

FATAL RISK FACTORS

SAFETY HAND BOOK

MIMBULA MINERALS



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EXPLOSIVES AND BLASTING

Misfires, premature detonation, fly rock, explosives handling failures.



CRITICAL CONTROLS

- 1. Authorization:** Only trained, licensed, and authorised personnel may handle or work near explosives.
- 2. Follow Approved Procedures:** Always comply with legal requirements, mine standards, and approved blasting procedures and avoid shortcuts at all cost.
- 3. Access Control:** Restrict access to explosives, and blasting zone at all times.
- 4. Handle with Care:** Explosives must be handled carefully no impact, rough handling, or unnecessary movement.
- 5. Separate Components:** Keep explosives and initiation systems separated unless the OEM procedure specify otherwise.
- 6. No Ignition Sources:** Smoking, open flames, and unauthorized electronic devices are strictly prohibited near explosives and within the blasting zone.



EXPLOSIVES AND BLASTING

Misfires, premature detonation, fly rock, explosives handling failures.

CRITICAL CONTROLS

- 7. Wear Required PPE:** Mandatory PPE must be worn at all times during blasting related activities.
- 8. Establish Exclusion Zones:** Clearly mark and enforce blast exclusion zones before, during, and after blasting not until the area is cleared.
- 9. Communicate Clearly:** Ensure effective communication, Warning systems (sirens, radio and email alerts), and conduct pre and post blast briefings.
- 10. Respect Weather Conditions:** Do not proceed with blasting during unsafe weather or environmental conditions.
- 11. Manage Misfires Safely:** Treat all misfires as dangerous and follow approved misfire management procedures only.
- 12. Never Be Complacent:** Treat every blast as high-risk, report unsafe conditions and stop work if safety is compromised.



MOBILE EQUIPMENT INTERACTION

Vehicle collisions, run-overs, rollovers, reversing incidents.



CRITICAL CONTROLS

- 1. Authorization:** Only drive or operate equipment when properly trained and authorized.
- 2. Equipment Inspection:** Inspect equipment before each shift for signs of wear, damage, or leaks, and always sign off on the inspection checklist.
- 3. Blind Spots:** Be mindful of the equipment's blind spots and ensure no personnel or obstacles are nearby before operating.
- 4. Distance:** Maintain a safe following distance to allow for adequate reaction time in case of a sudden stop or emergency.
- 5. Distractions:** Avoid distractions such as texting, talking on the phone, or eating while operating the equipment, as they can impair focus and reaction time.
- 6. Drive within Limits:** Adhere to speed limits, adjust your driving to road and weather conditions, and avoid aggressive driving.



MOBILE EQUIPMENT INTERACTION

Vehicle collisions, run-overs, rollovers, reversing incidents.



CRITICAL CONTROLS

7. Drugs and Alcohol: Never operate equipment under the influence of drugs or alcohol, as impaired driving poses a risk to yourself and others.

8. Equipment Operating Zone: Only enter the equipment operating zone when necessary and authorized.

9. Working Near Open Edges: Use berms and windrows where needed to create a safer buffer zone.

10. Defensive Driving: Anticipate potential hazards by continuously scanning the road and remaining alert.

11. Fire Equipment: Ensure the fire extinguisher is easily accessible, unblocked, and properly mounted.

12. Parking: Always park equipment on level ground, use wheel chocks on heavy equipment, and designate separate parking areas for heavy equipment away from light-duty vehicles. Never leave mobile equipment running unattended to!



GROUND / STRATA / STRUCTURAL

High wall collapse, pit wall failure, slope instability, trench collapse, collapse of platforms, buildings, tanks, gantries, scaffolding.



CRITICAL CONTROLS

1. Geotechnical Hazard Identification &

Risk Assessment: Identify ground and strata failure hazards (slope instability, bench failure, highwalls, weak zones, faults, water ingress). Conduct pit-wide and task-specific geotechnical risk assessments.

2. Geotechnical Design & Slope Parameters: Design pit slopes, benches, berms, and haul roads based on geotechnical studies. Adhere strictly to approved slope angles, bench heights, and berm widths.

3. Ground Control Management Plan

(GCMP): Implement a site-specific Ground Control or Strata Management Plan. Define design criteria, monitoring, trigger action response plans (TARPs), and responsibilities.



GROUND / STRATA / STRUCTURAL

High wall collapse, pit wall failure, slope instability, trench collapse, collapse of platforms, buildings, tanks, gantries, scaffolding.



CRITICAL CONTROLS

4. Geotechnical Inspections & Monitoring:

Conduct routine inspections of highwalls, benches, ramps, and dump faces by competent personnel. Use monitoring systems (prisms, radar, LiDAR, crack meters).

5. Trigger Action Response Plans (TARPs): Establish clear trigger levels for ground movement or instability. Define escalation actions, exclusion zones, and evacuation protocols.

6. Water Management & Drainage Control:

Control surface and groundwater through effective drainage, dewatering, and diversion. Prevent water build-up that may weaken ground conditions.

7. Blasting Design & Control Design blasts to minimise ground vibration and over-break. Control blast vibration, burden, spacing, and timing near pit walls.



GROUND / STRATA / STRUCTURAL

High wall collapse, pit wall failure, slope instability, trench collapse, collapse of platforms, buildings, tanks, gantries, scaffolding.



CRITICAL CONTROLS

8. Exclusion Zones & Barricading: Establish and enforce exclusion zones near highwalls, unstable slopes, and dumps. Clearly mark, barricade, and put signage (no-go area).

