



**Industry &
Investment**

Investigation Report

Serious injury involving a fall from height at
the Perilya Broken Hill Southern Operation on
6 November 2007

Report prepared for the Director-General of the
Department of Industry and Investment by the
Investigation Unit, Thornton

Mine Safety Investigation Unit

Title: Investigation Report,

Serious injury involving a fall from height at the Perilya Broken Hill Southern
Operation on

6 November 2007

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The information contained in this publication is based on knowledge and understanding at the time of writing. However, because of advances in knowledge, users are reminded of the need to ensure that information on which they rely is up to date and to check the currency of the information with the appropriate officer of the Department of Industry and Investment or the user's independent advisor.

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Overview

The incident At about 3.00 pm on 6 November 2007 Ian Battams, an underground maintenance worker at the Perilya Broken Hill Southern Operations, fell through the handrail of a raised walkway while cleaning the screens of the mine's dewatering filtration system. He fell about 2.5 metres to a concrete floor suffering serious injuries to his right leg, including a broken femur.

The mine

The mine:	Perilya Broken Hill Southern Operations
Mine location:	Wentworth Road Broken Hill NSW 2880 (about 3 kilometres south of Broken Hill CBD)
Ultimate holding company:	Perilya Limited
Operator of mining operation:	Perilya Broken Hill Limited
Number of employees at mining operation:	760 (September 2008 the workforce was reduced to 320)
Production:	1.9 million tonnes per annum of lead, silver and zinc bearing ore

Mine location and production The Perilya Broken Hill operations are located near Broken Hill, New South Wales, 1160km west of Sydney. The operations cover 1,042 square kilometres of prospective terrain. This includes mining leases incorporating the Southern Operations, the North Mine, the Potosi Trend, and the historic Little Broken Hill and Pinnacles areas.

Mining at the Broken Hill operations uses longhole open stoping method of extraction in the remnant stopes, narrow lenses and crown pillars left by the previous operations. The production rate at the time of the incident was about 1.9Mtpa from the Southern Operation and 0.2Mtpa from the North Mine. From this 110,000 tonne of lead/silver concentrate and 266,000 tonne of zinc concentrate are produced. These products are sent by rail to Port Pirie in South Australia to be sold to smelters and refineries in Australia, Korea and the USA.

Perilya Broken Hill Limited (PBHL) manages and operates the Perilya Broken Hill mines on behalf of Perilya Limited. Perilya Broken Hill Limited is a wholly owned subsidiary of Perilya Limited.

The Perilya Broken Hill Southern Operations underground workings and the incident site are contained within Consolidated Mining Lease CML8 (1973).

The company

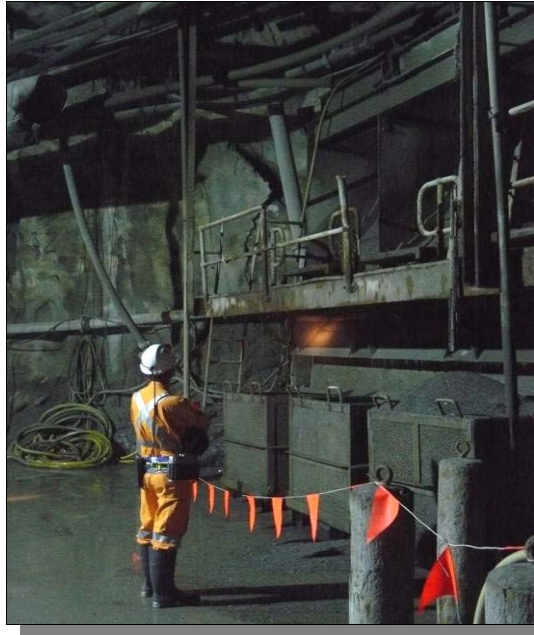
Perilya Limited is an Australian base metals mining and exploration company with a head office in Perth, Western Australia. Along with its zinc, lead and silver mine in Broken Hill, the company operates the Flinders Project in South Australia and the Mount Oxide Project in Queensland.

Perilya acquired the Broken Hill mine in May 2002. It is one of the largest and most renowned zinc, lead and silver mines in the world, having been in production since 1885 and produced over 200 million tonnes of ore.

