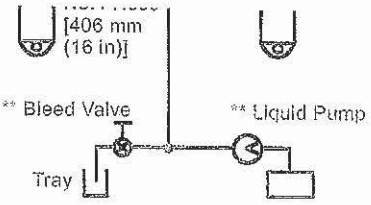
- P-1A conversion from MPA to psi incorrect
- P-1A spec incorrect Mpa 0.77 should be 0.97MPA pg W2-11-34
- Step 6 has incorrect spec press. not 5.88Mpa but 1.66MPa. pg W2-11-38

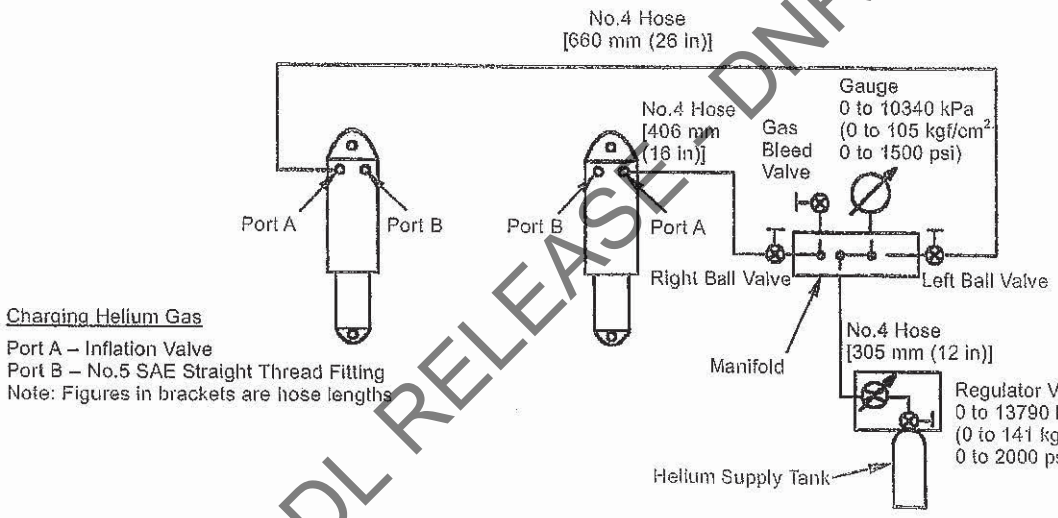
EH3500AC 2 Rear Strut

A

Charging Neocon Oil

Port A – Inflation Valve
Port B – No.5 SAE Straight Thread Fitting
Items marked ** not included in the charging kit
Note: Figures in brackets are hose lengths





Charging Helium Gas

Port A – Inflation Valve
Port B – No.5 SAE Straight Thread Fitting
Note: Figures in brackets are hose lengths

T701 00-1021

Helium Gas/Neocon Oil Charging Procedure Diagram

◦ Suspension Cylinder Charge Data

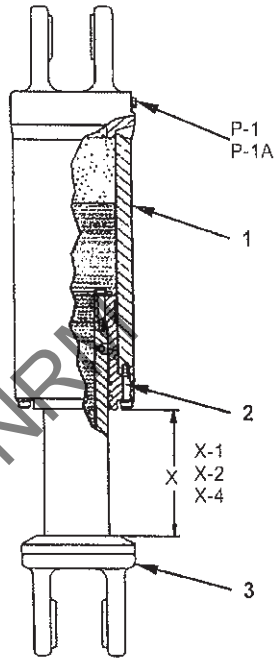
X-1	Rod dimension	Suspension cylinder when fully extended	127 mm	(5.0 in)
X-2	Rod dimension	When empty (After 48-hour operation)	82.9 mm	(3.26 in)
X-4	Rod dimension	After charging neocon oil only	50.8 mm	(2.0 in)
P-1	Charging pressure	Neocon oil/helium gas immediately after charging	1.66 MPa	(16.9 kgf/cm², 240 psi)
P-1A	Charging pressure	After 48-hour operation (When fully extended)	0.77 MPa	(9.9 kgf/cm², 140 psi) ← 112psi (?)
Neocon oil charge capacity			20.82 Liters	(5.5 US gal)

incorrect conversion
which is correct?