9. Safe Work Practices Near Highwalls: Prohibit work or parking under unsupported or unstable highwalls. Maintain safe standoff distances for equipment and personnel.

10. Waste Dump & Stockpile Stability: Design, construct, and monitor waste dumps and stockpiles to prevent slope failure. Control lift heights, dumping methods, and traffic management.

11. Competency, Training & Awareness: Train workers to recognize signs of ground instability (cracks, rockfalls, bulging, water seepage). Ensure only competent personnel conduct geotechnical assessments.



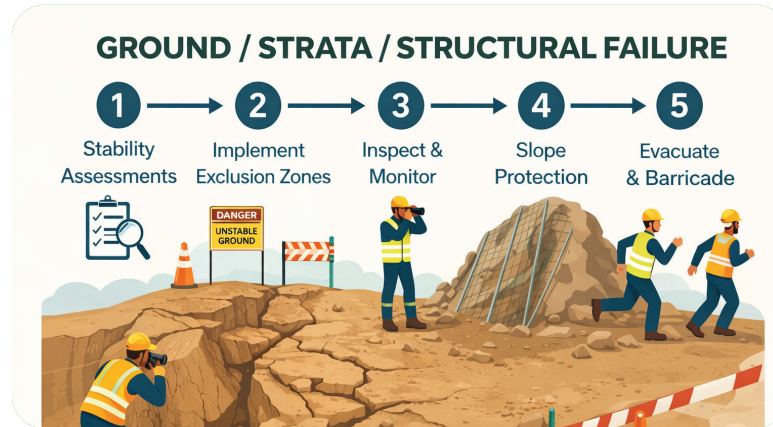
GROUND / STRATA / STRUCTURAL

High wall collapse, pit wall failure, slope instability, trench collapse, collapse of platforms, buildings, tanks, gantries, scaffolding.



CRITICAL CONTROLS

12. Change Management & Review: Apply a formal Management of Change (MoC) process for changes in design, geology, mining method, or operating conditions. Regularly review and update ground control measures.



ELECTRICAL ENERGY (HV & LV)

Contact with live conductors, arc flash, electrocution.



CRITICAL CONTROLS

- 1. Authorization & Competency:** Only licensed, trained, and authorized electrical personnel perform HV/LV work.
- 2. Permit to Work (PTW):** Valid electrical permits are issued, approved, and understood before work starts.
- 3. Positive Isolation:** All energy sources are isolated at the correct point using approved isolation devices.
- 4. Lock-Out / Tag-Out (LOTO):** Isolations are locked and tagged to prevent inadvertent re-energization.
- 5. Prove De-Energized (Test for Dead):** Use approved, tested instruments to confirm zero voltage before touching conductors.
- 6. Stored Energy Control:** Capacitors, batteries, UPS systems, and induced voltages are discharged or isolated.
- 7. Earthing & Short-Circuiting (HV):** Apply portable earths where required to protect against induced or back-feed voltage.



ELECTRICAL ENERGY (HV & LV)

Contact with live conductors, arc flash, electrocution.



CRITICAL CONTROLS

8. Arc Flash Risk Control: Conduct arc flash assessments and wear correctly rated arc-flash PPE.

9. Insulated Tools & Equipment: Use voltage-rated tools, test equipment, and insulating barriers appropriate to HV/LV tasks.

10. Access Control & Barricading: Establish exclusion zones, warning signage, and controlled access to electrical work areas.

11. Environmental & Housekeeping Controls: Manage water, dust, lighting, and cleanliness to reduce electrical hazards.

12. Recommissioning & Testing: Follow formal testing, inspection, sign off, and controlled re-energization procedures.



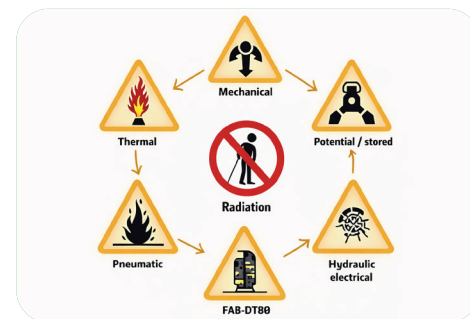
FATAL RISK FACTOR

MECHANICAL ENERGY

Unexpected start-up, hot work and release of stored energy during maintenance.

CRITICAL CONTROLS

- 1. Positive Isolation (LOTO):** Always isolate, lock, and tag all energy sources before starting work.
- 2. Test for Zero Energy:** Physically test isolations to confirm the plant cannot start or move.
- 3. Control Stored Energy:** Release or restrain hydraulic pressure, springs, counterweights, and suspended loads.
- 4. Secure Equipment & Components:** Support components with stands, pins, or blocks—never rely on hydraulics alone.
- 5. Safe Access to Work Area:** Use approved platforms, stairs, and ladders; donot improvise access.
- 6. Working at Height Controls:** Use fall prevention or arrest systems whenever there is a fall risk.
- 7. Manage Line of Fire:** Keep hands, feet, and body out



FATAL RISK FACTOR

MECHANICAL ENERGY

Unexpected start-up, hot work and release of stored energy during maintenance.

CRITICAL CONTROLS

of pinch points, crush zones, and drop zones.

8. Correct Use of Tools & Lifting Gear: Use inspected, fit for purpose tools, torque equipment, and certified lifting gear.