In February 2009, Shenzhen Zhongjin Lingnan Nonfermet Co. Ltd ('Zhongjin Lingnan'), China's third largest zinc producer, acquired a 50.1% interest in Perilya.

The fixed plant

The plant:	Pre-screens
Location:	Underground at 23 Level of the Southern Operations
Function:	Dirty water from the mine workings is piped to the pre-screens where it is filtered by a series of screens before being sent to the 24 Level where large pumps are used to recycle the water to the surface for use in ore processing and underground mining.
Date built:	The plant was commissioned by Pasminco Limited in about 1991 with the maintenance platform (walkway) being added in 1992.
Construction standard:	The plant, at that time, was required to be built to the relevant Australian Standards (SAA codes), including SAA Code for Fixed Platforms, Walkways, Stairways and Ladders (AS1657-1985).



23 Level Pre-screens
(Photo by Investigator
Mark Freeman)

The maintenance crew

Mine services The mining department of the Southern Operations included a mine service division. Mine services looked after all plant, equipment and mine services associated with the underground infrastructure that supports mining. This includes fixed plant for shafts and winders, ventilation, sandfill and ground control.

Service teams Mine services was then further divided into specific teams looking after fixed plant, projects, infrastructure and mine services. The fixed plant team is responsible for maintaining the following plant and equipment:

Primary

- Loading station
- 21 crusher
- 24 crusher
- 24 pump station
- 23 pre-screens

Secondary

- Satellite pumps
- Tru-flo (Fitzroy crossing)
- Submersible pumps
- Rockbreakers
- Underground fuel bays

The incident

Starting work	<p>On the day of the incident Mr Battams began work at the Perilya Broken Hill Southern Operations at about 7.00 am. He attended a start up meeting in the Fixed Plant Coordinator's office and then went to a safety meeting.</p>
Receiving the day's instructions	<p>At about 7.40 am Mr Battams, with the other four members of the fixed plant team, returned to the Coordinator's office to receive their work instructions for the day. The team then caught the shaft man-cage from the surface marble arch down to the 24 Level.</p> <p>At the 24 Level they stopped at the crib room and office to put their lunches away and have coffee. They then went to their respective jobs.</p>
Servicing 24 level pumps	<p>Mr Battams maintained the 24 Level pump station regularly each shift. He inspected the pumps, checked the oil and water levels, and took pressure and hour readings, which he noted in a book. While at the pumps Mr Battams cleaned the sieves, a task requiring the pumps to be turned off and isolated. He notified the Mine Control Centre (MCC) when he did this.</p> <p>The maintenance at the 24 pump station was a job that took some time. Mr Battams did not finish until about 12:50 pm. He performed this work alone, which was usually the case.</p>
Final check on the pumps	<p>After having lunch in the crib room, Mr Battams returned to the 24 pump station to do a final check that the pumps were running satisfactorily. Then he went to where the Integrated Tool carrier (IT) was parked and completed a pre-start check.</p>
Driving IT to 23 level	<p>Mr Battams drove the IT up the incline to the 23 Level maintenance bay. He parked the IT and then walked back past the 23 plat into the pre-screen area. On arrival he did a quick visual check of his surrounds.</p>
Cleaning pre-screen from floor	<p>Satisfied the area was safe from rock fall, Mr Battams got the nearby water hose and hosed down the two troughs at floor level on each side of the pre-screens.</p> <p>When he finished the floor level clean up he dragged the water hose up onto the raised walkway so he could hose the screens (see the following photo).</p>