Charging Neocon Oil

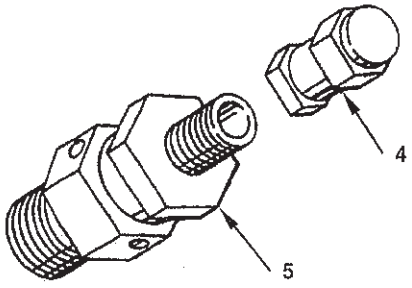
CAUTION: Suspension cylinder weight: 700 kg (1540 lb)

1. Lift suspension cylinder (2) upright with the rod facing down.
2. Remove valve (7) and pressure sensor (8) from suspension cylinder (7). Fully extend suspension cylinder (1). The maximum rod dimension is shown in X-1 of the suspension cylinder charge data.
3. Connect the neocon oil charge kit. Refer to the helium gas / neocon oil charging procedural diagram for connecting procedures.
   An example of a charge kit is shown in the diagram.
4. Connect the neocon oil charge line to pressure sensor (8) port, and loosen the outer lock nut (5) on inflation valve (6) by turning it anticlockwise.
5. Charge suspension cylinders (1) with neocon oil. Charge until the bubbles stop forming from inflation valve.
6. Close inflation valve (6) outer locknut (5). Retract suspension cylinder (1) by applying a load. Place a tray by the edge of the neocon charge line. Take out the neocon oil from pressure sensor (8) through the neocon oil charge line to adjust suspension cylinder (1) length to its specified rod length at a time of neocon oil charge completion (X-4).
7. Remove the neocon charge line, and attach valve (7) and pressure sensor (8). Do not spill the charged neocon oil.
   Valves (7)
   : 27 mm
   : 20 N·m (2.0 kgf·m, 180 lbf·in)
   Pressure sensor (8)
   : 27 mm
   : 98 N·m (10 kgf·m, 72 lbf·ft)
8. Do not extend the suspension cylinder until suspension cylinder is charged with neocon oil and the outer lock nut (5) on inflation valve (6) and valve (7) is shut. The air will enter through the seal if the suspension cylinder is extended.



