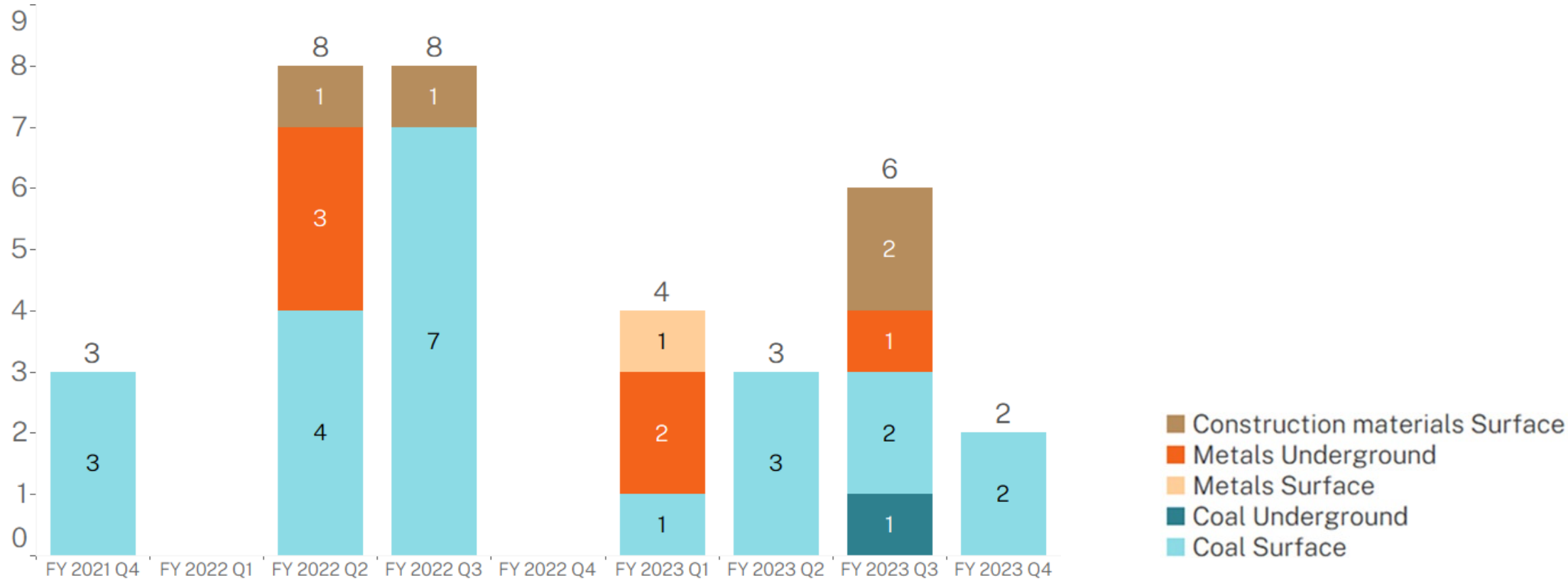
Misfires by type of misfire, sector and operation type
– 01 April 2021 to 21 May 2023



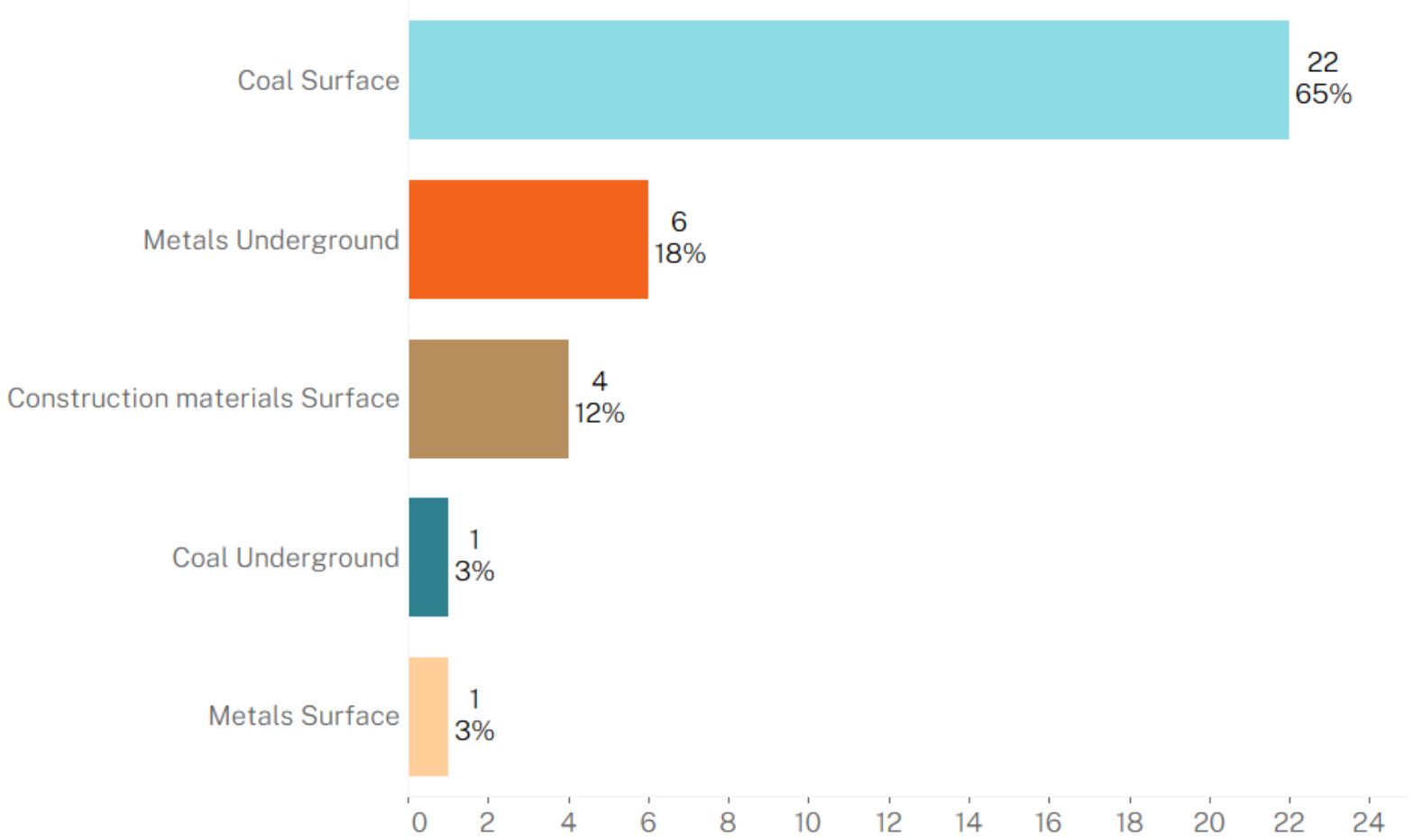
Summary of Explosives Incidents

- Reconciliation of HE/IE not matching
- HE/IE lost on bench
- High explosives found in underground 12 plugs
- Hot hole detonation
- MMU fire
- Emulsion found in pump cabinet during maintenance
- Explosives found in old magazine (planned for removal)
- Detonation of explosives in process mill
- Detonation of explosives during bogging
- Faulty Exploder
- Blast fired underground – failed to clear tag board
- Unplanned detonation of explosives

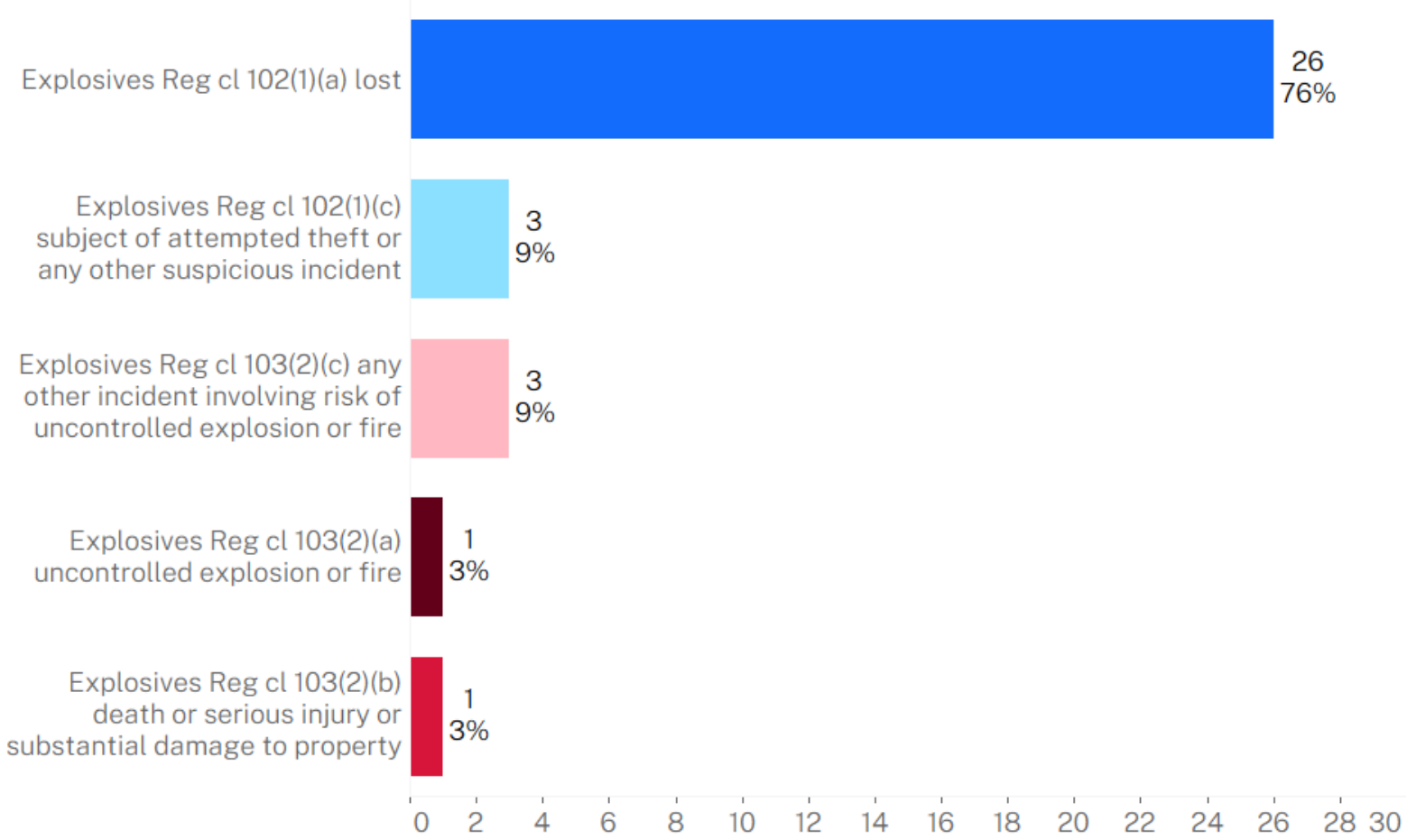
Explosives incidents by sector, operation type and quarter
– 01 April 2021 to 21 May 2023