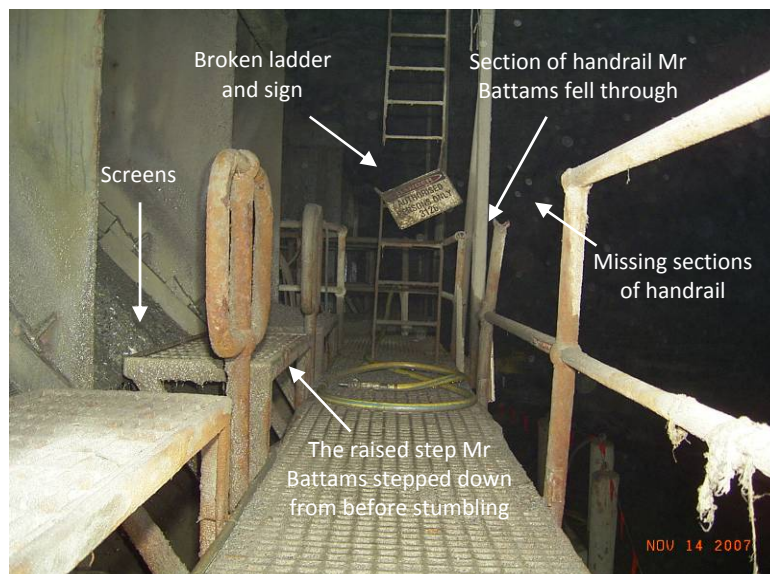


Cleans screens from walkway

Mr Battams used the ladder near the steam high pressure cleaner to access the walkway (seen on right of photo above). On the walkway he picked up the hose and cleaned the steps that were raised above the walkway. That done he hosed down the screens standing on the raised step, with the waste material falling into the trucks below. Each section of screen has a strainer at each end. Mr Battams hosed one strainer and then turned to step back onto the walkway to go to the other strainer.

Stumbles and falls

According to Mr Battams, while stepping back onto the walkway, he stumbled hitting the handrails of the elevated platform. He could not explain why he lost his footing. As he fell it appears he grabbed at the ladder near to him to stop himself, but a piece of ladder came away in his hand (see following photo).



23 Level Pre-screens walkway
(Photo by Investigator Mark Freeman)

Falls to ground	<p>The handrail gave way under the impact of Mr Battam’s falling body and he fell about 2.5 metres to the concrete floor below.</p>
Injured and waits for help	<p>Lying on the floor, Mr Battams saw he had dislocated a finger on his left hand. Although he couldn’t see his right leg he could wriggle his toes. But when he tried to get up he found the leg would not support him and he was in pain. He lay back down to ease the pain, using his helmet to support his head.</p> <p>Mr Battams got his cap lamp and shone it up the drive in the hope someone would see it and come to his aid. He checked his watch and found it was about 3.00 pm.</p> <p>He made himself as comfortable as possible and continued to call out for help. At one point he appears to have lost consciousness for some time.</p>
Team becomes worried	<p>By about 6.20 pm the other team members became worried. Mr Battams usually returned to the 24 Level with his IT at about 6.15 pm.</p> <p>A maintenance fitter went in search of him. He drove his Toyota ute up the drift from the 24 Level to the 23 Level pre-screens to check on Mr Battams.</p>
Fitter finds injured co-worker	<p>When the fitter entered the pre-screens he found Mr Battams on the floor lying on his left side facing the screens. Mr Battams told him he couldn’t move as he had injured his right leg and needed medical help. The fitter noticed that Mr Battams appeared to be in discomfort and was wet and shaking.</p> <p>Mr Battams asked the fitter to call for help from the 23 Level plat phone as the phone at the pre-screens was not working. This the fitter did. The Mine Control Centre asked him to stay at the 23 Level plat phone. After finishing this call the fitter called the 24 Level office and alerted the rest of the service crew to the situation.</p> <p>In response service crew members and the platman went to the pre-screens area to help and comfort Mr Battams.</p> <p>One of the crew returned to the 23 plat and the fitter told him to take the cage up to the marble arch to get the rescue team.</p>
Rescue team arrive	<p>The mines emergency procedure was put into action. When the mine rescue team arrived they gave Mr Battams pain relief and placed his leg in a position for transport. It took about an hour to get him to the surface. One of his service crew mates said that Mr Battams was in considerable pain for the whole of the trip.</p>
Ambulance to hospital	<p>The rescue team and Mr Battams arrived at the surface at about 7.45 pm where an Ambulance crew was waiting. They placed Mr Battams in the ambulance and gave him morphine to ease the pain.</p> <p>He was taken to the Emergency Department at Broken Hill Base Hospital. His family met him on arrival.</p>

Injuries diagnosed	Mr Battams had X-rays taken of his right leg and foot. His injuries were assessed as a fractured foot and broken femur of the right leg, and broken bone and dislocated finger of the left hand.
Flown to South Australia	Next day medical staff decided Mr Battams should be flown to Adelaide, South Australia, for surgery and further treatment. The surgery performed in Adelaide involved inserting a plate into his right foot, and a rod and a number of pins repaired his broken femur.
Transferred to hospital near home	Mr Battams was later transferred to Mildura Base Hospital in Victoria, which was near his home, for further care and rehabilitation. He was released from hospital on 23 November 2007 to continue convalescence at home.