9. Barricading & Exclusion Zones: Barricade work areas to prevent interaction with operating plant or pedestrians.

10. Hot Work & Fire Prevention: Follow hot work permits, remove combustibles, and maintain fire watch where required.

11. Clear Communication & Supervision: Confirm task steps, roles, and hazards with your supervisor before starting work.

12. Safe Recommissioning: Refit all guards, remove tools, clear personnel, and follow sign-off before start-up.



FIRE AND EXPLOSIONS

Fuel fires, fires of electrical origin due to overloads and short circuiting, gas/dust explosions, hot-work ignition, and process plant fires due to the use of combustible reagents.

CRITICAL CONTROLS

1. Hazard Identification & Risk Assessment: Identify fire and explosion hazards such as flammable gases, combustible dust, fuels, explosives, hot work, and electrical faults. Conduct task- and area-specific risk assessments.

2. Control of Flammable & Combustible Materials: Minimize quantities of fuels, oils, gases, and chemicals stored in work area such as in drums and containers. Store materials in approved, ventilated, and fire-rated facilities.

3. Ventilation & Gas Management: Maintain adequate ventilation to dilute and remove flammable gases, fumes, and dust. Continuous monitoring where methane, hydrogen, or other explosive gases may be present.



FIRE AND EXPLOSIONS

Fuel fires, fires of electrical origin due to overloads and short circuiting, gas/dust explosions, hot-work ignition, and process plant fires due to the use of combustible reagents.

CRITICAL CONTROLS

4. Ignition Source Control: Control hot surfaces, friction, sparks, static electricity, and open flames. Enforce strict controls on smoking, welding, grinding, and cutting.

5. Hot Work Permit System: Ensure the hot work permit process is followed through. Gas testing, fire watches, and post-work monitoring must be conducted.

6. Electrical Equipment Safety: Use flameproof, explosion-protected, or intrinsically safe electrical equipment where required. Regular inspection, testing, and maintenance of electrical installations.

7. Mobile Equipment Fire Prevention: Fit mobile equipment with fire suppression systems, thermal protection, and fire-resistant hydraulic fluids where applicable. Conduct regular inspections for leaks,



FIRE AND EXPLOSIONS

Fuel fires, fires of electrical origin due to overloads and short circuiting, gas/dust explosions, hot-work ignition, and process plant fires due to the use of combustible reagents.

CRITICAL CONTROLS

overheating, and damaged hoses.

8. Housekeeping & Dust Control: Maintain good housekeeping to prevent accumulation of combustible dust and waste. Implement dust suppression and regular cleaning regimes.

9. Explosives Handling & Storage Controls: Store explosives and detonators in approved magazines. Ensure separation, secure transport, competent handling, and strict procedural compliance.

10. Fire Detection & Suppression Systems: Install and maintain fire detection, alarm, and suppression systems (e.g., sprinklers, deluge, foam, extinguishers). Ensure systems are suitable for the fire class.

11. Training, Competency & Awareness: Train workers in fire risks, emergency response, use of fire extinguishers, and evacuation procedures. Only competent and authorized personnel to perform high-risk tasks.



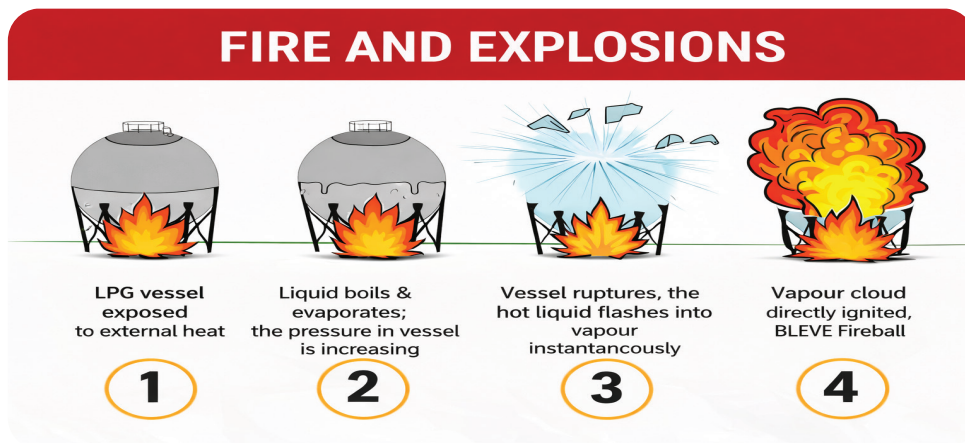
FIRE AND EXPLOSIONS

Fuel fires, fires of electrical origin due to overloads and short circuiting, gas/dust explosions, hot-work ignition, and process plant fires due to the use of combustible reagents.

CRITICAL CONTROLS



12. Emergency Preparedness & Response Planning: Develop and regularly test emergency response plans for fires and explosions. Conduct drills, ensure escape routes are clear, and provide refuge chambers where required.



WORKING AT HEIGHT

Any work to be performed above 1.5m from the ground such as on roof top, elevated plant Structures, conveyors, pit edges and ladders.

CRITICAL CONTROLS

1. Task Hazard Identification & Risk Assessment:

Identify fall hazards (edges, openings, fragile surfaces, weather, moving equipment). Conduct a task-specific risk assessment before work begins.

2. Permit-to-Work / Authorization: Obtain a valid Working at Heights permit where required. Clearly define scope, duration, controls, and competent personnel.

3. Elimination or Substitution First: Eliminate working at height where possible (prefabrication at ground level). Substitute with safer methods (remote tools, extended equipment).