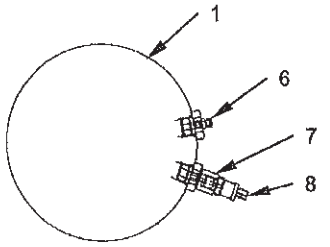
T8DS-04-05-008

Suspension Cylinder Rod Dimension



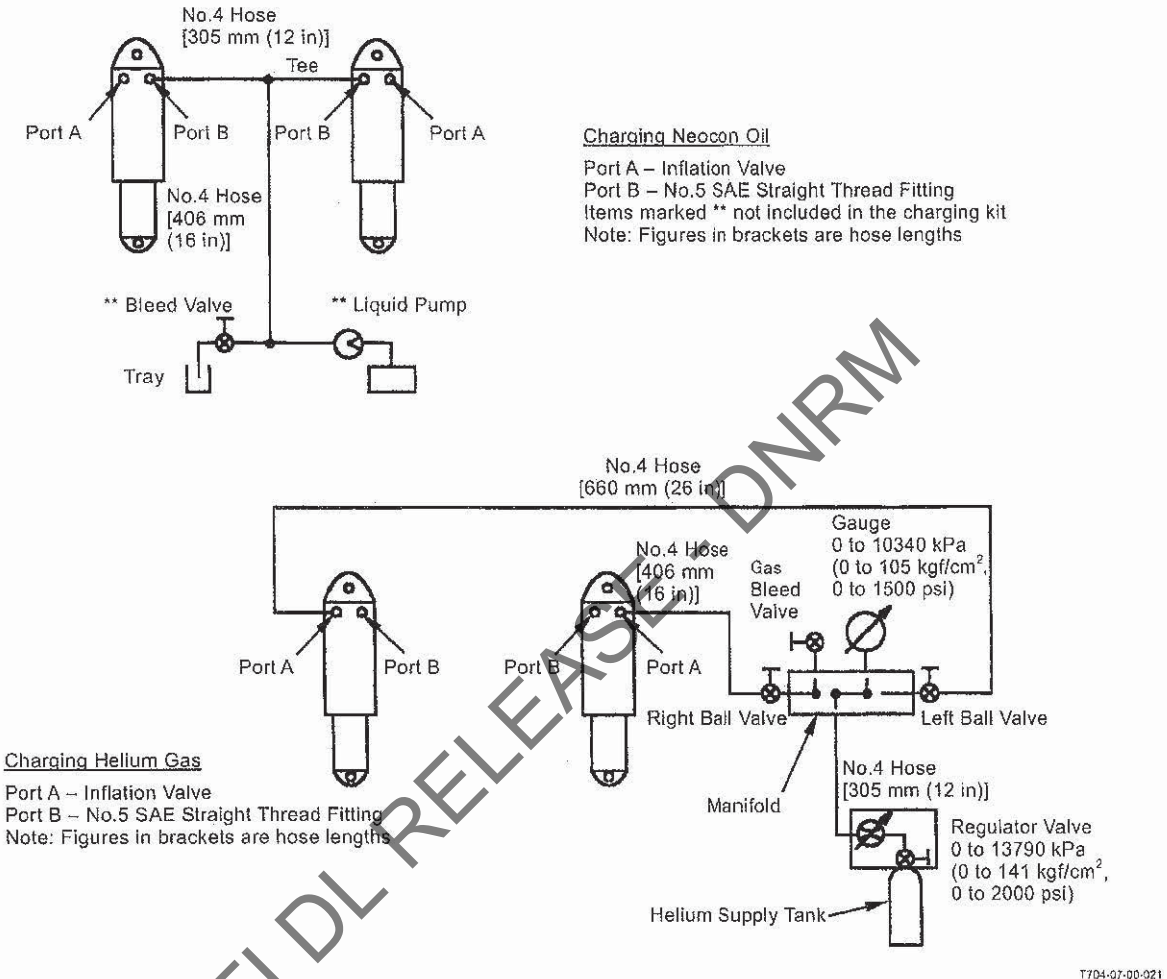
T704-07-00-014

Inflation Valve (6)



W6DS-02-11-006

CHARGING HELIUM GAS



Helium Gas/Neocon Oil Charging Procedural Diagram

• Suspension Cylinder Charge Data

X-1	Rod dimension	Suspension cylinder when fully extended	127 mm	(5.0 in)
X-2	Rod dimension	When empty (After 48-hour operation)	82.9 mm	(3.26 in)
X-4	Rod dimension	Immediately after charging neocon oil only	50.8 mm	(2.0 in)
P-1	Charging pressure	Neocon oil/helium gas immediately after charging	1.66 MPa	(16.9 kgf/cm^2, 240 psi)
P-1A	Charging pressure	After 48-hour operation (When fully extended)	0.77 MPa	(9.9 kgf/cm^2,140 psi)
Neocon oil charging capacity			20.82 Liters	(5.5 US gal)

Charging Helium Gas

IMPORTANT: Use a charge kit to charge helium gas into both front suspension cylinders (1).

CAUTION: Only charge helium gas into suspension cylinder (1). Do not charge any using other gas.