The injured person

Name:	Ian James Battams
Age at time of incident:	53 years
Sex:	Male
Occupation at time of incident:	Mechanical tradesperson
Mining experience:	30 years in the hard rock mining industry at Broken Hill
Task experience:	5 years

Employer Perilya Broken Hill	Ian Battams was employed by Perilya Broken Hill Limited as a Mechanical Tradesperson. He had worked in the mining industry for about 30 years. Most of his work was at the Broken Hill mines, including with the previous mine operator Pasminco Broken Hill Mine Pty Limited. He operated various mining machinery during his career.
Return to work	Mr Battams returned to work in August 2008 performing light duties. He worked in the surface workshop up to five hours a day, Monday to Friday. At that stage his fractured right leg had not healed and he needed a metal crutch to aid standing and walking. He continued with rehabilitation and physiotherapy. In April 2009 he resumed full time work, on a 5-day roster. He was doing minor repairs to pumps in the above ground south workshop. His right leg fracture had not healed and he continued to experience pain in his leg, thigh and knee. Although he was now able to walk unaided. He continued rehabilitation at Broken Hill and with a private provider in Mildura.

Current condition As at June 2010 Mr Battams was able to walk more freely after having a metal screw removed from the top of his right femur which caused pain and discomfort. He had almost regained normal strength in his leg and the leg fractures had healed. He still had some difficulty getting up from a lay-down position and with mounting steps.

Due to the incident, Mr Battams no longer wants to return to working underground.

Action taken by the mine

Initial actions The incident site was cordoned off and the scene preserved for investigation.

Corroded steelwork removed The redundant ladderway to the crows nest above the pre-screens was removed, along with the walkway structure and its access ladderways.

Risk assessment A risk assessment was conducted to identify interim measures for cleaning the screens. The risk assessment determined that a scissor lift would be used to hose the screens.

Structural review In June 2008 Perilya had an expert engineering company conduct a structural review of all underground steelwork. This was required by recommendations identified during the course of this investigation.

Replacement walkway designs Perilya reviewed designs for a replacement walkway for the 23 Level pre-screens in June 2008.

New walkway completed Following the incident the mine reassessed the pre-screens and began an evaluation and upgrade project. Pipe work and other structures were replaced, with a permanent raised walkway and access being completed in June 2010.

The 23 level pre-screens area upgrade also included installing improved lighting, ventilation and communications.

Action taken by the department

Investigating the incident	<p>The Cobar office of the Department's Mine Safety Operations was notified by phone of the incident on 6 November 2007, an arrangement that is in place when no Inspector is available in Broken Hill. The Broken Hill office was notified of the incident by Cobar's Inspector of Mines, when the Broken Hill Inspector returned from leave, on 12 November 2007.</p> <p>The Inspector of Mines from the Broken Hill office attended the mine on 13 November 2007. The next day he issued a Section 91 improvement notice under the <i>Occupational Health and Safety Act 2000</i> for remedial work on the 23 Level pre-screens infrastructure to prevent recurrence. This notice required Perilya to assess the risks associated with working around the plant and to implement suitable risk controls.</p> <p>A notice was issued by the Inspector to take the pre-screen sections of handrails and ladder stile as exhibits. These exhibits were taken into custody by the Investigator on 20 November 2007. The exhibits were returned to Perilya on 16 April 2008 to assist their investigation of the incident.</p> <p>The Investigation Unit conducted a detailed and thorough investigation into the incident. This included examining the fixed plant, the employer, and the safety management and maintenance systems at the mine.</p>
Feedback to the injured worker	<p>The Investigator met with Mr Battams on 29 November 2007 at his home in Victoria. At this meeting he was provided with information regarding the investigation process and his rights as a potential victim.</p> <p>The Investigation Unit continues to provide Mr Battams with feedback on the investigation and its results.</p>
Feedback to Mine Safety Operations and mine manager	<p>A number of issues were drawn to the attention of Mine Safety Operations and the mine manager during the course of the investigation. These issues included:</p> <ul style="list-style-type: none">• the inspection and repair of fixed plant and structures in the underground environment• risks of persons working alone• the ongoing temporary measures for the cleaning of the pre-screens• use of integrated tool carriers as man-basket lifts• quality of risk management at the mine; including identifying potential risks and the application of the hierarchy of controls.
Monitoring improvements at the mine	<p>Mine safety operations officers from Broken Hill had several discussions with Perilya Broken Hill management regarding the status of remedial work and the proposed design for the replacement walkway at the 23 level pre-screens.</p> <p>Inspectors from Broken Hill continued to review the progress made by Perilya in changes to the pre-screens area, including review of final designs for the upgrade and inspection of completed works.</p>