4. Engineering Controls in Place: Install fixed platforms, handrails, toe boards, covers, or scaffolding. Ensure all structures are designed and certified for load capacity.



WORKING AT HEIGHT

Any work to be performed above 1.5m from the ground such as on roof top, elevated plant Structures, conveyors, pit edges and ladders.

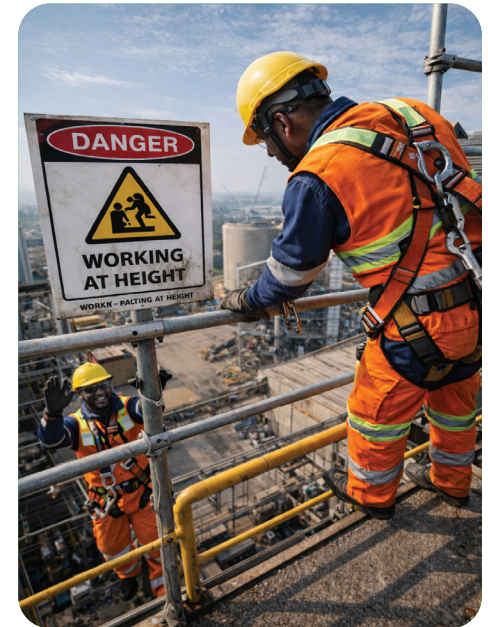
CRITICAL CONTROLS

5. Fall Prevention Systems: Use guardrails, temporary edge protection, or travel restraint systems to prevent falls.

6. Fall Arrest Systems (Last Line of Defence): Use full body harnesses, shock-absorbing lanyards, inertia reels, and certified anchor points. Ensure correct fall clearance and anchorage ratings.

7. Inspection of Equipment & Anchor Points: Inspect harnesses, lanyards, connectors, ladders, scaffolds, and anchor points before use. Remove defective equipment from service immediately.

8. Competent & Trained Personnel: Only trained, medically fit, and authorized workers to perform work at height. Competency in harness use, rescue techniques, and hazard awareness.



FATAL RISK FACTOR

WORKING AT HEIGHT

Any work to be performed above 1.5m from the ground such as on roof top, elevated plant Structures, conveyors, pit edges and ladders.

CRITICAL CONTROLS

9. Management of Working Floor: Prevent slips and trips by controlling water, mud, and oil, securing tools and equipment, and maintaining effective good housekeeping practices.

10. Environmental & Site Conditions: Assess wind, rain, heat, dust, lighting, and ground stability. Suspend work when conditions become unsafe.

11. Prevention of Falling Objects: Secure tools and materials using tool lanyards. Barricade and signpost drop zones below elevated work areas.

12. Emergency Response & Rescue Plan: A site specific fall rescue plan must be in place before work commences.



WORKING AT HEIGHT

HAZARDS	PRECAUTIONS
 Fall from height Risk of serious injury or death	 Wear full-body safety harness connected to lifeline
 Falling objects Tools, materials hitting workers below	 Install guardrails & toe boards on platforms
 Unstable scaffolding/ ladders Collapse or tipping	 Secure tools and materials with lanyards or nets
 Slippery surfaces Loss of balance	 Inspect scaffolding/ ladders before use
 Weather conditions Strong wind or rain	 Use non-slip footwear before use
 No edge protection Increased fall risk	 Avoid working in bad weather Provide clear safety signage

FALLING OBJECTS

Rock fall, dropped tools, suspended loads, overhead works.



CRITICAL CONTROLS

- 1. Overhead Installation and Structures:** Ensure all overhead installations or structures are properly fitted and regularly inspected for corrosion and loose bolts.
- 2. Engineered Edge Protection:** Install toe boards (kickplate), and other barriers on all elevated working platforms to prevent tools and materials from falling.
- 3. Fall Prevention Before Fall Arrest:** Eliminate or prevent fall risks using platforms and barriers before relying on harness systems.
- 4. Fall Arrest Systems** Certified harnesses, lanyards, inertia reels, and anchor points are used and inspected before use.
- 5. Improperly Rigged and Unstable Loads:** Ensure loads are correctly rigged, evenly balanced, within safe load limits, and lifted using



FALLING OBJECTS

Rock fall, dropped tools, suspended loads, overhead works.



CRITICAL CONTROLS

undamaged slings and shackles to prevent slipping or falling.

6. Overhead Crane & Structure Access

Controls: Ensure designated access points, walkways, and tie-off locations are provided for crane and gantry work.

7. Conveyor & Crusher Access Control: Ensure walkways, handrails, covers, and maintenance platforms are installed, properly secured and used correctly.

8. Pit Edge & Slope Protection: Ensure berms, windrows, barricades, and setback distances are maintained at pit edges and highwalls.

9. Surface Condition Management: Ensure slips and trips are controlled by managing water, mud, oil, loose rock, and tool/equipment are properly secured.



FALLING OBJECTS

Rock fall, dropped tools, suspended loads, overhead works.



CRITICAL CONTROLS

10. Vibration from Machinery: Install vibration dampers or isolators on crushing units, moving equipment, and screens to avoid weakening of support structures and bolts.

10. Environmental & Site Conditions: Assess wind, rain, heat, dust, lighting, and ground stability. Suspend work when conditions become unsafe.

11. Prevention of Falling Objects: Secure tools and materials using tool lanyards. Barricade and signpost drop zones below elevated work areas.

