NSW GOVERNMENT | Industry & Investment

Investigation Report

Fatality involving
David Hurst Oldknow
Ravensworth Underground Mine
Coal Preparation Plant
Reject bin 802
18 February 2009

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

Mine Safety Investigation Unit

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Introduction

Aim of this report

This summary investigation report highlights key features of an incident that took place at about 2:30am on 18 February 2009 at Ravensworth Coal Preparation Plant reject waste bin, associated with coal produced from the Ravensworth Underground Mine in the NSW Hunter Valley.

In the incident David Hurst Oldknow a contract road haulage driver received fatal injuries when 10 tonnes of waste rock material was inadvertently released and fell 2m in 2.5 seconds onto the cabin of his truck.

This incident summary aims to provide people in the mining industry with information to help them identify hazards in their workplace and to establish risk controls to avoid a similar incident.

The investigation unit

The incident was assessed under the Department of Industry and Investment (referred to as Industry and Investment NSW) policy and identified as an appropriate incident for a major investigation carried out by the Investigation Unit.

The Investigation Unit has been established to investigate serious mine incidents and report directly to the Director General of Department of Industry and Investment. The Investigation Unit is independent of Mine Safety Operations.

The investigator

The Industry and Investment NSW investigation was led by Tony Smith, Senior Investigator with the Unit.

Conclusions are evidence based

Observations and conclusions provided in this report are based on the evidence and findings identified in the course of the detailed investigation conducted into the incident.

The mine

Ravensworth Underground Mine is located 22 kilometres north west of Singleton in the Hunter Valley. The mine and associated infrastructure is operated by Resource Pacific Pty Ltd.

After raw coal is extracted from the mine, coal is separated from rock waste material at the Preparation Plant. The coarse rock waste (material of a size too large to be pumped by pipe) is then transferred 2km by a series of conveyors to a 500 tonne capacity Reject Bin.

From the Reject Bin the rock material is hauled by road registered contract trucks along a 3.6 kilometre haul road owned by another company to a tipping pad operated by a civil works contract company.

The incident

The work process

The work involved driving a truck and dog trailer beneath the Reject Bin's single opening delivery chute to receive 30 tonnes of reject rock material. This was received in three ten tonne releases; one in the truck and two in the trailer. The material was then transported 3.6 km to the dumping area.

The sequence of the work followed a set cycle: receiving a load at the bin, hauling it to the dump site, dumping the load and then returning to the bin for another load. This work sequence took approximately 20 minutes to complete.

Main system of control

The main system of control over the work process was an electronic programmable logic control system (PLC) housed in the main distribution and control board (MCC) at the Reject Bin. This system included truck detection sensors, traffic lights, bin capacity sensing and a local control station which housed a receiver unit for the 27MHz signals sent from the remote control, hand held transmitters used by the truck drivers.

Time of the incident

The incident that resulted in Mr Oldknow's death occurred between 2.20 am and 2.30 am on Wednesday 18 February 2009.

He had started work the previous evening at 6 pm, so he had been at work for 8.5 hours of a 12 hour shift.

Loading from the bin appeared to be normal

Mr Oldknow was preparing to commence loading his 14th cycle from the Reject Bin when the incident occurred. This was the 55th loading cycle for the shift.

There had been approximately 162 individual 10 tonne loads obtained from the chute at the Reject Bin before the incident without any of the four drivers involved in the work identifying a faulty bin operating condition.

No witnesses

There were no witnesses to the incident. The following sequence of events has been established through the findings of the investigation.