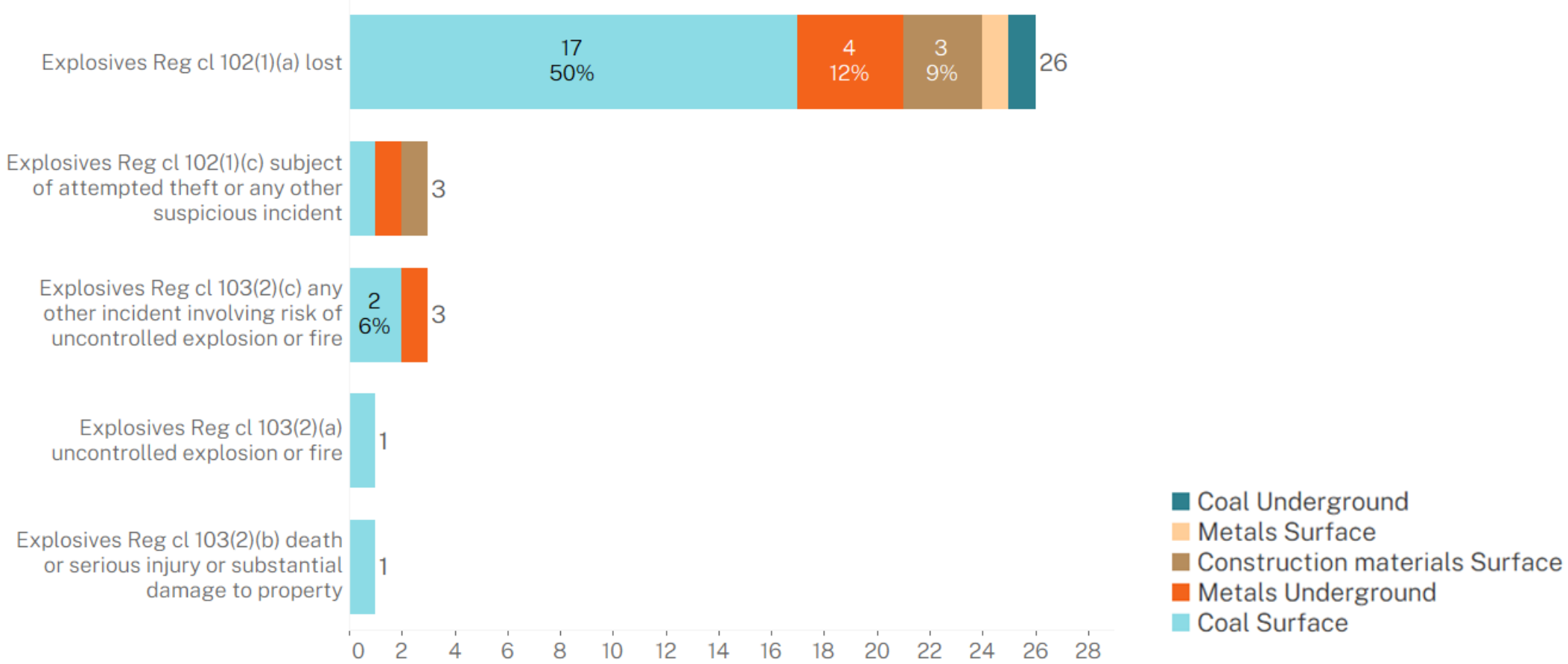
Explosives Incidents by sector and operation type
– 01 April 2021 to 21 May 2023



Explosives Incidents by clause
– 01 April 2021 to 21 May 2023



Explosives Incidents by clause, sector and operation type
– 01 April 2021 to 21 May 2023

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Questions

Contents

Key points:

- Brief
- In-Field inspection and Assessment areas
- Positive observations
- Improvements
- Questions

Brief

- Explosives are routinely utilised within mining environments and, if not stored, handled or used correctly, can potentially cause serious and/or fatal injuries to workers. For this reason, where explosives are used at an operation, an explosives control plan must be developed and implemented.
- The NSW Resources Regulator has commenced a program of planned inspections and targeted assessments. The first being stage one Explosives Assessment Program which consist of the following two elements.
  - Explosives safety and security. Protect explosives from unintended or uncontrolled detonation, loss, theft and misuse.
  - Explosives suitable for application. Explosives are in good condition and used for approved purposes.
- The completion of 40 Stage one Explosives Program assessments in the Open Cut Coal and Metex sectors have been completed.

In-Field inspection and Assessment

- Magazines
- Reload compounds – including MMU and or MPU's
- Shotfirers loading on bench and shotfirers vehicles
- Drilling operations
- Carry out interviews to determine that workers have an understanding of the sit procedures, Security plan and Explosives Control Plan etc
- Interviews included – Shotfirers, drill operators, blast engineers, supervisors, MPU operators etc

Non-Compliant issues - Magazines

Vegetation on mounds.

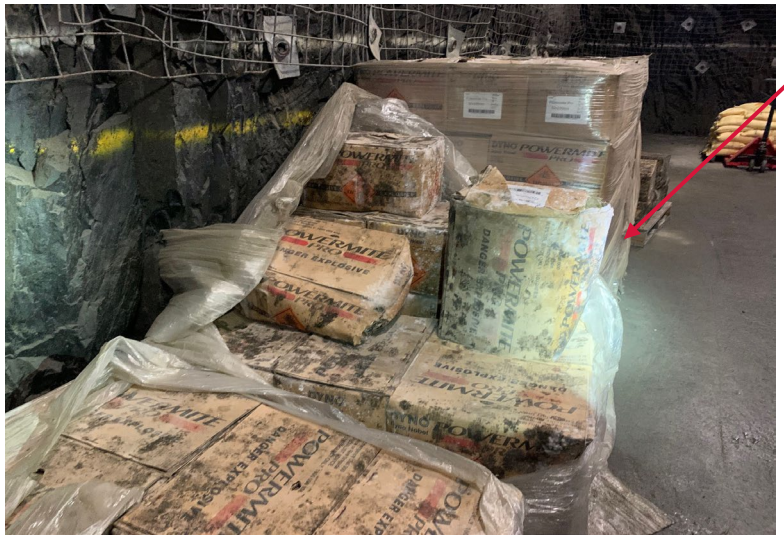
Magazine signage deteriorating.

Corrosion on the external surface of the magazine.

Trees inside the compound and along the security fence

Overloaded magazine and products outside of packaging

Explosives have fallen over and mould on products

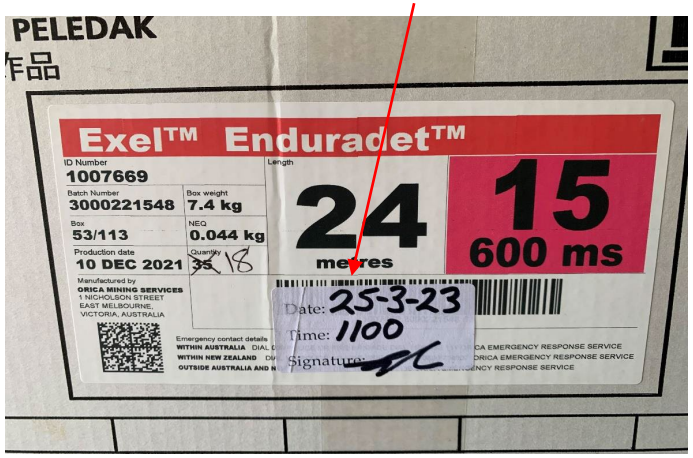


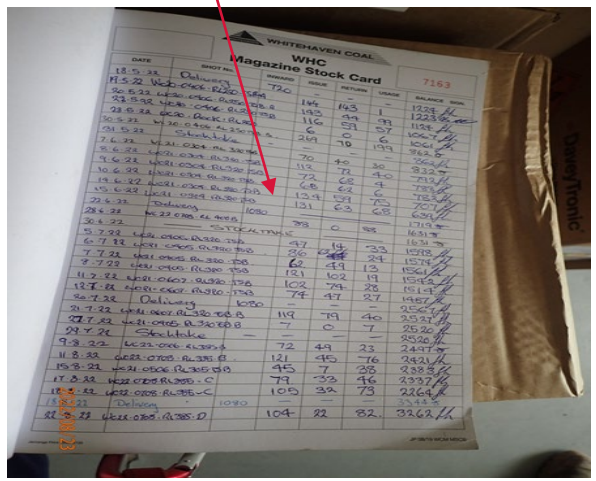
Magazines Good Practice

Correct signage &
labelling date after opening of box

Earthing of magazine correct hazmat box

Magazines with shade roof and mounding and magazine record books





Positive Observations

- Explosives control plan in place
- Explosive security plan in place
- Risk assessments
- Facilities licenced
- Procedures and process in place to manage certain aspect of explosives and blastin
- Workers are trained and have an understanding of what is required
- Magazines are is good condition and comply to most conditions
- Reload compounds are well maintained and comply to most conditions
- On bench activities are managed to on site procedures
- Shotfirers vehicles and MPU's are mostly compliant to relevant standards and codes
- Good understanding of hot and reactive ground issues.

Improvements not limited to:-

- Security and Explosives control plan are missing vehicle list – Explosives vehicles that carry and manufacture explosives
- Loss of magazine keys is not documented
- Emergency management of credible event – testing of the plans. Including the correct information in the Hazmat boxes
- Not all risks are identified in the explosives risk assessments – including sabotage, refuelling close to ammonium nitrate facilities, impact from equipment -example IT loaded and forklift etc
- Explosives Control Plan – missing phases of blasting for example loading holes- dry, wet, hot, decking, through seam etc
- Magazines – surface corrosion, earthing, vegetation, mounding not to standard, signage peeling off magazines, detonators and high explosives left outside their original packaging (Not following sites magazine rules)
- Reload compound – Incorrect signage (EIP's) on tanks and silos, ANE tanks have not been inspected for some time for integrity as per AS 4326, end caps missing off ANE hoses etc
- Shotfirers vehicles – Incorrect signage for mixed loads being transported, missing emergency procedure guides on the inside of drivers door, damaged explosives signs /wiring and carry box compliance etc
- On bench – traffic management – number of vehicles on the bench, some shotfirers are not aware of the explosives control plan and or security plan.
- The management of out of date explosives
- Managing risk while working near to exposed edges and under highwalls on blast benches.
- Training of shotfirers and ensure competency's are meet.