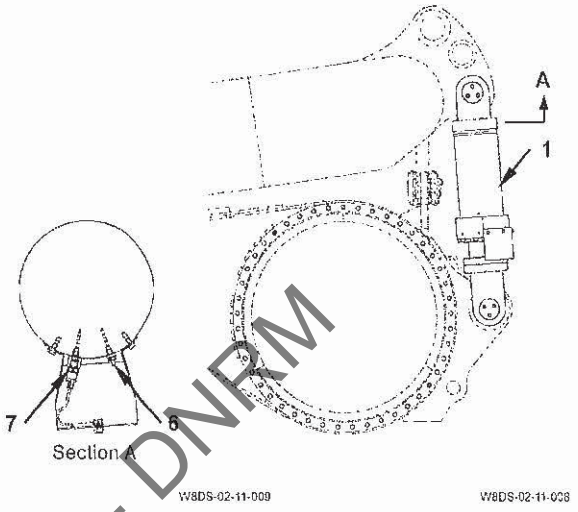
1. Connect helium gas charge kit adapter to port A inflation valve (6) located on both suspension cylinders (1). Open inflation valve (6) by turning outer locknut (5) by turning anti-clockwise.

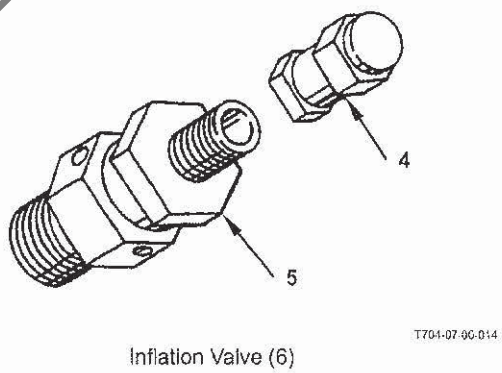
CAUTION: Machine rear axle weight: 75600 kgf (166700 lbf)

2. Prepare to lift the rear of the machine frame when charging the suspension cylinder (1).

3. Set the gas regulator to minimum pressure of 690 kPa (7 kgf/cm^2, 100 psi).

4. Open the ball valves on the left and the right manifolds. Simultaneously, lift the rear part of the machine as high as possible and charge helium gas to the suspension cylinders (1). Air entering through the seal can be avoided by charging suspension cylinder (1) with gas regulator pressure of over 690 kPa (7 kgf/cm^2, 100 psi) while extending.





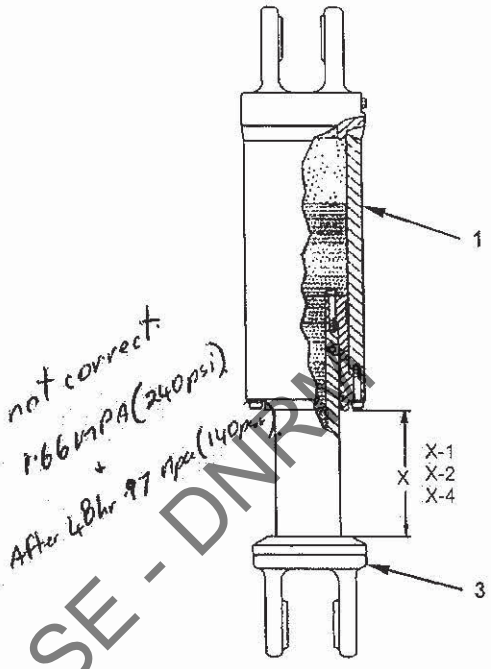
Inflation Valve (6)

5. Check that the vehicle is stable. Charging helium gas into suspension cylinder (1) until it is fully extended. The length of the rod should be at a dimension stated on the charge data X-1. Check the length of both suspension cylinders (1).

6. Adjust the pressure of both suspension cylinders (1) to its initial settings P-1, and adjust the balance of both sides by opening the ball valve.
   If suspension cylinder (1) fails to extend fully with helium gas pressure, apply external force and extend gradually. The rod dimension should be at X-1 when it is fully extended.
   Set the helium gas charging pressure to 5.88 MPa (60 kgf/m², 853 psi) when the suspension cylinder is fully extended.