Sequence of events

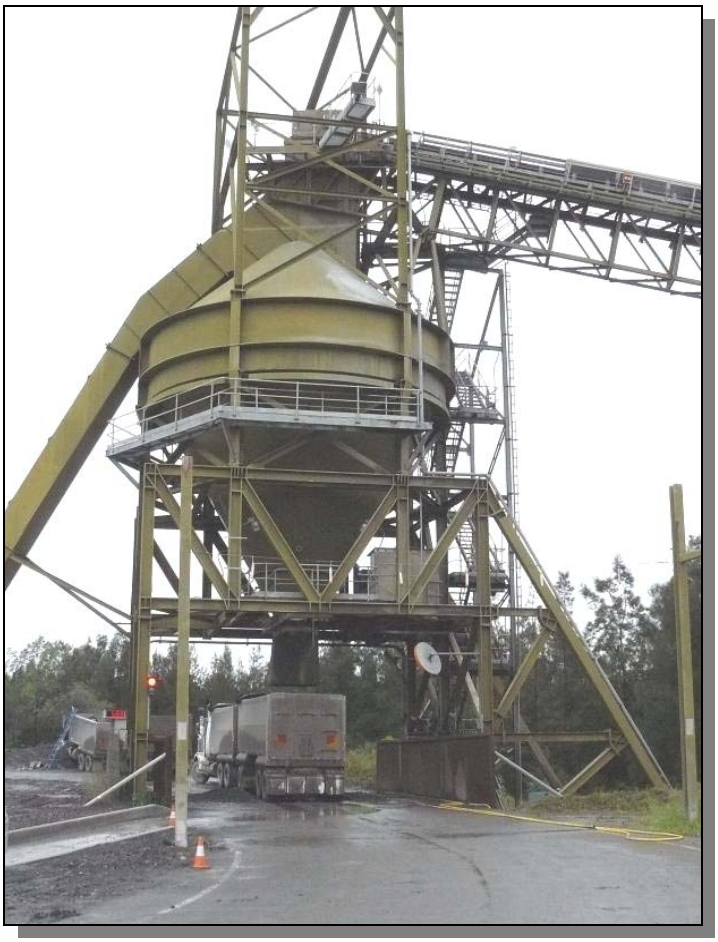
Mr Oldknow was sitting in the driver's seat of his cabin as he drove his truck in a low range gear at slow speed under the Reject Bin delivery chute. As he approached to take the first ten tonne load into his truck a signal originated from the hand held, remote control in his cabin for the chute to open. It is not know whether this signal was inadvertent or intentional.

At this time the front of Mr Oldknow's truck was obscuring the first line of three lines of sensors. However, the second line of sensors was obscured by dirt on the lenses and, as a result, was not working properly.

With two lines of sensors appearing to be blocked and a signal received from the remote control this satisfied the conditions to open the chute door and release a ten tonne load of waste rock material.

However, this release was premature as Mr Oldknow's truck was not positioned to receive it. As a result the load fell on the cabin and front trailer of the truck, crushing Mr Oldknow.

After the inundation the truck continued forward for approximately 30 m before the front wheels encountered a dirt embankment and came to a stop.



View west of the entry road to Reject Bin.

Mr Oldknow's truck can be seen on the embankment beyond the loading zone, while one of the other driver's trucks is parked under the bin.

(Photo Smith 18/2/09)

The incident victim

A self employed contract driver

The victim of the incident was David Oldknow, 59, of Singleton.

Mr Oldknow was a self employed road freight haulage driver contracted on an hourly basis by the civil works contract company to transport rock waste from the Reject Bin to the dump site. Mr Oldknow drove his own road registered Kenworth T401 rigid tipper and tipping dog trailer to perform the work.

The truck cabin collapsed

Mr Oldknow received fatal injuries while seated in the driver's seat of his truck cabin. The fibreglass cabin roof collapsed onto him when approximately 10 tonne of reject rock material was inadvertently released from the bin.

The electronic operating system at the reject bin released the rock material before the truck was in the correction position to take the load.

Driver's side view of the Kenworth T401 truck cabin showing the damage caused as a result of the incident

(Photo: Smith 17/3/09)

Autopsy findings

An autopsy found the cause of death from the combined effects of multiple injuries and traumatic asphyxia.

The investigation

Investigation methodology

The investigation of the incident involved various lines of inquiry, including:

- Examining the site
- Examining documents and records
- Interviews
- Operational testing
- Simulation tests

The investigation closely examined the Reject Bin operating system and safety features, the loading process followed by drivers and the suitability of the vehicles being used at the time of the incident.

The loading and tipping process

Interviews with drivers involved in the work and examination of the bin operating records established the steps in the loading process.

Transport of rock waste could be a 24 hour operation using four trucks per shift if the volume of waste required continuous removal.

The Reject Bin door was controlled by a hand held remote control device operated from inside the truck cabin.