Safety alert

A safety alert, SA08-06 *Worker falls through guardrail* was released to industry by the Chief Inspector on 14 April 2008.

The safety alert contained recommendations for the mining industry in regard to the testing of handrails in accordance with published Australian Standards and the need to undertake effective preventative maintenance. The issue of persons working alone was also addressed.

The investigation

The Department's Authority

The Department has authority to investigate the incident as it occurred at an underground metalliferous mine.

The Department's investigator who led the investigation into the incident, Mark Freeman, holds an identification card issued under section 48 of the *Occupational Health and Safety Act 2000* (OHS Act).

As a result, Investigator Freeman is authorised to exercise functions under the OHS Act with respect to a mine, and other premises, for the purpose of investigating any matter under the OHS Act in relation to a mine and mining workplace.

Investigator Freeman was given carriage of the investigation on 16 November 2007.

The lines of inquiry

The investigation focussed on the pre-screen fixed plant and its maintenance, along with risk controls for persons working alone.

Lines of inquiry included:

- inspection of the underground fixed plant
- obtaining information from the employer, mine management and other mine services tradespeople
- obtaining information on the fixed plant, including original design plans
- examination of documents and other written records; with a focus on pre-screen inspections, maintenance and repairs, safe work arrangements and supervision.

Department officers inspected the incident scene

On 14 November 2007 officers of the Department's Broken Hill office conducted a scene assessment of the incident.

Investigator Freeman travelled to Broken Hill and visited the mine on 21 November 2007 to conduct his own scene assessment. He took photographs of the scene and of fixed plant.

Independent observation of exhibits	While at the scene Investigator Freeman took into his possession three pieces of the corroded handrail and ladder as exhibits. These exhibits were examined by an independent engineering facility to report on their condition and provide an opinion with respect to their structural integrity.
Conducting interviews	The Investigator met with nine people from the mining company who gave information or evidence with regard to the incident.
System documents and records	<p>The documents and records examined during the investigation include:</p> <ul style="list-style-type: none"> • mining lease and ownership records • medical treatment records for the injured worker • workers compensation and rehabilitation reports for the injured worker • Perilya Broken Hill's health, safety and environment management system • mining and maintenance service departments safety and health management plan • workplace inspections sheets, work orders and fixed plant floor plans • safe work procedures and written instructions • insurance risk assessments reports • employee training and assessment records • OHS committee minutes • handrail maintenance and repairs records • Perilya Broken Hill Limited annual reports and HSE management committee minutes.

Findings

Facts determined by investigation	<p>The following facts were determined by the investigation.</p> <ul style="list-style-type: none"> • The underground environment at the 23 Level is a corrosive one, with ample water and oxygen present to react with the iron and steel. • The pre-screens had been in such an environment since they were constructed by previous mine owner, Pasminco, in about 1991-2. • Perilya Broken Hill Limited had a system of inspections for plant that should have identified the corrosion to the pre-screen plant, and in particular the galvanized steel pipe of the guardrails. • Rusting on ladders at the pre-screens was identified, reported and included as a corrective action in the maintenance system. However, no work was undertaken to replace the handrails and ladders as required by the maintenance work order.
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Primary cause The primary cause of the incident was a slip by Mr Battams that caused him to fall against the handrail which failed under load and did not prevent him from falling off the walkway to the floor below.

The investigation identified the following organisational failings and other factors that contributed to the incident.