Storage of ANE and AN reload
Typical Hazchem signage at reload

Mobile processing unit MMU

Shot fires Vehicle Category 2 as per the AEC
And compliance plate on carry box.

Summary- The main areas of concern and examples in short

- Placarding – Hazchem signage incorrect
- Shotfirers vehicles- Carry box no compliance plate, no emergency response guides
- Housekeeping - Weeds and dry grass in magazine compounds and reload areas, ANE waste in buckets mixed with rags, accumulation of empty packaging and loose explosives.
- Emergency Response – Test the emergency plan, understand the type of emergency and know when and where to evacuate
- Security - Key register discrepancies not signing for keys, not all explosives are accounted for in the magazine record books.

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Emergency Service Information Package (ESIP).

HAZMAT

Justin Allan
Manager Emergency Planning and Response Capability (EPRC).

May 2023

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Department of Regional NSW

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Introduction

Justin Allan

Manager Emergency Planning and Response Capability (EPRC)

1

Justin Allan, Manager EPRC

- 20 years with Fire and Rescue NSW, served operationally as a Firefighter, Officer and Senior Officer. Most recently worked within the Fire Safety, Operational Safety and Office of the Commissioner Directorates.
- I have been with the Resources Regulator since January 2023 and looking to enhance its emergency management capability and provide industry with the tools to safely and efficiently prevent, prepare, respond and recover from emergency incidents.
- Initial focus will be to understand the complexity of emergency management within the mining industry and determine the best pathway to enhance both the Regulator and industry capability.

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Emergency Service Information Package (ESIP)

ESIP

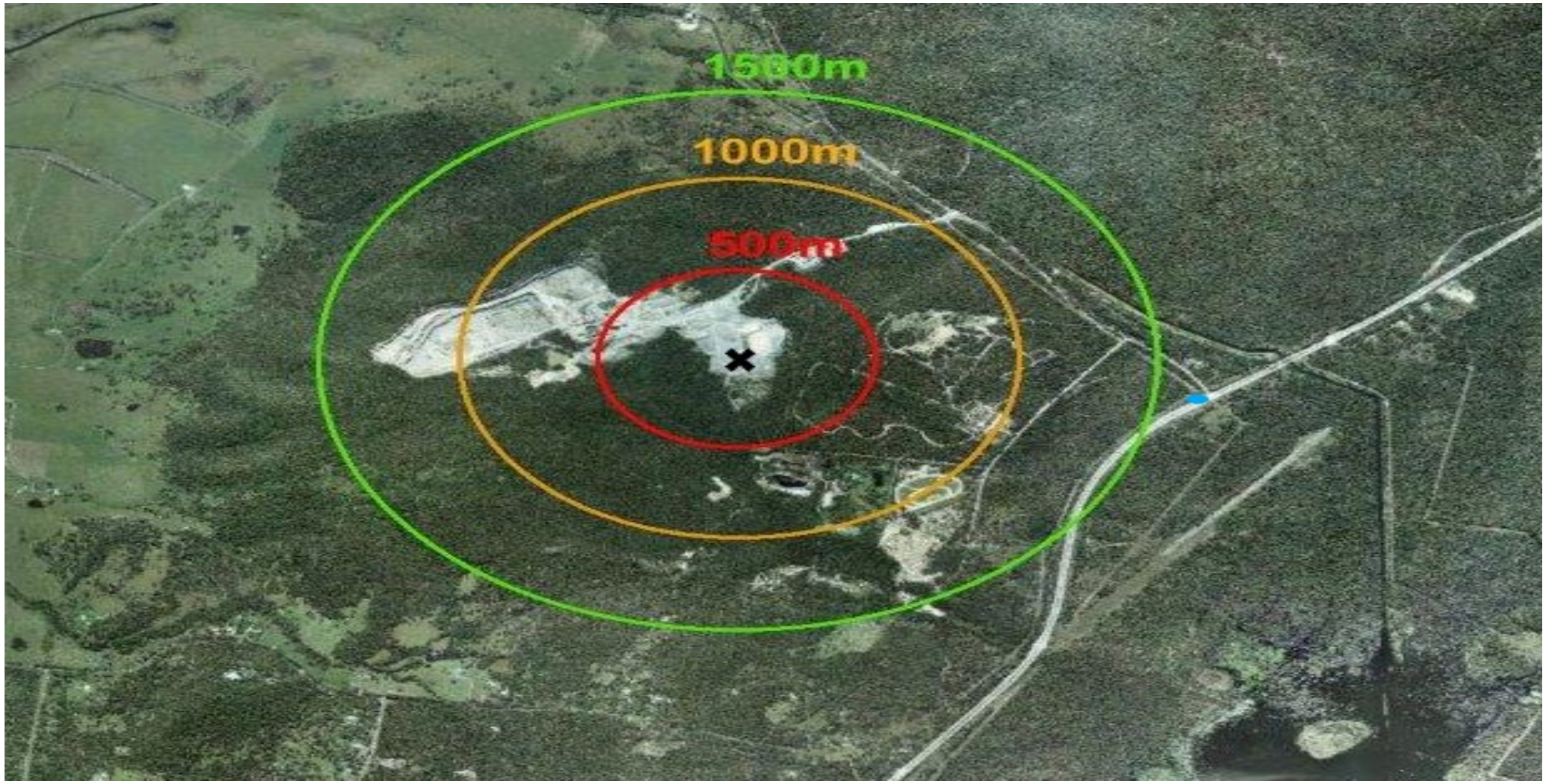
2

What is an ESIP

- An ESIP is an A3 size removable plastic binder which contains concise and relevant information about the site. The information is specifically designed to assist emergency services more easily identify critical factors and to develop and implement an effective Incident Action Plan (IAP) to manage a fire or emergency incident.

Contents

- An overview of the site (nature of the business, occupation during day/night etc).
- The sites Emergency plan.
- Contact list (a list of key personnel that can be contacted in an emergency).
- Evacuation overview.
- Tactical Check lists including Emergency shutdown procedures.
- Tactical fire plans including hydrant/sprinkler system details, essential utility services, and hazardous chemical locations.
- Details on hazardous chemicals including Manifests.
- Safety data Sheets for HAZCHEM.
- Mapping: Including you are here.


1500m
1000m
500m

Storage

- Within an ‘EMERGENCY INFORMATION’ container if the premises doesn’t have an FCC.
- The Emergency Information container is a weatherproof red box secured with a 003 key, generally located at a site entrance and a magazines/ re-load facilities.
- Within your Incident Control Centre/ Operations Room/ EOC etc.

Location

- Designated site entry point/s.
- Pre determined locations based on consultation with emergency services/ FRNSW.
- Alternate site entry points.
- Outside the magazines.
- Within the cold/warm or safe zone.

Hunter Valley, New South Wales, December 1999Industrial - Hunter Valley silo explosion

Industrial - Hunter Valley silo explosion

On 6 December 1999, an explosion took place at Rutherford's Caines margarine factory. The explosion was attributed to stored cotton seed which caught fire and created a fireball in the silo. Three individuals were critically injured in the incident and subsequently died. A firefighter also sustained injuries from the incident.

Benefits

- Portable package that can be picked up and moved to any location.
- Allows for quick access of information relevant to responding emergency responders. This is particularly critical for a premises without on-site staff which are remotely monitored.
- Provides easy to read information and instructions which can assist the decision-making process, especially for responders unfamiliar with the premises.
- More efficient handling of the incident leading to a better outcome for the business owner/operator or premises occupants (i.e., less damage, quicker resumption of operations, minimise revenue loss).

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EPRC Update

EPRC

3

EPRC Update

- Continuing with programmed Inspections on Emergency Planning and Response.
- Mine Sub Plan is endorsed and will be released shortly.
- Resources Regulator doctrine updated.
- LEMC/REMC engagements.
- Emergency exercises.
- Industry presentations.

References

- Australian Institute for Disaster resilience (AIDR). https://knowledge.aidr.org.au/resources/industrial-hunter-valley-silo-explosion-new-south-wales/
- **FRNSW:**
- https://www.fire.nsw.gov.au/gallery/files/pdf/guidelines/guidelines_ESIP_and_TFP.pdf
- https://www.fire.nsw.gov.au/page.php?id=9159
- **Resources regulator:**
- https://www.resourcesregulator.nsw.gov.au/safety/health-and-safety-management/emergency-planning
- **Legislation:**
- Work Health and Safety regulations 2017
- Work Health and Safety(Mines and petroleum sites) regulations 2022
- Work Health and Safety (Mines and petroleum sites) Act 2013

R.DUNCAN
PTY LIMITED

R.DUNCAN PTY LIMITED

We are one of a few manufacturers of relocatable explosive storage magazines in Australia.

There will be slight variances between manufacturers product.