The procedure adopted by drivers was to position the truck according to a painted mark on the sidewall in the loading area and two large round sighting mirrors, and load 10 tonnes into the truck tipper tray.

The truck moved forward to a second marked loading position to take a 10 tonne load into the front of the tipper dog trailer.

The truck moved forward to a third marked position to take a 10 tonne load into the rear of the tipper dog trailer.

The driver then drove the loaded truck to the tipping pad where the material was unloaded.

The truck then returned to the Reject Bin to obtain the next load.

On occasion, if excessive water and slurry mixture was dripping from the Reject Bin door a driver could drive through the load area to avoid dirtying the truck windscreen, then reverse under the bin door to obtain the load.

The vehicles used

The trucks selected for the haulage task were rigid tipper and tipping dog trailer type vehicles. The truck cabins did not have falling object protection systems (FOPS).

The Reject Bin operating system

The main system of control for the Reject Bin was an electronic programmable logic control system (PLC) housed in a main distribution board at the bin.

The control system included truck detection devices (six photo electric sensors), two sets of traffic lights, bin capacity sensors, truck tray up detection, bin percentage indicator, emergency stop and truck in position light housed on a local control station box. A receiver unit was housed in the local control station to receive the digitally encoded 27MHz signal sent from a remote control hand held transmitter by the driver.

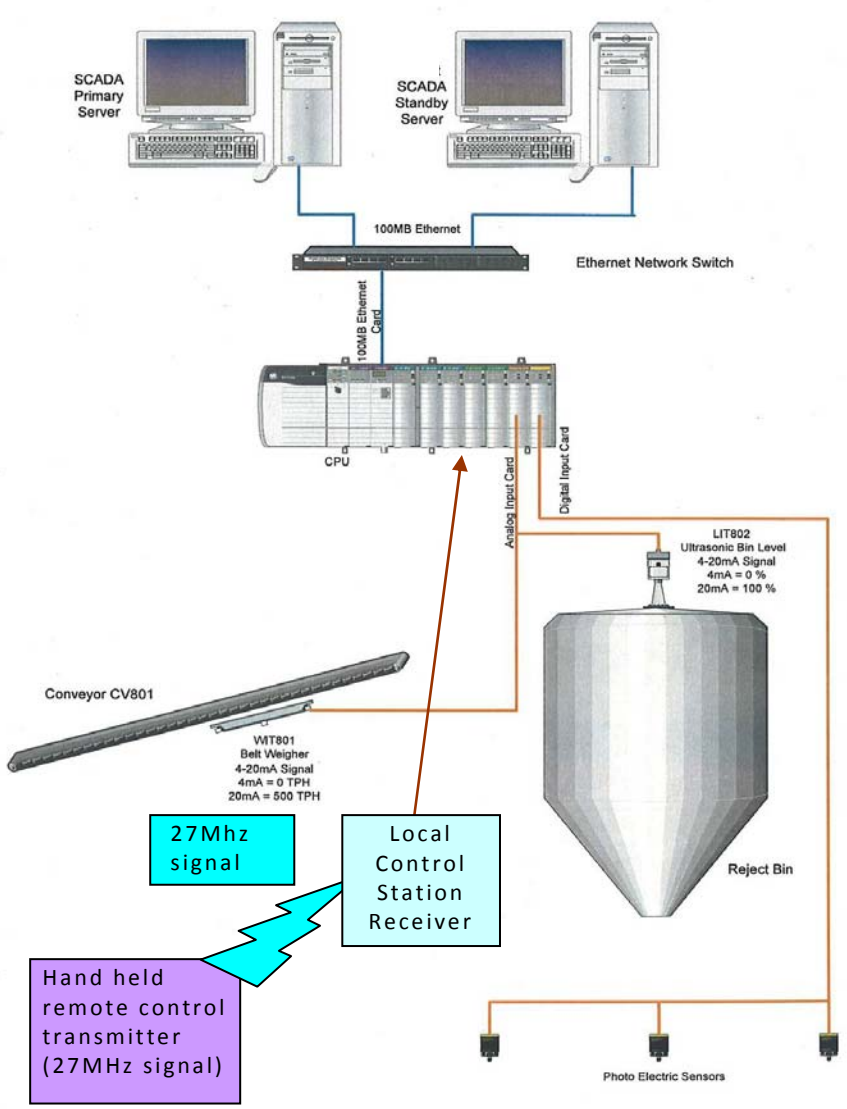
Programmable logic control(PLC) system

Delivery of material from the Reject Bin to the truck was controlled by a PLC processor and software. The software included sequential control logic routines and sequential code (rungs) to control the bin operation.