Unsafe plant The handrails provided at the pre-screens raised walkway to prevent persons from falling off were found to be corroded:

- steel of the pipe of the handrail was found to be very thin, offering little strength when a force or load was applied, and
- inspections of the pre-screens plant after the incident by the Inspector and Investigator readily identified surface rust and possibly deep corrosion on other steel components of the plant.

Further examples of unsafe plant and equipment were identified, in particular the ladder that went from the platform up to a crows nest near the roof of the cavern. This ladder appears to have been redundant for some time and had a sign attached prohibiting unauthorised access.

As Mr Battams fell he grabbed at the ladder hoping to stop his fall, only to find that a section of the extremely corroded ladder stile came away in his hand.

Failure of safety systems and risk management Perilya Broken Hill Limited failed to adequately inspect the 23 Level pre-screens to ensure safe plant.

The mine's overarching HSE safety management system, along with the Mining Department's Safety and Health Management Plan, had risk management processes for plant safety. These included:

- daily workplace inspection upon first entry of an underground work area
- safe work procedure on how to conduct a workplace inspection before starting work
- a safe work procedure for cleaning of the pre-screens
- planned task observations
- formal inspections of the 23 Level pre-screens to identify hazards.

Non-conformances or failings of the management system were:

- no specific standard for workplace inspection of fixed plant
- no safe work procedure or written instruction on how to perform an inspection of handrails and ladders at the 23 Level pre-screens
- no records found of formal inspections of the 23 Level pre-screens.

Ladder corrosion reported but not fixed

A member of the fixed plant maintenance team noted that the access ladders to the walkway at the 23 Level pre-screens were rusty and reported this as a safety issue to his co-ordinator. The report was entered into Maximo, the mine's maintenance planning software, on 10 April 2007.

MAXIMO is a maintenance database and work order system. It supported repair and preventative maintenance activities, along with reporting of inspections and follow up actions.

This system generated *work orders* and the daily *floor plans* which list planned preventative and corrective maintenance tasks for plant and equipment.

The 23 Level pre-screens work order was generated by the Mine Services Planning Co-ordinator each Friday. It specified inspections and cleaning.

The pre-screens work order listed work plan details for the week including the inspection of handrails and ladder ways. There were no instructions, written or verbal, on how to conduct this inspection.

It appears the inspections of the handrails and ladders performed by mine services employees were restricted to visual inspections. No attempt was made to perform non-destructive or physical testing of the structures.

The floor plan that listed tasks for each maintenance team was printed from the Maximo system for each shift each day. This floor plan was given to the relevant service team. The fixed plant services team received a plan for Fixed Plant Mechanical Maintenance.

Floor plans supplied by Perilya for the period 11 April 2007 to the 6 November 2007 note a corrective action for the pre-screens as: "Replace handrails and ladders that are rusted."

If work was undertaken against this action it should have been recorded. If the action was completed the task would be removed from the floor plan. The floor plans noted above had no record of work being undertaken for this corrective action.

The fitter who reported the corroded ladders said during his giving of evidence that nothing was done with regard to the Maximo entry requiring replacement of the handrails and ladders.

Fixed plant standard not maintained

To comply with the requirements of the Mining Department Safety and Health Management Plan the Mine Services Superintendent inspected the 23 Level pre-screens and other locations where maintenance work under his control was undertaken.

As part of these inspections the Mine Services Superintendent recalls inspecting the pre-screen area about mid-August 2007. He made a visual inspection of the handrails and found them satisfactory. He looked at the handrails at the end of October 2007 and again found them satisfactory.

The Mine Services Superintendent did not conduct any physical testing of the structure as he did not consider the pre-screen environment to be corrosive.

This incident investigation found that kickplates were missing from the raised platform in the prescreens area. Kickplates are required by Australian Standard, AS1657-1992: *Fixed platforms, walkways, stairways and ladders - Design, construction and installation*.

Redundant hinges indicated that kickplates may have once been fitted.

No one who worked in the area or performed inspections on the walkway noticed the kickplates were missing.

This further indicates that the inspection system applied in the prescreens area was unable to identifying non-conformances and potential risks.

Persons working alone, without supervision

Risks to employees working at the 23 Level were increased by the fact they were allowed to work alone and unobserved.

In addition, the phone, the only means of communication from the area, was found to be defective. It had not been working off and on for some time.