12. Emergency Response & Rescue Plan: A site-specific fall rescue plan must be in place before work commences.



FATAL RISK FACTOR

CONFINED SPACE / IRREPARABLE & NOXIOUS ATMOSPHERES

Oxygen deficiency, toxic gases, engulfment.



CRITICAL CONTROLS

1. Confined Space Identification & Authorization:

Confirm the space is formally classified as a confined space and authorized for entry.

2. Permit to Work (Confined Space Entry Permit):

A valid permit is issued, approved, and communicated to all involved personnel.

3. Atmospheric Testing (Pre-Entry): Test for oxygen levels, flammable gases, and toxic contaminants using calibrated detectors.

4. Continuous Atmospheric Monitoring: Maintain ongoing gas monitoring during occupancy to detect changing conditions.

5. Ventilation & Purging: Provide forced ventilation or purging to maintain a breathable atmosphere.



FATAL RISK FACTOR

CONFINED SPACE / IRREPARABLE & NOXIOUS ATMOSPHERES

Oxygen deficiency, toxic gases, engulfment.



CRITICAL CONTROLS

- 6. Isolation of Energy & Materials:** Positively isolate mechanical, electrical, hydraulic, and process lines; blank, blind, or disconnect where required.
- 7. Control of Noxious Substances:** Identify, eliminate, or substitute hazardous chemicals, fumes, dusts, or gases where possible.
- 8. Respiratory Protection:** Use correctly selected, fit-tested respiratory protective equipment and self-contained breathing apparatus (RPE/SCBA) when required.
- 9. Access, Egress & Rescue Provision:** Ensure safe entry/exit points and a documented, practiced rescue plan with trained personnel and equipment.
- 10. Standby Person (Hole Watch):** Assign a competent attendant to monitor entrants and conditions at all times.



FATAL RISK FACTOR

CONFINED SPACE / IRREPARABLE & NOXIOUS ATMOSPHERES

Oxygen deficiency, toxic gases, engulfment.

CRITICAL CONTROLS

11. Communication & Accountability: Maintain reliable communication and track personnel entering and exiting the space.

12. Emergency Response & Evacuation: Define clear emergency triggers, evacuation procedures, and rapid medical response capability.



TYRE AND RIM HANDLING

Explosive rim separation, tyre inflation failure (high-energy events).



CRITICAL CONTROLS

- 1. Hazard Identification & Risk Assessment:** Identify tyre and rim hazards such as stored energy, multi-piece rims, heat, pressurisation, and handling risks. Conduct task-specific risk assessments before work begins.
- 2. Competent & Authorised Personnel Only:** Tyre and rim work to be performed only by trained, assessed, and authorised personnel. Clear competency requirements for LD, MD, and ORT tyres.
- 3. Correct Tyre, Rim & Component Matching:** Ensure tyre, rim, bead, lock ring, and components are compatible and manufacturer-approved. Never mix components from different manufacturers unless approved.
- 4. Isolation of Vehicle & Energy Sources:** Park on level ground, apply park brake, chock wheels, and isolate



TYRE AND RIM HANDLING

Explosive rim separation, tyre inflation failure (high-energy events).



CRITICAL CONTROLS

vehicle systems. Lower suspended loads and ensure the vehicle is stable before work.

5. Deflation Before Removal: Fully deflate tyres before loosening wheel nuts or rim components. Remove valve

cores and confirm zero pressure.

6. Safe Inflation Practices: Inflate tyres using a remote inflation device with clip-on chuck and in-line gauge. Stand outside the trajectory zone during inflation.

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6. Safe Inflation Practices: Inflate tyres using a remote inflation device with clip-on chuck and in-line gauge. Stand outside the trajectory zone during inflation.



TYRE AND RIM HANDLING

Explosive rim separation, tyre inflation failure (high-energy events).



CRITICAL CONTROLS

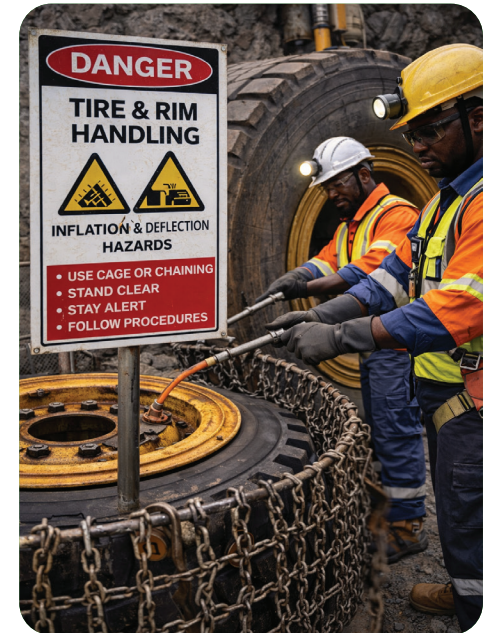
7. Use of Safety Cages or Barriers: Use approved tyre inflation cages or physical barriers for LD, MD, and ORT tyres where risk assessment dictates. Ensure cages are rated for tyre size and pressure.

8. Inspection of Tyres, Rims & Components: Inspect for cracks, corrosion, distortion, heat damage, missing components, or bead damage. Remove damaged or suspect components from service.

9. Handling & Lifting Controls: Use mechanical aids (cranes, tyre handlers, forklifts) designed for tyre size and weight. Avoid manual handling of heavy tyres and rims.

10. Exclusion Zones & Barricading: Establish exclusion zones during inflation, deflation, and fitting. Prevent unauthorised access to the tyre work area.