The PLC processor was supported by a SCADA software system.

SCADA is an acronym for 'Supervisory Control and Data Acquisition' software. Its primary function is to collect data and provide an interface with equipment and enable storage of historical data.

The following diagram is an indicative representation of the bin control system.



Ravensworth Reject Bin Control System Block Diagram

Traffic light configuration

Two sets of traffic lights placed at the entry and exit points of the loading area signalled to drivers the bin loading permissive status when approaching the loading area.

The entry traffic signal remained green at all times, only indicating red when there was less than 15% material available in the bin, if there was a hydraulic power pack fault, truck tray up was detected, there was no power to the sensors or the local control station was set to manual operation.

The exit traffic light changed colour status (green-amber-red) as the vehicle moved through to start the loading sequence.

The exit traffic light turned to red once the three sets of sensors had been detected as being blocked.

When the three sensors had been detected by the PLC as being blocked and the first 10 tonne load had been taken the exit traffic light would then reset to green.

The exit traffic light indicated both green and amber as the truck moved through the loading area to obtain the second load. Once the second load was received the exit traffic light returned to green for the remainder of the loading sequence.

The exit traffic light would remain indicating green as the truck departed from the loading area.

The exit traffic light would only indicate a red flashing light to warn the driver if there was less than 15% material available in the bin, if there was a hydraulic power pack fault, truck tray up was detected, there was no power to the sensors or the local control station was set to manual operation.

Truck detection sensors

The Reject Bin operating system was designed to detect if a truck was in the correct loading position using three sets of photo electric sensors, comprising both transmitter and receiver sensors.

Three pairs of sensors were mounted at a height of 2.7m from the ground.

The sensors were specifically located to detect the side of the truck and trailer passing through the loading area.

The sensors were individually mounted in protective housings to cover the sensor.

Each sensor provided two means of detecting signal degradation due to a dirty lens condition. The first by provision of light emitting diodes (LED) to visually indicate on inspection signal degradation. The second the capability to be hard wired electrically into the PLC system to detect signal degradation.

Looking east under the Reject Bin. The arrows simulate the infra-red beams from the rows of transmitter sensors being blocked by the truck trailer.
One of two sighting mirrors is also visible.
The red paint line on the wall is the visual reference for a driver positioning the truck to take the first load.

(Smith 18/2/09)

Activating the Reject Bin

The Reject Bin door would not open, initially, until all three rows of sensors were blocked, the truck in position light would then be activated and then a digitally encoded 27Mhz frequency modulated (FM) signal was received.

The following two loads could be taken when the sensors on row one and row two were blocked, the truck in position light remained active and a digitally encoded 27Mhz signal was received.

When in position and correctly aligned to receive a load the driver would press a button on the hand held remote unit in the cabin.

The 27Mhz signal was encoded (4,096 code permutations) using a 10 way dip switch and 2 additional links to link to the receiver at the local control station. The hand held remote control device is a commonly used type.

The control system was designed so the driver did not have to leave the truck cabin. The driver was not permitted outside of the cabin in the loading area while the bin was being operated.

A 27Mhz digitally coded signal received at a local control station would then activate a hydraulic pump to pressurise an accumulator tank which then provided the volume of stored energy required for the bin door opening system.

The Reject Bin door comprised two large metal horizontal plates attached to two opposing sets of hydraulically operated rams.

The hydraulic rams pulled the two plates apart to allow rock material to fall under gravity from the storage bin. The Reject Bin door was programmed to automatically open and close in 2½ seconds, the time required to release approximately 10 tonnes of rock waste into the truck trailer positioned below.

It was possible for the truck driver to override the automatic door close system and reduce the time the door was open by activating a second button on the remote control device to close the bin door.

The Reject Bin operation could be remotely monitored via a computer screen at the Ravensworth Coal Preparation Plant control room.

It was not possible for the control room operator to observe loading operations by direct sight from the control room.

There was no video link to the monitor the Reject Bin operation back to the control room.