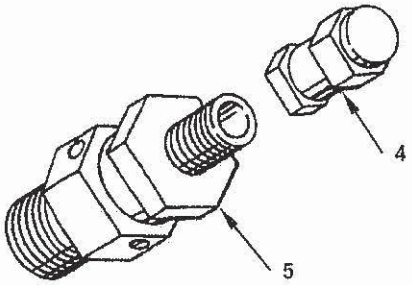
   NOTE: The helium gas (charging) pressure when fully extended will become 5.19 MPa (53 kgf/m², 752 psi) after 48 hours of operation.

7. Turn outer inflation valve (6) outer locknut (5) clockwise to close inflation valve (6) (port A) on suspension cylinder (1). Remove the pressure in the line by open the gas bleed valve on the manifold. Remove the helium gas charge kit assembly from the inflation valve (6) and place protective cap (4). (Refer to the diagram.)



T8DS-04-05-008

Suspension Cylinder (1) Rod Dimension



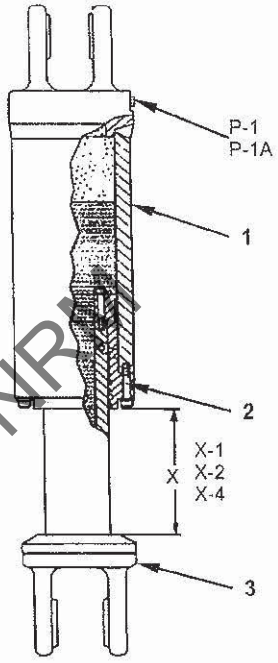
T704-07-00-014

Inflation Valve (6)

SERVICING PROCEDURE OF REAR SUSPENSION CYLINDER

For the first 48 hours of operation after charging, the helium gas and neocon oil mixes inside the suspension cylinders (1) and dissolute. Suspension cylinder (1) dimension may become shorter when dissolution occurs. Regularly inspect suspension cylinder (1) after operating the machine for 48 hours. Measure the distance between cylinder head (2) and piston rod (3) head (X-2) to determine the state of suspension cylinder (1). Measure the length on a flat ground with no load on the machine. Operate the machine for at least 1 hour before measuring. (Do not apply excessive braking.) Correct measurement cannot be taken if the above conditions are not met.
Check the following points if the piston rod dimension of the suspension cylinder is out of its permissible range.

1. Neocon oil, helium gas leak
2. Measure the suspension cylinder pressure when the cylinder is fully extended (P-1A). Solve any issues found, and follow the charging procedures and recharge the oil/gas.



Suspension Cylinder (1) Rod Dimension

SUSPENSION CYLINDER STORAGE

Insert specified amount of oil, and plug all ports when storing the suspension cylinder. Store in a way that the finishing does not corrode, and chrome plated area of the piston rod does not become damaged. If the oil had to be left charged in the cylinder when storing, have the suspension cylinder upright with piston rod facing down.

BODY / Frame Suspension

(Blank)

Mine Name	File No.	Operator	Activity Type	Region	Activity Date
Middlemount Mine	1762	MIddlemount Mine Management Pty Ltd ABN: 62 140 398 143	Inspection - Weekend or Backshift	Central	20/06/2013

Vision: Our Industries Free of Safety and Health Incidents

Mine Record Entry

This report forms part of the Mine Record under s68 of the Coal Mining Safety and Health Act 1999. It must be placed in the Mine Record and displayed on Safety Notice Boards.

Note that inspection or audit activities conducted by the Mines Inspectorate are based upon sample techniques. It remains the primary responsibility of Mine Personnel to identify hazards, and risks associated with Operations and ensure those risks are at an acceptable level.

Today Inspectors of Mines Fritz Djukic (Occupational Hygiene), Neville Atkinson (Electrical) and Darryl Casey (Mining) attended Middlemount Coal Mine. The purpose of the visit was to review progress with respect to the mines investigation into the suspected carbon monoxide exposures that occurred during the period 11 to 14 May 2013.