However, all relocatable explosive storage magazines must be manufactured to comply with AS2187.1-1998

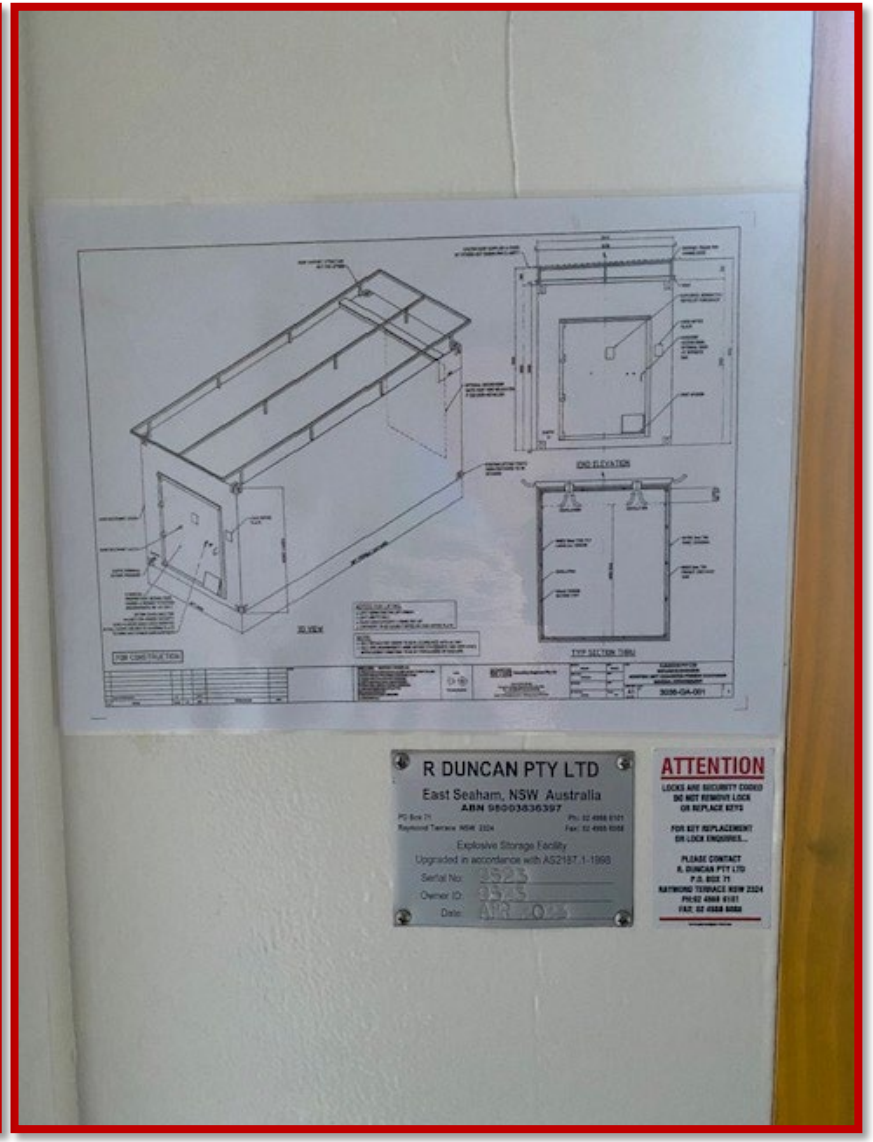
Who are we?

- Family owned and operated business located in the Lower Hunter Valley, NSW
- Operating since late 1950's through to today
- Specialise in the manufacture and supply of relocatable explosive storage magazines compliant to Australian Standard
- We continue to supply into all areas of mining, quarrying, civil and industrial industries.

R.DUNCAN PTY LIMITED

Magazine Compliance

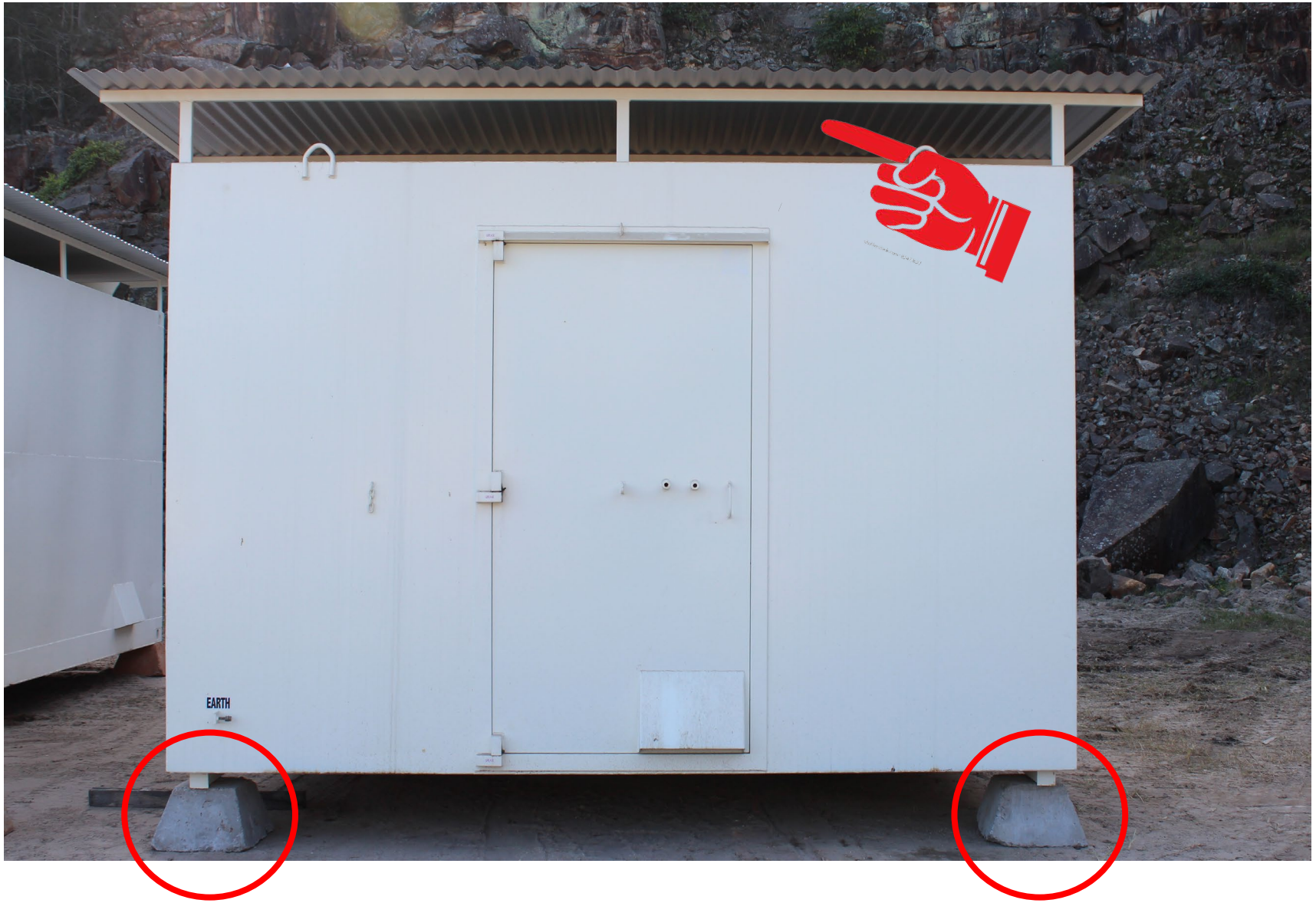
- R Duncan Pty Ltd place two compliance plates on a magazine
- R Duncan Pty Ltd magazines built or upgraded prior to 2011 will not necessarily have compliance plates
- Just because a magazine has a compliance plate **does not** mean that it is compliant to the AS today.
- Modifications may have taken place or the magazine could be damaged or have deteriorated.



R.DUNCAN PTY LIMITED

Installation of Magazines

- Concrete foundation blocks
- Shade roof cladding kit



R.DUNCAN PTY LIMITED

Visual Site Inspection

Regular maintenance is the key

- Door hinges
- Paintwork and rust
- Door vent & timberwork
- Roof channel vent
- Keep clear zone
- Stacking at height limits
- Earth points (R Duncan do not provide any advice on earthing of magazines)
- Penetration of external steel skin
- Door restraint
- Locking mechanism

R.DUNCAN PTY LIMITED

Keep in Mind…

- External vent covers may not be 5mm thick
- Exposed fork slots & base not sheeted
- Internal timber lining not painted
- Water damage via rotary type vents
- Damage to internal floor and walls

R.DUNCAN PTY LIMITED

Protect the Base

Protecting the base of the magazine is important

- Reduce the chance of extensive rust to the base sheets and runners
- Reduce maintenance costs

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Magazine Upgrade

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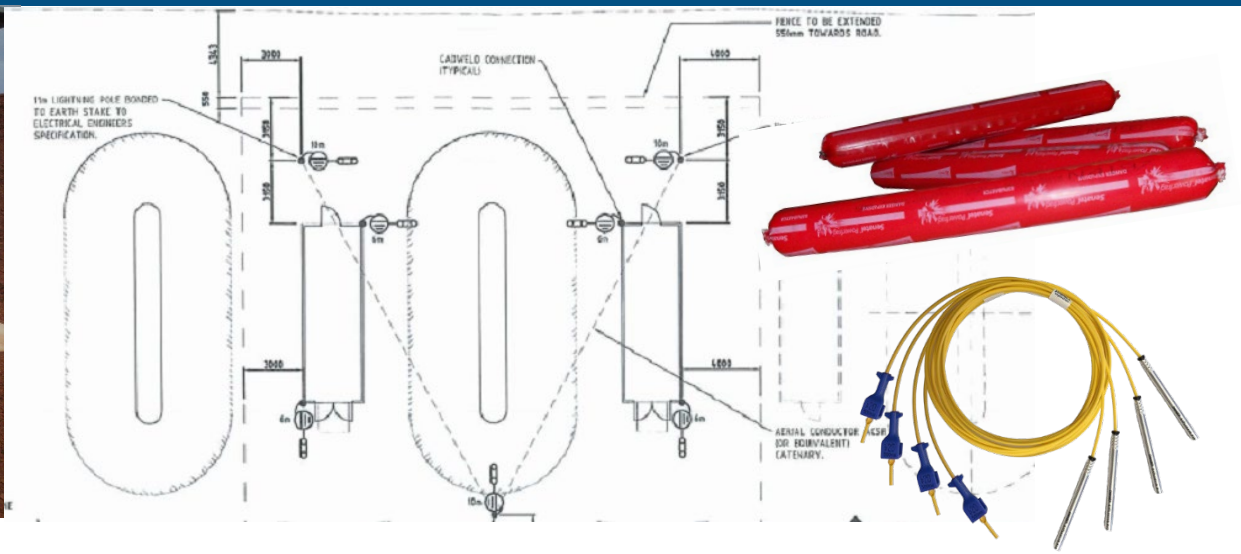
Magazine Upgrade



DRILL AND BLAST FORUM 2023

Explosive Storage and Electrical Risk Management

Matthew Bale, Engineering Director

Hunter Valley 2023

safearth training

Introduction - Safearth

Specialist electrical engineering consultancy

Leading expertise in earthing, lightning, electric incidents

Work across all industries including mining coal & hard rock

Team of 30+ engineers across Australia

Australian and International standards

- AS1768, IEEE998, AS2067, EG-0 & 1
- AS3007, AS7000

Design, test/commission, audit, investigation

Introduction – Why am I here

Storage of explosives can present significant risks, largely due to high consequence of a failure.

This talk will cover:

- Hazard sources: Lightning, Static, Electrical system
- Controls used to reduce risks
- Monitoring for controls failure and degradation.

These hazards are different, and each have unique controls.