The Reject Bin door could not be opened remotely from the control room.

The control room operator could start and stop the hydraulic pump that provided the hydraulic energy to the rams to open and close the bin door.

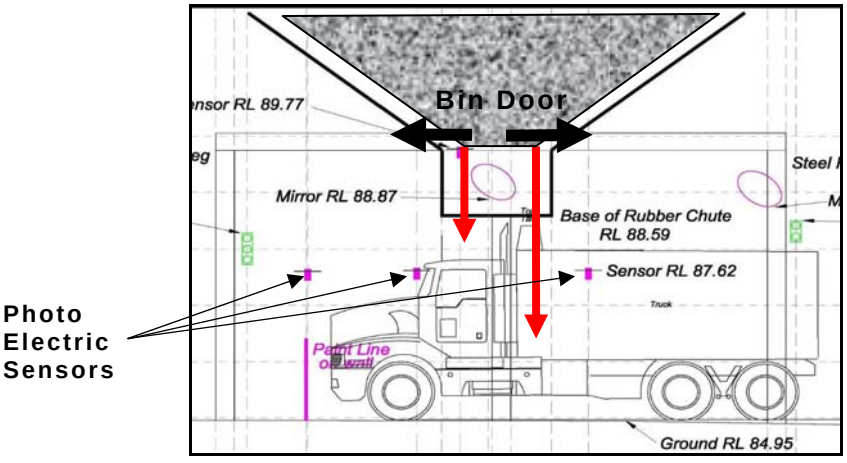
The truck driver could activate a bin door close emergency stop button by leaving the truck cabin and walking a short distance to the local control station box located in the loading area.

The findings

Incident scenario diagram

The following incident scenario diagram shows the approximate position of Mr Oldknow's Kenworth truck at the time the cabin was inundated by the reject rock material.

The material fell approximately 2m onto the cabin as indicated by the left red arrow. Some rock material also fell into the front section of the truck tipper behind the cabin as indicated by the right red arrow.



Incident scenario diagram

Truck sequence and location

The last truck that loaded before the Oldknow incident had taken an extra ½ load of rock material into the dog trailer by pressing the first and second buttons on the remote control device in quick succession.

The driver left the loading area and was proceeding along the haul road to the tipping pad.

This driver was the last person to see Mr Oldknow's truck before the incident as it travelled in the opposite direction towards the Reject Bin to obtain the next load.

The two other drivers were in the vicinity of the tipping pad as Mr Oldknow travelled towards the Reject Bin.

There was no evidence that any of the three trucks on the shift were within range of the Reject Bin and inadvertently transmitted a 27Mhz signal to cause the bin door to open at the same time Mr Oldknow's truck proceeded beneath the bin door.

Shortly after the incident the next driver in sequence behind Mr Oldknow travelled down the hill towards the Reject Bin. He observed that Mr Oldknow's truck was located beyond the bin loading exit as indicated by the position of the truck lights.

The driver was unable to get a response from Mr Oldknow over the truck two way radio communication system.

Second row of sensors not working

An inspection of the Reject Bin and loading area after the incident identified that the transmitter sensor in the second row of sensors was blocked due to a build up of dirt on the lens.

It is unknown how long the blocked sensor had been in this condition before the incident.

The last recorded inspection of electrical control equipment maintenance and inspection before the incident at the Reject bin was dated 8th December 2008.

Probable sequence of events that finally caused the incident

With the second row sensor blocked by dirt and not detected the PLC logic code enabled the system to remain active and not reset to the start of the permissive code sequence.

To continue to open the bin door it only required sensor row one to be blocked by a truck and for a digitally encoded 27Mhz signal to be received.

Post incident testing identified that when the second row sensor was blocked that both sets of traffic lights would still show 'green' to the driver. There was no visual traffic light signal warning that a sensor was blocked.

The other truck drivers said they were unaware that the bin door could potentially open other than the standard sequence.

It was stated in the standard operating procedure for the task that the operating system would not permit the bin door to open until the truck was in the correct position – that is blocking of the three sensors by the body of the truck before the bin door would be permitted to open.

It is most likely that a digitally encoded 27Mhz signal was transmitted from the remote control transmitter unit located in Mr Oldknow's truck as it was moving forward under the Reject Bin.