11. Heat, Fire & Pyrolysis Controls: Do not approach or



TYRE AND RIM HANDLING

Explosive rim separation, tyre inflation failure (high-energy events).

CRITICAL CONTROLS

work on tyres exposed to fire, overheating, or braking events. Apply cooling and exclusion periods where pyrolysis is suspected.

12. Emergency Response & Incident Preparedness:

Have procedures for tyre burst, rim failure, and pyrolysis



MOVING EQUIPMENT

Entanglement, crushing, drawing-in injuries at crushers, and conveyors.



CRITICAL CONTROLS

1. Hazard Identification & Task Risk Assessment:

Identify hazards such as entanglement, crushing, shearing, trapping, and struck-by risks. Conduct task-specific risk assessments before work starts.

2. Equipment Design & Engineering Controls:

Ensure machinery is designed and modified to eliminate or minimise exposure to moving parts. Fit guards, interlocks, nip-point protection, and emergency stops.

3. Isolation, Lock-Out & Tag-Out (LOTO): Isolate all energy sources (electrical, hydraulic, pneumatic, mechanical, stored energy) before accessing moving parts. Apply locks and tags to prevent inadvertent startup.



MOVING EQUIPMENT

Entanglement, crushing, drawing-in injuries at crushers, and conveyors.



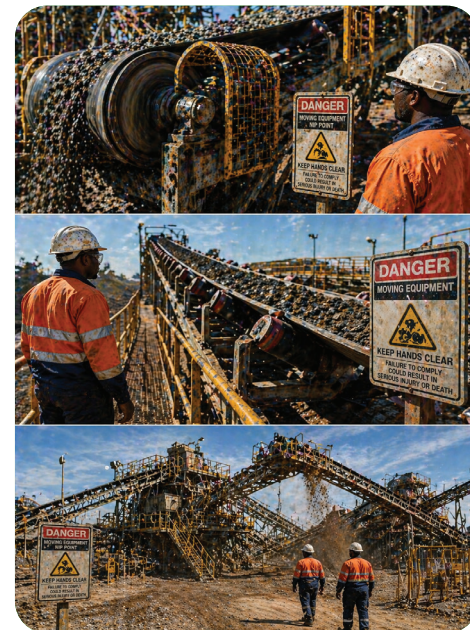
CRITICAL CONTROLS

4. Verify Zero Energy (Try-Start / Test): Confirm all movement and stored energy has been released. Perform a try-start to verify isolation effectiveness where safe to do so.

5. Guarding Integrity & Removal Control: Ensure guards are in place, secure, and functional before operation. Control and authorise any temporary removal of guarding with additional controls.

6. Safe Operating Procedures (SOPs): Develop and follow SOPs for operation, maintenance, and cleaning of equipment. Clearly define prohibited practices (e.g., clearing blockages while running).

7. Competent & Authorised Personnel: Only trained and authorised workers may operate, maintain, or work near moving equipment. Ensure operators



MOVING EQUIPMENT

Entanglement, crushing, drawing-in injuries at crushers, and conveyors.



CRITICAL CONTROLS

understand equipment limits and hazards.

8. Proximity & Exclusion Zones: Establish exclusion zones around operating machinery. Use barriers, signage, and spotters where people and equipment interact.

9. Emergency Stops & Alarms: Ensure emergency stop devices are accessible, tested, and functional. Use audible

and visual alarms to warn of start-up or movement.

10. Clothing, PPE & Personal Controls: Prohibit loose clothing, jewellery, or unsecured hair near moving parts.

Use appropriate PPE such as fitted clothing and protective footwear.



MOVING EQUIPMENT

Entanglement, crushing, drawing-in injuries at crushers, and conveyors.

CRITICAL CONTROLS

11. Inspection, Maintenance & Defect Reporting:

Conduct routine inspections and preventative maintenance. Immediately report and rectify defects that could lead to uncontrolled movement.

12. Change Management & Incident Learning:

Apply Management of Change (MoC) for equipment modifications or process changes. Investigate incidents and near



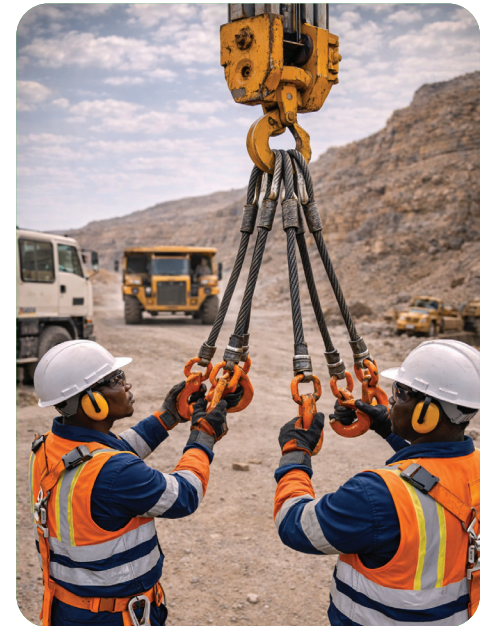
LIFTING AND CRANAGE

Crane failure, dropped loads, rigging failures.



CRITICAL CONTROLS

- 1. Lift Hazard Identification & Risk Assessment:** Identify lifting hazards such as dropped loads, overload, instability, proximity to people, structures, and power lines. Conduct a task-specific lift risk assessment.
- 2. Lift Planning & Classification:** Plan all lifts and classify them (routine, non-routine, critical/complex). Develop documented lift plans for critical lifts.
- 3. Competent & Authorised Personnel:** Ensure crane operators, riggers, doggers, and supervisors are trained, licensed, and authorised. Confirm competencies match crane and load type.
- 4. Lifting Equipment Certification & Inspection:** Use only certified cranes, lifting devices, and lifting gear with valid inspection records. Inspect slings, shackles, hooks, and lifting points before use.