Explosives and Storage

Explosives – Differences and Vulnerabilities

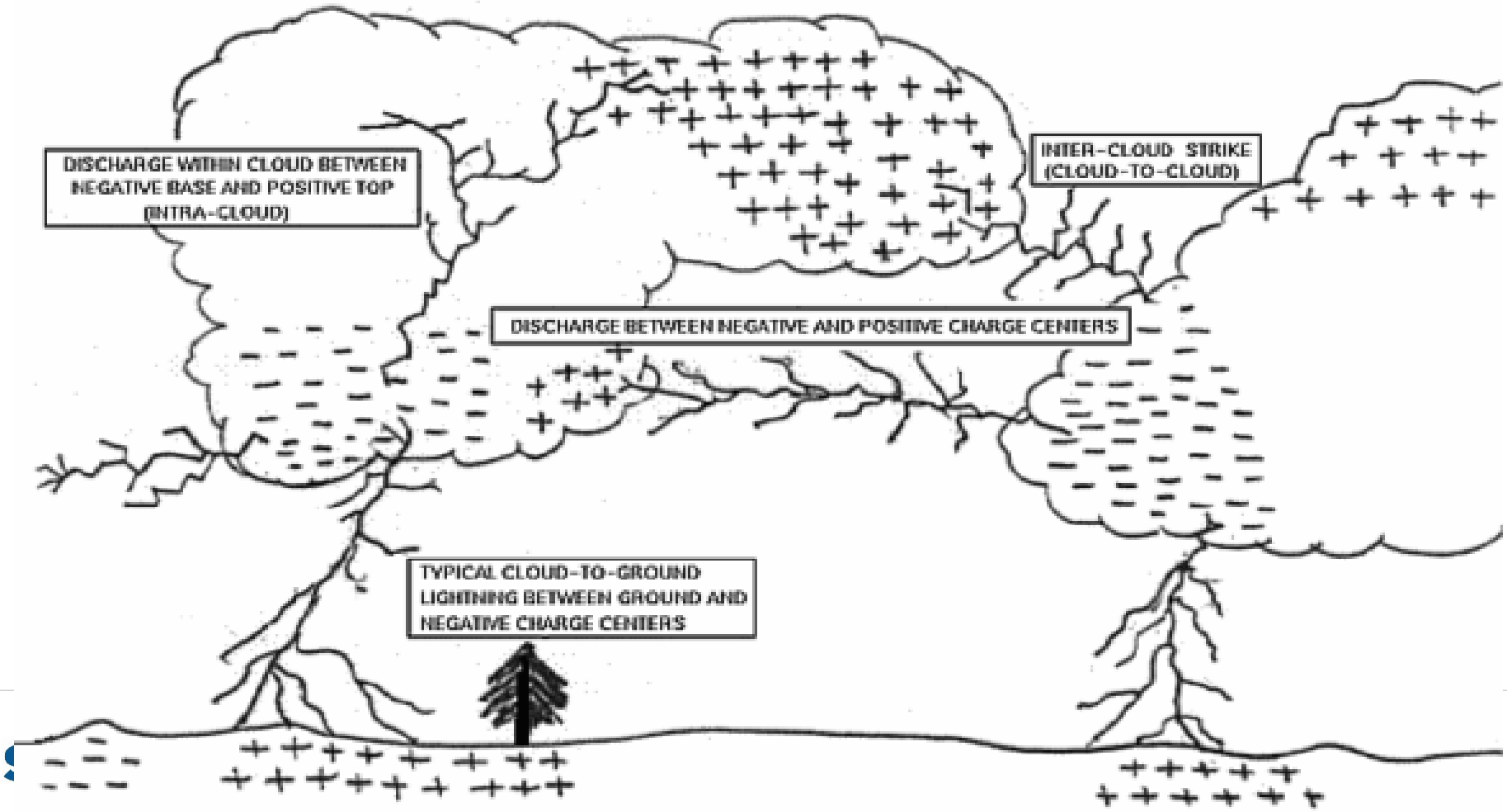
Risk	ANFO / emulsion	Cartridge	Primary explosives/ Detonators
Fire	Classified as non-flammable Can combust if subject to self heating reaction in containment.	Not typically	Yes.
Explosion	Yes. Requires pressure/containment and heat	Yes. Under confinement and heat	Yes. Can be sensitive to shock, flame, spark, electrical current, heat, impact.