The PLC system of detecting the position of the truck permitted rock material to fall onto Mr Oldknow's truck cabin before it was in the correct position to receive the load.

Rock material fell from a height of 2m onto the cabin roof which was not designed to carry such a weight.

The dynamic loading event caused the final barrier protecting Mr Oldknow, the cabin roof, to collapse onto Mr Oldknow and ultimately caused his fatal injuries.

It is not known why the release signal was sent

It is not known whether the activation of the remote control unit in Mr Oldknow's truck was inadvertent or intentional.

One of the drivers had observed that David Oldknow had replaced the battery in his remote control device at the start of the shift. Post incident testing confirmed that Mr Oldknow's remote control device and battery opened the bin door without issue.

System could not identify blocked sensor

The investigation identified that the PLC system could not differentiate between a photo electric sensor blocked by a truck or blocked by dirt covering the lens and remained active.

The PLC system when upgraded in August 2007 was not designed to AS 61508-2006 *Functional Safety of Programmable Electronic Safety Related Systems* nor was the PLC functionality assessed to a Safety Integrity Level (SIL) rating.

The sensor unit had a small red and green LED light on the top of the unit that could visually indicate a potential dirty lens condition.

Visual inspection of the LED status by a competent person could potentially have indentified a blocked sensor condition.

The sensor was capable of being electrically connected to the PLC for electrical detection of dirty lens condition however the sensor was not electrically connected beyond the main electrical control board to the PLC system.

There was no evidence of a specific documented system requiring maintenance personnel to inspect and clean the photo electric sensors at the Reject Bin, nor was there any instruction for drivers to do so as part of a shift pre-start activity.

It was identified that Mr Oldknow and another truck driver used a broom and water hose to clean the two sighting mirrors located underneath the Reject Bin at the start of the incident shift.

They did not clean the photo electric sensors at that time.

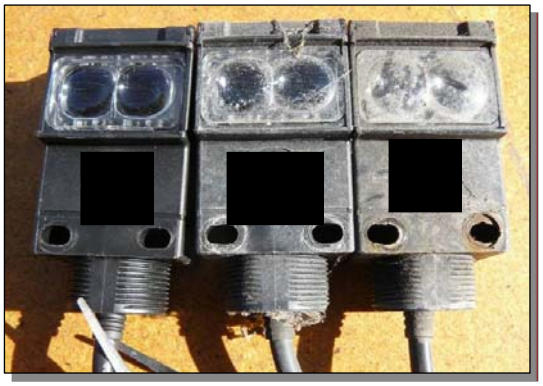
Degradation of the sensors

Testing after the incident identified the amount of signal degradation of each row of sensors.

The following photographs show the condition of each row of transmitter and receiver sensor lenses, compared to a new transmitter sensor on the left.

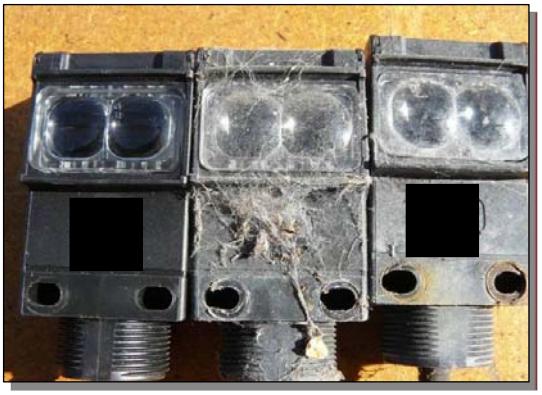
Row 1 sensor signal was 17.64% more degraded by dirt than the new (control) sensor

(Photo Smith 19/11/09)



Row 2 sensor signal was observed to be operational but constantly blocked by dirt during post incident inspection.

(Photo Smith 19/11/09)



Row 3 sensor signal was 0.63% more degraded by dirt than the new (control) sensor.

(Photo Smith 19/11/09)

Truck cabin not constructed to take loads

The Kenworth T401 cabin was constructed of moulded fibreglass with internal reinforcements.

There was no formal permitted design load limit specified at the time of manufacture as the cabin structure was not intended to be loaded.