LIFTING AND CRANAGE

Crane failure, dropped loads, rigging failures.



CRITICAL CONTROLS

5. Load Weight & Centre of Gravity Verification: Confirm the load weight, dimensions, and centre of gravity. Ensure crane and lifting gear capacities are not exceeded at the planned radius.

6. Crane Setup & Ground Conditions: Set up cranes on firm, level ground with adequate bearing capacity. Use outrigger pads, mats, or engineered foundations where required.

7. Exclusion Zones & Barricading: Establish and enforce exclusion zones under and around suspended loads.

Prevent personnel access to drop zones.

8. Safe Rigging & Attachment: Use approved lifting points and correct rigging techniques. Ensure loads are secured, balanced, and protected from slippage.



LIFTING AND CRANAGE

Crane failure, dropped loads, rigging failures.

CRITICAL CONTROLS

9. Environmental & Operating Conditions: Monitor wind speed, visibility, weather, lighting, and nearby activities. Suspend lifting operations if conditions become unsafe. **10. Communication & Signalling:** Use agreed hand signals, radios, or signalers. Maintain clear communication between operator and lifting team at all times.

11. Power Line & Infrastructure Controls: Identify overhead and underground services. Maintain minimum approach distances and implement isolation or spotter controls.

12. Emergency Preparedness & Incident Response: Establish procedures for crane failure, dropped loads, and rescue scenarios. Ensure emergency stop systems, alarms, and trained responders are available.



FATAL RISK FACTOR

CHEMICALS AND OTHER HAZARDOUS MATERIAL SUBSTANCES

Toxic exposure, reactive chemicals, chemical fires, burns from corrosive chemicals and other process reagents.

CRITICAL CONTROLS

1. Hazard Identification & Chemical Risk Assessment:

Identify all hazardous chemicals and substances used or generated (e.g., fuels, cyanide, reagents, acids, chemical dusts, fumes). Conduct task-specific chemical risk assessments.

2. Chemical Register & Safety Data Sheets (SDS):

Maintain an up-to-date chemical register. Ensure current SDS are readily accessible to all workers.

3. Substitution & Minimisation: Eliminate or substitute hazardous chemicals where practicable. Minimise quantities stored and used in work areas.

4. Approved Storage & Segregation: Store chemicals in approved, labelled, and banded facilities. Segregate incompatible substances (e.g., acids from cyanide, oxidisers from fuels).



FATAL RISK FACTOR

CHEMICALS AND OTHER HAZARDOUS MATERIAL SUBSTANCES

Toxic exposure, reactive chemicals, chemical fires, burns from corrosive chemicals and other process reagents.

CRITICAL CONTROLS



5. Labelling & Identification: Ensure all containers, including decanted vessels, are correctly labelled. Use GHS-compliant labels and signage.

6. Safe Handling & Transfer Procedures: Use documented procedures for mixing, transferring, dosing, and disposal. Employ closed systems, pumps, or dosing equipment where possible.

7. Engineering Controls & Ventilation: Use ventilation, enclosures, spill containment, and automated systems to reduce exposure. Ensure fumes, vapours, and dusts are controlled at the source.

8. Personal Protective Equipment (PPE): Provide and enforce the use of appropriate PPE (respiratory protection, gloves, goggles, face shields, chemical suits). PPE selection based on SDS and risk assessment.



FATAL RISK FACTOR

CHEMICALS AND OTHER HAZARDOUS MATERIAL SUBSTANCES

Toxic exposure, reactive chemicals, chemical fires, burns from corrosive chemicals and other process reagents.

CRITICAL CONTROLS



9. Training, Competency & Awareness: Train workers in chemical hazards, SDS interpretation, safe handling, and emergency response. Ensure only competent and authorised personnel handle high-risk substances.

10. Spill Prevention & Containment: Implement spill control measures such as bunding, drip trays, and secondary containment. Maintain readily available spill kits suited to the chemicals in use.

11. Health Monitoring & Exposure Control: Conduct exposure monitoring where required (air sampling, biological monitoring). Implement health surveillance for high-risk substances.

12. Emergency Response & Incident Management: Establish procedures for spills, leaks, exposure, and chemical fires. Ensure emergency showers, eyewash stations, alarms, and trained responders are available.



LOSS OF CONTAINMENT

Pipeline rupture, tank failure, slurry or chemical release, and pond embankment failure.

CRITICAL CONTROLS

1. Hazard Identification /Risk Assessment: Identify credible loss-of-containment scenarios (pressure, fluids, gases, molten material, chemical dust, tailings, process solutions, and chemicals). Assess causes, consequences, and critical controls for each scenario.

2. Asset Integrity & Design Standards: Design plant, pipelines, vessels, tanks, and containment systems to recognised engineering standards. Ensure materials are suitable for pressure, temperature, corrosion, and abrasion.

3. Preventive Maintenance & Inspection Programs: Implement condition-based and scheduled maintenance for pipes, hoses, valves, seals, tanks, bunds, and liners. Use nondestructive test (NDT), thickness testing, and corrosion monitoring where applicable.



LOSS OF CONTAINMENT

Pipeline rupture, tank failure, slurry or chemical release, and pond embankment failure.failures.