Storage Facilities - Magazine

Storage Facilities – Bulk AN

Hazard Sources

Electrical Hazard Sources - Lightning




LiveLeak

Electrical Hazard Sources - Lightning

safearth training

Electrical Hazard Sources - Static

safearth training

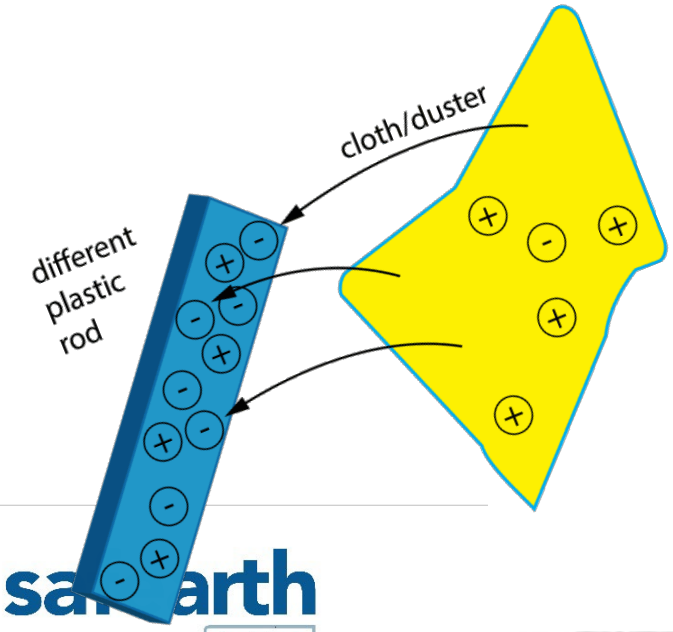
Electrical Hazard Sources - Static

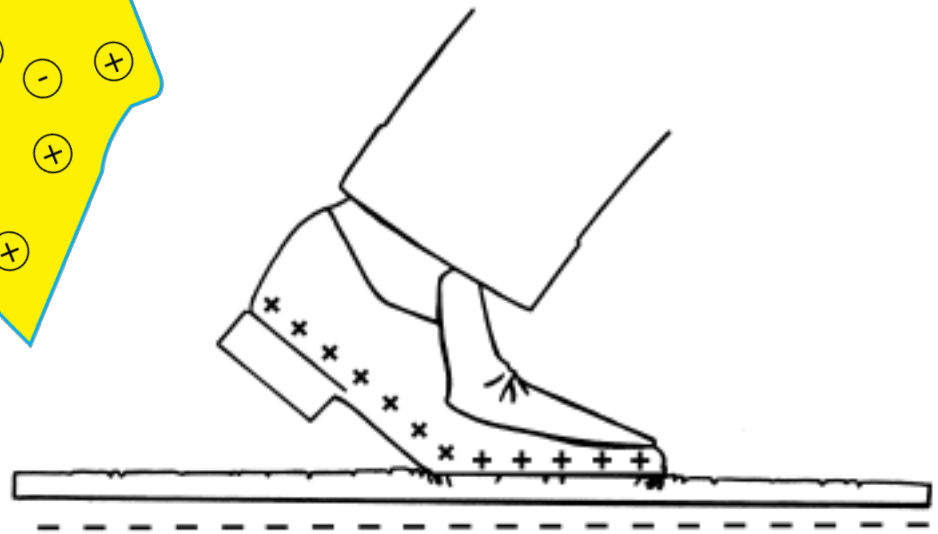
High voltages

Very small currents

Charged object discharges, causing a spark

Spark contains enough energy to ignite high explosives

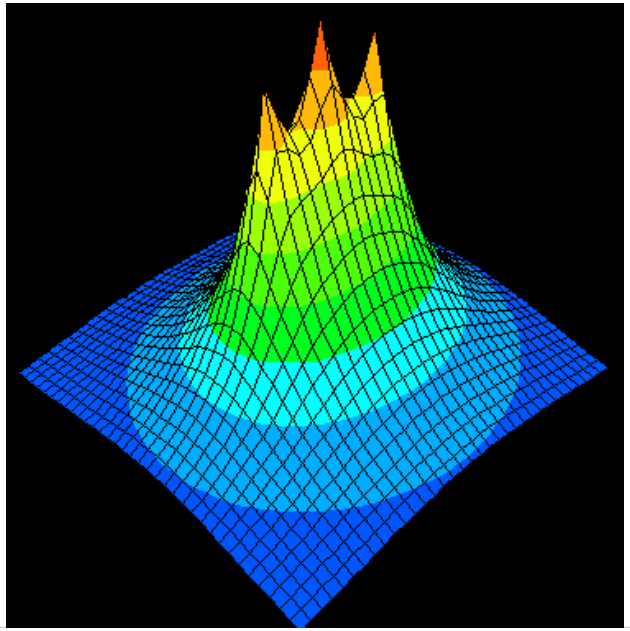


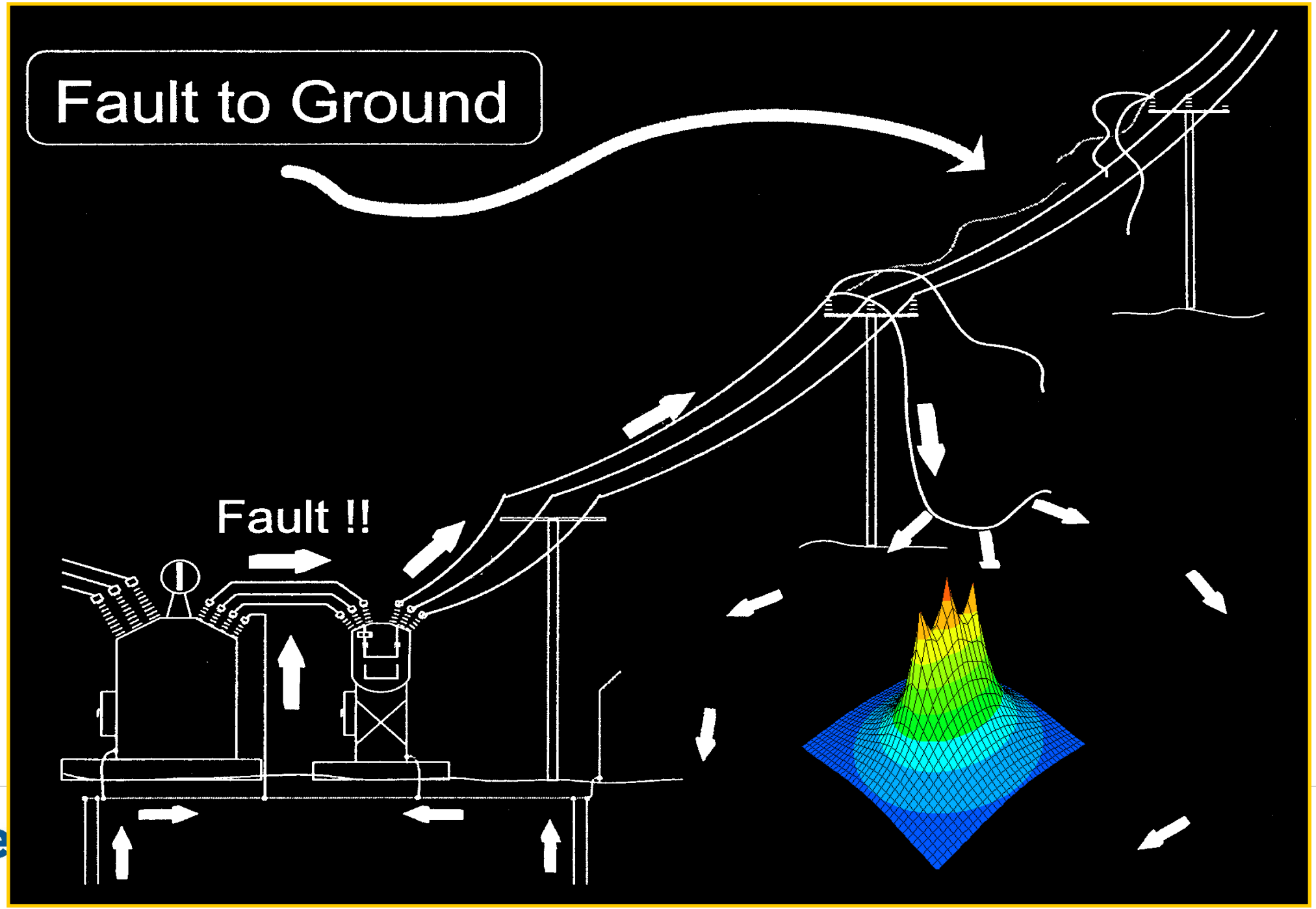


Electrical Hazard Sources – Power System

Power System Faults

- Arcing
- Earth Potential Rise from HV




Fault to Ground
Fault !!

Electrical Hazard Sources – Power System

Induction

- Capacitive coupling from HV powerlines
- Low frequency induction from current flow in powerlines into parallel conductors eg: pipe or fence.

Controls

Risk Controls

Hazard Source	Risk Controls
Lightning	Lightning Interception protection Magazine earthing and equipotential bonding Keep fences > 3m Procedural controls for load/unload AS1768
Static	Structure material Bonding and earthing Procedural controls for magazine access PPE – anti static clothing and footwear AS/NZS 1020
Power System	Physical separation to create an exclusion zone No LV supplies within exclusion

AS1768 - Lightning Protection - Risk Assessment

Example 2—Darwin hotel

Risk Assessment for Lightning Protection

Standards Australia Version 1.3 Date: 03/12/2003

Structure Identification: Hotel in Darwin

Structure Dimensions

Length (m)	15
Width (m)	15
Height (m)	30

Structure Attributes

Risk of Fire or Physical Damage	Low
Risk of Dangerous Discharge	Medium
Internal Wiring Type	Unscreened

Environment

Thunderdays per year	100
Environmental Factor	Similar Height
Service Line Density	Dense

Service Lines

Power Line

Service	Underground
Cable Type	Unscreened
Transformer at Structure	No Transformer

Other Overhead Services

Number	0
Cable Type	Unscreened

Other Underground Services

Number	0
Cable Type	Unscreened

Loss Categories

Category 1 - Loss of Human Life

Special Hazard	10	Fire Damage Factor	0.1	Overvoltage Damage Factor	0

Category 2 - Loss of Essential Services

Fire Damage Factor	0	Overvoltage Damage Factor	0

Category 3 - Loss of Cultural Heritage

Fire Damage Factor	0

Category 4 - Economic Loss

Fire Damage Factor	0.5	Acceptable Risk of Economic Losses	1.E-03
Overvoltage Damage Factor	5.E-03	Step & Touch Potential Damage Factors	0

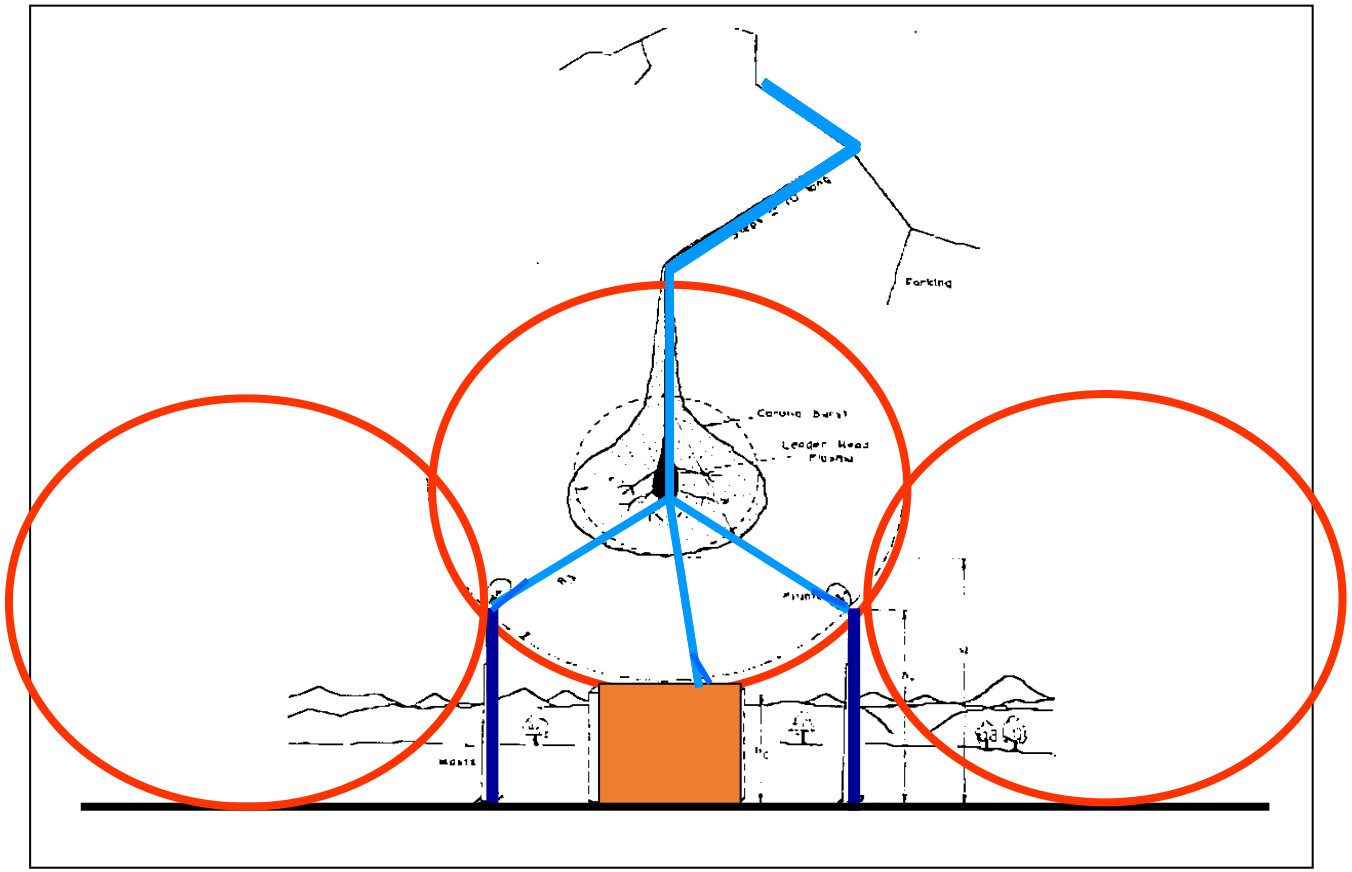
Protection Measures

Efficiency of Building Protection	0.8	Surge Protection at Point of Entry	Yes
Fire Protection	None	Surge Protection on All Equipment	No