Testing conducted by Kenworth Australia (a division of PACCAR Australia) of similar components in preparation for Economic Commission for Europe ECEr29 compliance (a standard series of load and impact tests on vehicle cabins and widely regarded as the international standard for cab strength in the trucking industry) indicated that when a distributed load was applied over time that a 10 tonne load was achievable.

Ultimately, the roof of the fibreglass cabin in the Oldknow incident failed to withstand the dynamic loading of the falling reject material from the bin.

Substitute vehicle without fall protection was used

The bin was constructed circa 1983 for use with mine haul trucks with FOPS to remove the rock material and had not been used for a period of time prior to 2007.

The Reject Bin was recommissioned and electrically upgraded back into operation in 2007 by the mine operator.

The haul road owner would not permit the mine operator to use mine haul trucks so the mine operator chose to use road registered trucks for the task.

The road registered trucks selected were not fitted with FOPS.

In late 2008 the mine operator attempted to conduct a trial using FOPS fitted mine haul trucks from the Reject Bin, however the trial did not take place.

Discussions between the mine operator and the haul road owner were still taking place up to the date of the incident.

Industry and Investment NSW Guidelines MDG 15-2002

A prepublication draft amendment in 2007 incorporated into *MDG 15* identified updated clauses in particular for other mobile plant not deemed to be earth moving machinery that a risk assessment must be carried out to determine the risk of unintended overturning or a falling object coming into contact with the driver and the required operator protective devices.

The amendment document added a new clause *'RTA Plant Registered Equipment'* and required that RTA plant registered equipment shall be subject of an inspection by a competent person prior to use on a mine site and as a minimum the inspection is to include:

- Mobile plant has been maintained and is in a fit for purpose condition to enter the mine site.
- All safety critical systems are functional

- A structural inspection is carried out including body and all structural areas
- The tyres are in good condition
- Conduct in service brake testing to verify the mobile plant is capable of stopping on the maximum grade for use.

Australian Standards

AS 2294-1997

Kenworth Australia has fitted ROPS/FOPS to some off road mining trucks and has also made provision on a small number of on-highway trucks for fitment of ROPS/FOPS canopies certified to *AS 2294-1997* manufactured in Australia for bonnet type trucks at the customers request.

NSW RTA compliance rules

The NSW Roads and Traffic Authority (RTA) published heavy vehicle mass limits for vehicles over 4.5t (GVM) permitting operation up to a maximum loaded mass of 42.5 tonnes. NSW RTA also requires a vehicle to display Australian Design Rule (ADR) compliance plates.

NSW RTA does not publish specific guidelines related to FOPS for on road registered heavy vehicles.

Risk assessments related to the operation of the Reject Bin

There are no records of a specific risk assessment being carried out in 2007 to assess the risk introduced by the change in the planned transport of rock waste, from a vehicle that had FOPS to one that did not.

The Reject Bin PLC truck detection system required to be altered to accommodate the physical gap between the truck and dog trailer.

Evidence was found of several risk assessments conducted by the mine operator and the civil contract company related to the task of loading, hauling and dumping the rock material.

Of significance the investigation identified actions listed in a operational risk assessment conducted at the Reject Bin in February 2008 by the site operator which listed amongst other items to:

- Verify the design standard and review the design risk assessment for the coarse reject bin.
- Review of coarse reject bin design for suitability of application.

These two actions were listed as due for completion in February 2008.

It is significant to note that the company operating the mine was the subject of a share market takeover in March 2008 resulting in subsequent significant changes to the operational management at the washery and mine.

The investigation was not able identify evidence that the verification and review of the Reject Bin identified in the February 2008 risk assessment had taken place.

Prior truck loading incidents occurring at the Reject Bin

The investigation identified five unplanned movements associated with loading trucks at the Reject Bin from August 2007 up to the date of the fatal incident.

Of note an incident in 2007 involved a double load of material being placed in the front truck trailer and causing rock material to spill onto the truck cabin roof and bonnet.

Two incidents in 2007 involved inadvertent opening of the bin door before the dog trailer was in the correct position to take the load. One of the incidents caused significant structural damage to the dog trailer tarp cover system.

Action taken after the incident

Actions taken by Industry and Investment NSW

Inspectors from Industry and Investment NSW issued several prohibition notices under the OHS Act on the mine operator covering a variety of issues arising from the investigation.