CRITICAL CONTROLS

4. Operating Limits & Process Controls: Define and enforce safe operating envelopes (pressure, flow, temperature, levels). Use alarms, interlocks, and automatic shutdowns to prevent exceedances.

5. Change Management (MoC): Apply formal MoC for changes to equipment, materials, operating conditions, or procedures. Assess impacts on containment integrity before implementation.

7. Secondary Containment & Bunding: Install and maintain bunds, drip trays, liners, and sumps to capture releases. Ensure capacity and integrity meet worst-case release scenarios.

8. Leak Detection & Monitoring: Use inspections, sensors, pressure/flow monitoring, piezometers, and visual checks to detect leaks early. Encourage prompt reporting and escalation of any abnormal condition.



LOSS OF CONTAINMENT

Pipeline rupture, tank failure, slurry or chemical release, and pond embankment failure.failures.

CRITICAL CONTROLS

9. Procedures for Transfer, Loading & Unloading:

Use documented procedures for filling, decanting, pumping, and transfer operations. Prevent overfilling, hose failure, and incorrect connections.

10. Competency, Training & Authorization: Train personnel in process safety, signs of containment failure, and correct response actions. Restrict high-risk tasks to competent and authorised workers.

11. Critical Control Verification & Continuous Improvement: Regularly verify the effectiveness of loss containment controls. Investigate incidents and near misses and update controls accordingly.

12. Emergency Response & Spill Management:

Maintain site- specific response plans for spills, ruptures, and releases. Provide spill kits, isolation tools, PPE, and trained



FATAL RISK FACTOR

OPEN WATER BODIES AND PROCESS SOLUTION HOLDING PONDS

Drowning, slips, trips and falls, wall failure, embankment failure, flooding, overtopping (flooded Pit, borrow pits, pit dewatering sumps. PLS, ILS, Raffinate and Stormwater emergency ponds).

CRITICAL CONTROLS



1. Physical Barriers & Berms: Maintain adequate bund walls, berms, and guardrails around ponds and pit edges.

2. Access Controlled: Restrict access with signage, fencing, and permit systems.

3. Edge Protection & Safe Distances:

Establish minimum approach distances for vehicles and personnel.

4. Traffic Management Plan: Clearly defined routes away from pond edges, speed limits and designated turning areas.

5. Life-Saving Equipment: Ensure the life rings (lifebuoy) and lifesaving jackets are provided, throwropes, and rescued poles installed at strategic locations.



FATAL RISK FACTOR

OPEN WATER BODIES AND PROCESS SOLUTION HOLDING PONDS

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CRITICAL CONTROLS



6. Mandatory PPE: Provide the suitable chemical resistant PPE (gloves, goggles, face shields) for those working around process solution holding ponds and high-visibility clothing for those working in the night.

7. Chemical Handling Procedures: Ensure the emergency eyewash and shower stations are operational and follow SDS guidelines.

8. Regular Inspections: Routine checks of embankments, pond levels, pumps, and pipelines and report erosion, cracks, or seepage immediately.

9. Water Level Monitoring: Ensure continuous monitoring of pond capacity, storm preparedness and pump redundancy.

10. Safe Work Procedures (SWPs): Conduct task-specific risk assessments before working near



FATAL RISK FACTOR

OPEN WATER BODIES AND PROCESS SOLUTION HOLDING PONDS

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CRITICAL CONTROLS

waterbodies and process holding solution ponds.
Ensure permit-to-work process is adhered to for high-risk activities.

11. Training & Emergency Drills: Conduct drills related to drowning rescue response, chemical spill response and empower employees with first aid skills.

12. Communication & Supervision: Ensure proper supervision and provide the two-way radios for those working far or working alone near water bodies and process solution holding ponds. No lone work near high-risk water bodies/process solution holding ponds without proper controls.



FATAL RISK FACTOR

HUMAN BEHAVIOR (CRITICAL DECISION ERRORS)

Procedural violations, fatigue, complacency, poor risk perception.

CRITICAL CONTROLS

- 1. Fitness for Work:** Ensure workers are physically and mentally fit (fatigue, stress, alcohol/drugs, illness controlled).
- 2. Competency & Training:** Verify workers are trained, competent, and authorized for the task.
- 3. Clear Communicatio** Use clear, standardized communication (toolbox talks, handovers, and logbook).
- 4. Procedures & Work Instructions:** Ensure procedures are clear, current, understood, and followed.
- 5. Task Planning & Risk Assessment:** Conduct effectiverisk assessments and job safety analyses before work starts.
- 6. Supervision & Leadership:** Provide adequatesupervision, especially for high-risk or non-routine tasks.



FATAL RISK FACTOR

HUMAN BEHAVIOR (CRITICAL DECISION ERRORS)

Procedural violations, fatigue, complacency, poor risk perception.

CRITICAL CONTROLS

7. Fatigue Management: Control work hours, rest periods, and shift patterns to reduce fatigue-related errors.

7. Chemical Handling Procedures: Ensure the emergency eyewash and shower stations are operational and follow SDS guidelines.

8. Regular Inspections: Routine checks of embankments, pond levels, pumps, and pipelines and report erosion, cracks, or seepage immediately.

9. Water Level Monitoring: Ensure continuous monitoring of pond capacity, storm preparedness and pump redundancy.

10. Safe Work Procedures (SWPs): Conduct task specific risk assessments before working near waterbodies and process holding solution ponds. Ensure permit-to-work process is adhered to for



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