Mr Battams had cleaned the 23 Level pre-screens and maintained the 24 level pump for at least the previous five years. Generally he did both these jobs on his own during that time.

Most of the fixed plant team work alone, often in areas where potential risks were present. Other service personnel described working alone in places where slips or trips could occur.

This risk became a reality when Mr Battams lay injured, unable to raise the alarm, for nearly three and a half hours before someone noticed he was missing.

When questioned the general manager noted that Perilya did not have a procedure in the HSE management system for working alone. It was indicated that there was an informal practice for people working alone to contact the MCC at regular intervals. From the evidence of this incident it appears not all employees were aware of this practice.

Regular visits by a supervisor to an area where people are working alone is a way to monitor their safety. Mr Battams' supervisor, the Fixed Plant Coordinator, did not visit the 23 Level pre-screens, and he infrequently went underground.

It appears the limited frequency of the Coordinators visits underground was not known to company managers until after the incident.

Strategies to prevent recurrence

Failure of structures a known risk

Failure of structures is identified on the Department's internet site as a *mechanical engineering key risk* (*Mechanical engineering key risks*: <http://www.dpi.nsw.gov.au/minerals/safety/resources/mechanical/key-risks>).

The majority of metalliferous mines in New South Wales have been operating continuously for long periods of time, some for a hundred years or more. This is particularly so for mines in the Broken Hill and Cobar mining districts.

New owners of mines such as the Perilya Broken Hill operation inherit plant and equipment that may have been in place for years. This was so with the pre-screens fixed plant which was about 10 years old when Perilya began mining.

Identify work environment risks

Environmental conditions must be considered when identifying and assessing risk of plant and structural failures. Exposure to conditions that promote corrosion and fatigue of structures must be recognised as a hazard, not only at surface mines and processing plants, but also underground.

Need to review and audit maintenance systems

Mine maintenance and other related systems must be audited to make sure their associated risks are effectively controlled. This is to ensure that:

- Risk assessments identify all potential hazards. There must be recognition of increased risk of failure of plant that is increasing in age and is located in an environment that may contribute to corrosion and structural failure. This must not be restricted to operational plant and must be equally applied to little used and redundant plant.
- Structural components that are required as part of safe plant and access, such as handrails, guardrails and ladderways, must have an inspection and maintenance schedule that is equal to, or of higher priority, as that of the operational components of that plant.
- Fixed access ladders and guardrail installations must be periodically inspected by visual and physical checking for rust, corrosion and structural integrity. They must be maintained in good condition so that no worker is endangered.
- Competent and qualified people must conduct the required testing and inspections to ensure structures do not fail.
- Records of inspections and maintenance of fixed structures, including walkways, handrails and ladderways, must be kept and maintained.
- The effectiveness of documented systems must be periodically checked by monitoring, review and auditing by line and senior management.

No safe work procedure for working alone

This incident investigation identified that no formal safe system of work for persons working alone was in place at the Perilya Broken Hill Southern Operations. In addition, the underground phone system was unreliable and beyond the reach of the injured worker.

Most of the fixed plant maintenance team worked alone, often in areas that had high potential for risk. In particular, they were exposed to risks from slips, trips and falls while accessing fixed plant.

Safe work procedure requirements

Safe work procedures for persons working alone must include:

- appropriate working communication systems (such as the PED and RFID systems that are used throughout the coal and metal mining industries)
- regular contact with other persons, such as the control room operator, with regular reporting-in and checking
- adequate and competent supervision.

Further reading

Related published resources

- AS 1657-1992: *Fixed platforms, walkways, stairways and ladders – Design, construction and installation*
- AS 1470-1986: *Health and safety at work – Principles and practices*, Section 9. Machinery, plant and equipment
- I&I NSW, (2004) *Minerals Industry Safety Handbook*, Part 5 Equipment and machinery, pp 49-51.
<http://www.dpi.nsw.gov.au/minerals/safety/publications/workbooks/safety-handbook>
- I&I NSW (2008) Safety Alert, SA08-06 *Worker falls through guardrail*
- I&I NSW (2007) Safety Alert, SA07-03 *Structural bin failure*

View safety alerts at www.dpi.nsw.gov.au/minerals/safety/safety-alerts