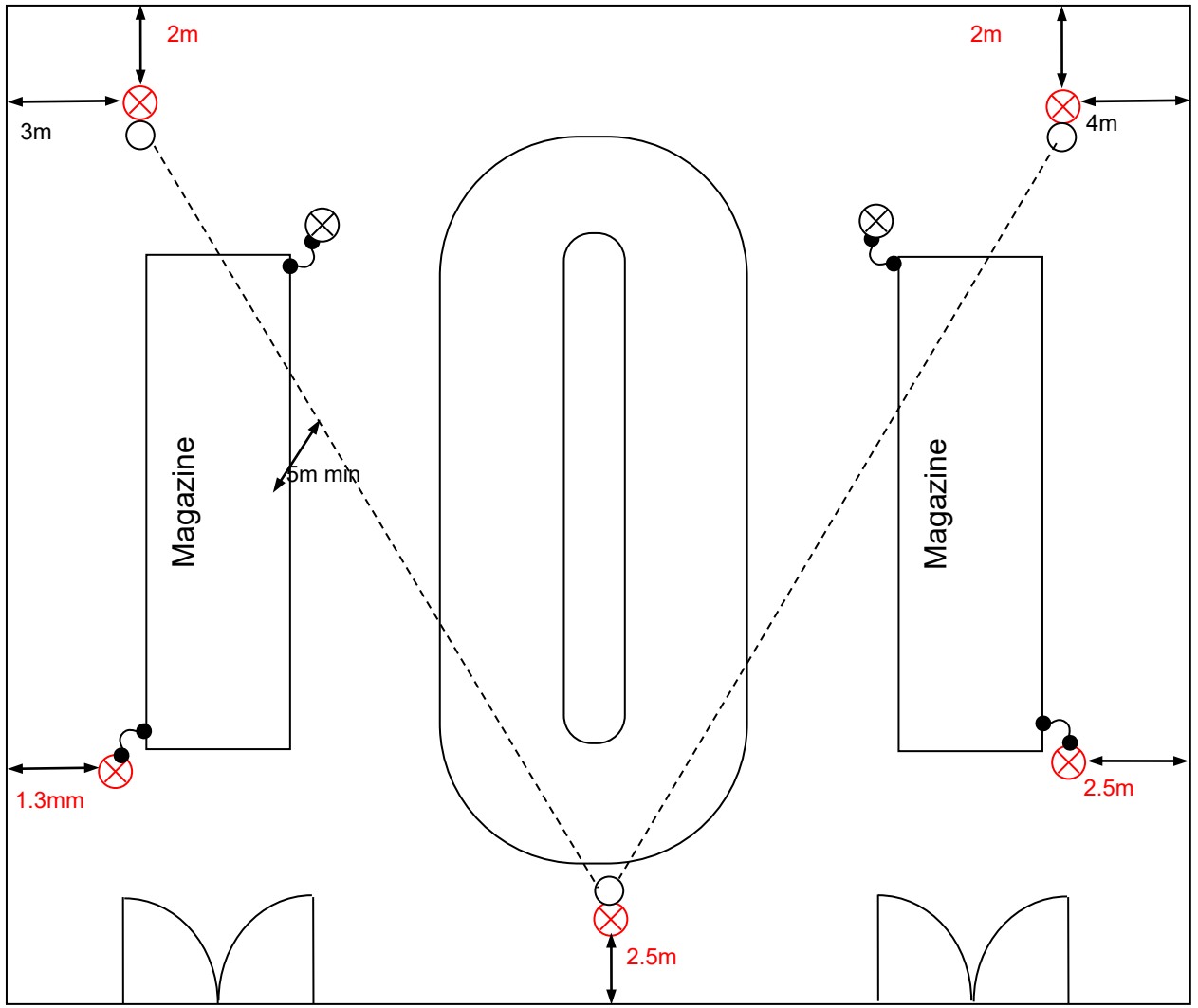
Overall Risk

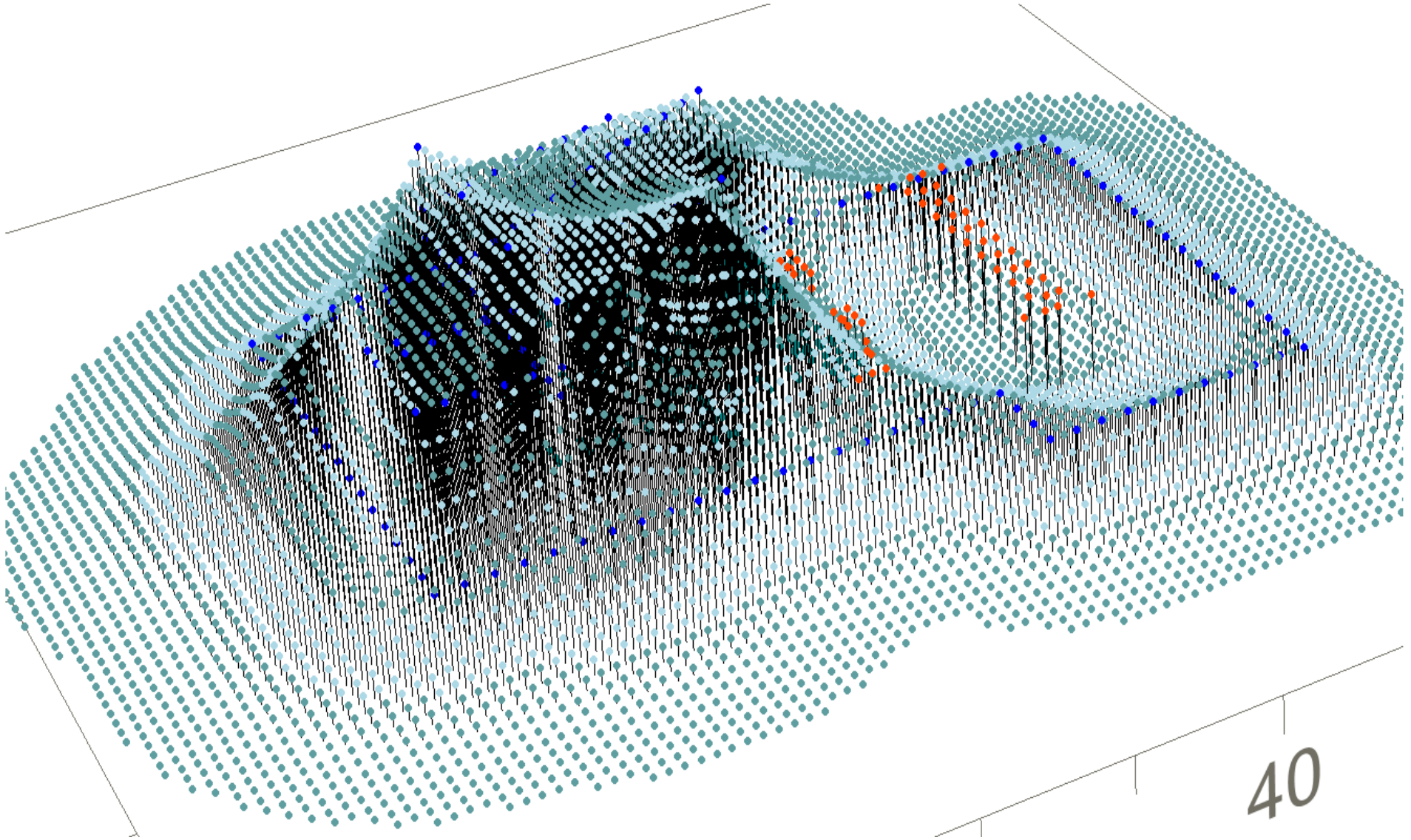
	Calculated Risk (R)	Acceptable Risk (Ra)	Direct Strike Risk (Rd)	Indirect Strike Risk (Ri)
Loss of Human Life	5.31E-06	1.0E-05	5.31E-06	0.00E+00
Loss of Essential Services	0.00E+00	1.0E-03	0.00E+00	0.00E+00
Loss of Cultural Heritage	0.00E+00	1.0E-03	0.00E+00	0.00E+00
Economic Loss	5.31E-04	1.0E-03	2.68E-05	5.04E-04

Intercepting the Strike – Rolling Sphere Concept



⊗ Electrode
○ Aerial mast
--- ACSR (or equiv) catenary
— Perimeter fence

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Intercepting the Strike

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Intercepting the Strike

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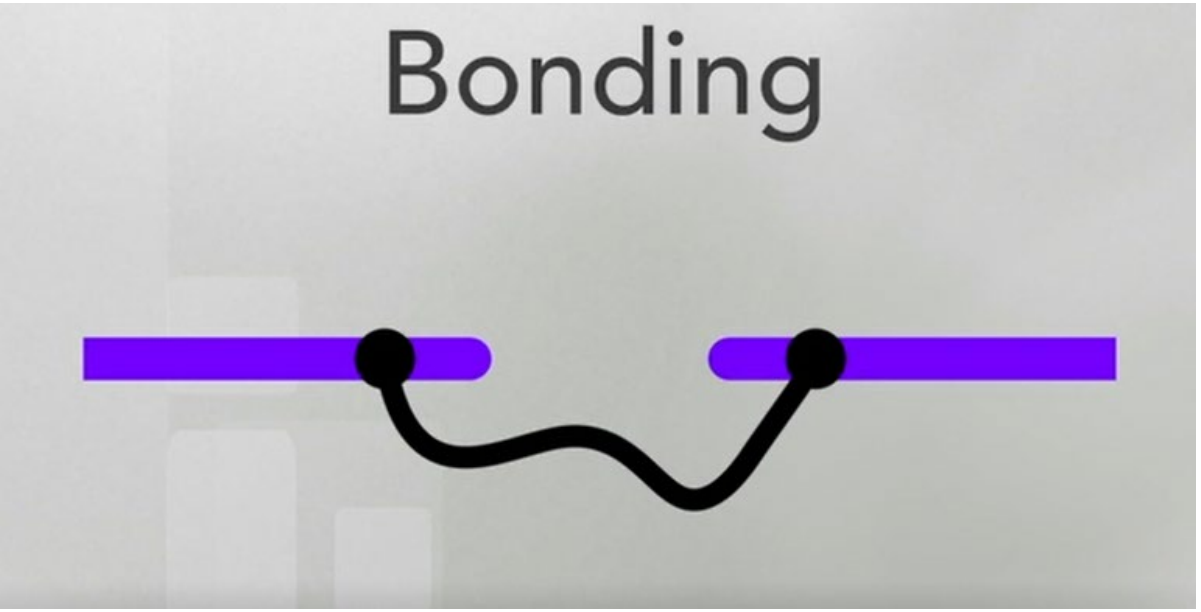
Earthing


EXPLOSIVE
10 000 KGS
DOM 3-07
EXPLOSIVE
1
MANUFACTURED BY
D. & F. ENGINEERING (W.A.)

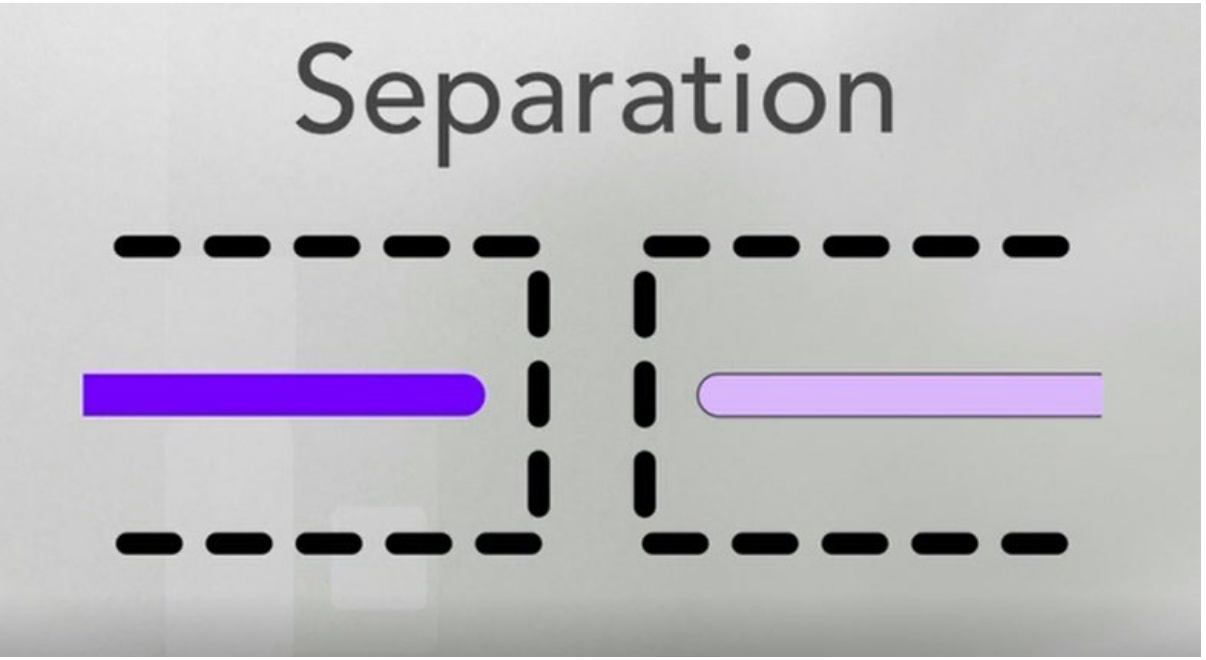
Equipotential Bonding



- Deliberate electrical bond between two conductive parts.
- Ensures that two things can never be at different electrical potential
- Eliminates risk of spark between parts
- Effective control for lighting and static.
- Used at doors, gates, tanks, hopper bins

Structure Material

Separation



- Creating an exclusion zone for power
- Reduces a high electrical potential being able to transfer to another area.
- Effective control for power system faults
- Keeps HV and LV out of magazine area
- Separate fencing – at least 3m.
- No extension leads into magazine area
- Use battery tools if needed.