Inspectors issued a notice prohibiting the use of a truck without a falling object protection structure (FOPS) at the Reject Bin.

Further notices issued on the mine operator required the operator to conduct a fault tree analysis conducted by an independent assessor and to conduct a safety assessment of the safety related functions of the Reject Bin and assignment of appropriate safety ratings to AS61508 requirements.

The mine operator was required to provide a written report and provide a presentation to Inspectors before the Reject Bin was returned to service.

Industry and Investment NSW released a Safety Alert (SA 09-03) in February 2009 to the mining industry which provided recommendations to mine operators to review storage bin loading systems including;

- Identify loading system hazards
- Assess truck loading systems where the cabin passes underneath the discharge point
- Review the effectiveness of operator protection systems
- Review risk controls of a bin delivery system to provide an acceptable level of risk.
- Review electrical and mechanical engineering controls to ensure a safety integrity level or safety category suitable for the level of risk

- Review the system against relevant standards
- Review the procedures for loading a truck

The Department as part of the ongoing Electrical Engineering Management Plan auditing program has targeted functional safety application in the mining industry.

Inspectors undertaking mine site visits have identified operators that operate trucks under loading bins and have actively questioned operators concerning their review of critical safety systems associated with bin loading operations.

In November 2009 Industry and Investment NSW conducted the annual two day Electrical Engineering Safety Seminar which was attended by over 300 delegates.

The seminar included technical papers on safety considerations for PLC and SCADA applications in the mining industry and application of AS 61508 equipment assessments.

Inspectors at the conference also provided feedback to industry and identified current safety issues concerns including outcomes from the Ravensworth Reject Bin investigation.

Actions taken by the mine operator

After the incident the mine operator carried out risk assessments and introduced a number of changes to the process of transporting rock waste from the Reject bin. These changes included:

- Only permitting off-road haul type trucks with fall protection structures to transport rock waste from the bin to the dump site.
- Physically blocking the front entry to the loading area and introducing a practice that required the off-road haul truck to reverse into the loading area so that the cabin is never under the Reject Bin chute.
- Barriers put in place to prevent trucks entering the loading area from the wrong side.
- Installation of additional area lighting in the loading area.
- Establishing a pre-start system check by supervisor and operators.
- Adding a timer to the operating system to detect a sensor remaining obscured with the result the control system will shut down.
- New procedure and maintenance system implemented.
- Isolation devices provided for the hydraulic circuit.
- Installing holder in truck cabins for the remote control unit.
- Retraining of supervisors and operators.

The loading area showing barriers preventing front and side entry, and an off-road haul truck with cabin FOPS reversing under the Reject Bin

(Photo Smith 9/4/09)

Relevant published reference material

Australian Standards	AS 4024 – 2006 (series) *Safety of Machinery* AS 61508 – 2006 (parts 0-7) *Functional safety of electrical / electronic / programmable electronic safety related systems* AS 62061 – 2006 *Safety of machinery – Functional safety of safety related electrical, electronic and programmable electronic control systems* AS 2294.1 – 1997 *Earth moving machinery – protective structures - general*
Industry and Investment NSW **Safety Alerts and Guidelines**	Safety Alert – *Structural bin failure* SA07-03 dated 17/1/07 Legislation update – *Provision of electrical mechanical safeguards with appropriate safety integrity* LU 07-05 dated 22 June 2007 Safety Alert – *Truck operator fatality* SA09-03 dated 20/2/09 Safety Alert – *Rail loading bin spill* SA09-11 dated 14/9/09 Technical reference EES01 *Electrical Engineering Management Plan* Version 1 December 2006 Technical reference EES011 *Technical principles for the design of electrical systems at NSW mines (coal and metals) and extractive operations* Version 1 March 2007 *MDG Guideline for mobile and transportable equipment for used in mines* March 2002 Pre-publication draft amendments No 2 – MDG 15 March 2002 Dated 1 February 2007
RTA NSW guidelines	National heavy vehicle reform – vehicle operations Heavy vehicle mass, loading and access *Dimensions and mass limits for vehicle combinations* Vehicle Standards Information 18 Revision 2 October 2003 *Australian Design Rules* Number 7 revision 3.1 dated 1/11/07