Static Controls – People

For highly static environments

Anti-Static work boots

Don’t load / unload in a storm

Condition Monitoring

Condition Monitoring

- Regular inspection and test to validate control effectiveness.
- Minor defects can have a big impact on effectiveness of safety control

Condition Monitoring

- Regular inspection and test to validate control effectiveness.
- Minor defects can have a big impact on effectiveness of safety control

Condition Monitoring

Look out for:

- Loose, missing or broken connections
- Connection corrosion
- Electrode or backfill deterioration

Stay Safe

Holcim

Strength. Performance. Passion.

Drill and Blast Presentation Cooma Rd

Overview of site

Overview continued

- Site has been operational since the mid 60’s
- Supply Canberra and South Coast markets
- Production of Aggregates and road base materials as well as occasional amour rock and ballast.
- Current consent of 1.5Mt per annum this is sales and ENM/VENM
- Small crew of 14 people to run the site on a single shift

Drill and blast onsite

- Consent to blast Monday - Friday between 9:00am and 3:00pm
- Small crew of 14 people to run the site on a single shift
- Currently use contractors onsite to supply and fire our blasts we do not have our own shot firer
- Site is involved in the design and location of blast with consultation with our blasting contractor
- Consultation with contractors regarding SWMS, RA’s and ECP

Site locality

Challenges

- Ensuring our design is going to meet our needs contractor does not have a vested interest in the result
- Continual improvement
- Monitoring of the contractor and KPI’s for the contractor
- Ensuring the contractors stay in line with changes in legislation
- Managing maintenance program to fit in with our production schedule
- Consent conditions ie; blasting times, monitoring locations
- Dealing with complaints

Challenges

- Ensuring our design is going to meet our needs contractor does not have a vested interest in the result
- Continual improvement
- Monitoring of the contractor and KPI’s for the contractor
- Ensuring the contractors stay in line with changes in legislation
- Managing maintenance program to fit in with our production schedule
- Proximity to community


Holcim

SNAP, SLAP AND SHOOT INCIDENT 1998

Rob Hayes

Summerfield Consulting

Some Background - 1998

- Google founded
- Bill Clinton denies relations with Monica Lewinsky
- John Howard declined to meet the Spice girls
- Mobile phones were analogue “1G”
- Thermal Coal was worth US$26/tonne
- AND…. Open Cut Coal blasting commonly used Nonel or Detonating cord for initiation

Some things have not changed

- Nonel is still a very similar product
- Complacency is still with us

Disclaimer

- 25 years have passed since this incident
- I have not retained investigation reports, only a site notice issued the following day was found
- Digital photos were not commonly taken. One copy of a photograph was found that would have been taken on 35mm film.
- The mine-site has changed hands – none of this presentation reflects the current ownership, systems or processes at the mine
- Most people involved have since retired from the industry
- I do not consider myself to be a technical expert on the subject – I am passing on what happened

What happened

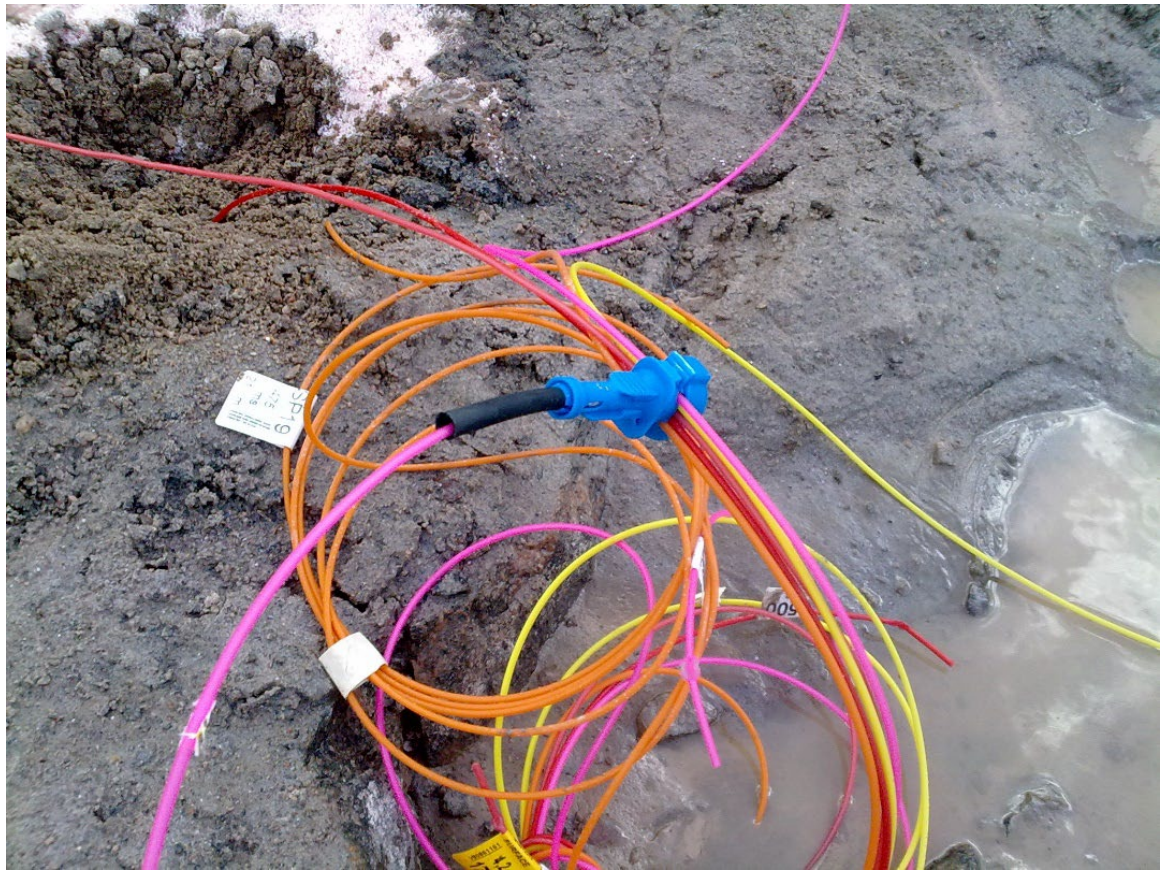
- An unplanned initiation of an Enduradet non-electric detonator occurred 7:30pm Friday 1 May 1998.
- This initiated a 2.5m deep blasthole containing 33kg of Powergel 2540 stemmed with 1.7m of gravel.
- There were three people on the shot at the time, none sustained serious injury. Two were taken to hospital for observation and released the same night.
- Initial investigations indicate that the Enduradet tail became entangled around the wheel of a stemming truck. The operator of the truck was within 5m of the blasthole when it fired. He sustained a laceration to his hand. The truck sustained considerable damage from flyrock.
- A shotfirer was at a lighting set approximately 7m from the blasthole. He dived behind the lighting set and luckily escaped physical injury.
- Flyrock was spread over a 30m radius and and fortunately missed the second shotfirer at his vehicle off the shot.

The scene – Saturday 2 May 1998

- This photo was taken the following day
  - It had started to rain
  - The photo shows the lighting plant – one shotfirer was lowering this at the time
  - The stemming truck and crater visible

Snap, Slap and Shoot – a technical description

- **Snap, Slap and Shoot is an occurrence where Nonel is stretched tight, snaps, the loose end flings against a metallic object creating a spark to initiate the nonel, and it initiates.**
- This was almost unheard of at the time
- The supplier acknowledges that incidents occurred at their detonator plant where Nonel was spun at high speeds on rolls, occasionally became jammed, then the loose end would break and hit against objects
- **The Theory emerged that the stemming truck drove over a loaded hole, Nonel became entangled around an axle, then the incident occurred**



Learnings

- **Post Incident Management of People**
  - I required all three people to undertake post trauma counselling.
  - The stemming truck operator refused as a contractor
  - Two weeks later the stemming truck operator went on sick leave and resigned from the job
- **Emergency management**
  - > 10 vehicles arrived at the scene and parked in a queue on a one lane track into the shot
  - Most were well meaning spectators
  - When the OCE arrived, he demanded everyone leave, reversing out one at a time
- **Disturbance of the scene**
  - Witnesses reported having seen nonel on the axle of the truck on the evening of the incident.
  - It was on the ground the following morning
- **Culture of acceptance**
  - Considered “normal” to drive over nonel
  - Nonel was considered “safe”
- **Blast Pattern “tidiness” is critical**
  - Don’t drive over Nonel
  - Plan your shots
  - Secure your downlines

Final Thoughts

- It’s real and can happen – Don’t drive over Nonel!
- Complacency is our enemy
- Emergency response – test it
- Investigation technique – Treat the statements of key witnesses like gold
- Follow up with those affected

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Around the grounds

Upcoming events

Seminars • Safety

Wednesday, 2 August 2023 at 9:00 am
Hyatt Regency Sydney

Mechanical Engineering Safety Seminar

Register now! The Mechanical Engineering Safety Seminar (MESS) is returning in 2023. The NSW Resources Regulator is proud to be hosting the...

→

Seminars • Safety

Wednesday, 18 October 2023 at 9:00 am
Sydney

Save the date: Mining Engineering Safety Seminar

Save the date: Wednesday 18 October 2023 and Thursday 19 October 2023. More details to come.

→

Seminars • Safety

Wednesday, 8 November 2023 at 9:00 am

Save the date: Electrical Engineering Safety Seminar

Save the date: Wednesday 8 November and Thursday 9 November. More details to come.

→

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Thank you