On arrival to site an opening meeting was held and attended by Alex Mumme (SSE), Darren Cuthbertson (Production Manager), Paul Shankley (Maintenance Superintendent), John Palmer (EEM) and Sonia Finney (Health Safety and Training Manager). The purpose of the meeting was to provide the Inspectors with a progress update with respect to the ongoing incident investigation. The issues discussed are summarised below.

- Progress with the ICAM investigation

The ICAM investigation is planned for Monday 17 June 2013. The ICAM process has been delayed while additional information was gathered from monitors and other lines of enquiry were completed. In the interim Middlemount Coal mine has engaged expert technical assistance from Bob Butcher.

Investigations to date indicate that the most likely cause of the initial exposures were the result of an accumulation of Carbon monoxide entering the cabins. This is likely to be caused by two shovels loading adjacent to a closed face. The dump trucks were on relatively short runs down in the pit and vehicles were queuing in close proximity to each other. This was coupled with favourable environmental conditions that supported the build up of gas.

A copy of the ICAM report is to be supplied to the District Inspector - Darryl Casey when completed.

- Results from continuous monitoring in the Hitachi 3500

Middlemount Coal Mine has been providing the inspectorate with regular results from monitoring conducted inside the cabins of the 3500s and weather station data. The gas monitoring has been consistently well below the shift adjusted Time Weighted Average (TWA) of 15 ppm. The TWA data is typically well below 1 ppm. Only brief excursions of up 27 ppm have been recorded. These levels quickly dissipate back to zero and no evidence has been recorded to show the gradual build up and accumulation of carbon monoxide inside the cabins. It is possible that a change in mining practices, enforced stand off distances for loading trucks and greater awareness of the hazard has

resulted in improved operating conditions and a reduction in the accumulation of gas. These changes to mining practice have not yet been included into the relevant SOPs or underpinning risk assessments.

Discussions were held regarding the current monitoring requirements, alarm levels and operator rotation policy. It was agreed that the monitors will remain in the Hitachi EH 3500's and that an alarm level of 15 ppm for carbon monoxide will remain in place. Inspector Djukic advised that if no alarm was experienced, based on gathered monitoring data, it was no longer necessary to rotate operators at every six (6) hour interval.

The SSE has undertaken to ensure that all relevant SOPs and underpinning risk assessments are reviewed with a cross section of the workforce to ensure that the hazard of toxic gas including carbon monoxide is identified and controlled. This should include the changes that have been made to mining practices and any other controls or recommendations identified during the ICAM process.

- Results from baseline engine exhaust testing across the fleet

Paul Shankley provided an overview of baseline engine exhaust testing conducted by Graham Helig of Emerald Diesel Pump and Injector Service. Results indicate that the Hitachi EH 3500s do not produce any more carbon monoxide in comparison to the other diesel operated equipment.

Nitrogen dioxide (NO_2) in Hitachi EH3500 (RTD 16) was observed to be elevated but still within acceptable levels. The problem was traced back to the injectors. The injectors were subsequently replaced.

Based on this information the SSE is instructed to review the monitors currently being used to ensure a capability for the measurement of nitrogen dioxide (NO_2) in side the cabin so that this can ruled out as a source of exposure. An NO_2 sensor may be used at the expense of hydrogen sulphide (H_2S) or methane (CH_4).

It is acknowledged that the symptoms reported form the initial exposures do not reflect NO_2 exposure, however, as NO_2 is a component of exhaust gas it would be appropriate to measure this gas rather than H_2S or CH_4. In addition more recent reported exposures include symptoms that included irritation.

The SSE was advised that Inspector of Mines (Mechanical) - Anthony Logan will be on site in the near future to review mechanical aspects of this investigation including emission testing data and maintenance practices.

- Results from OEM inspection of the Hitachi 3500

Paul Shankley advised that both Cummins and Hitachi had been assisting with the investigation process. No issues had been identified by either OEM and similarly they were not aware of any gas related incidents at any other sites where this model truck was being used.

Previous enquiries by Inspector Atkinson had established that a software change had been made to the EH 3500s in the weeks leading up to the reported exposures. Problems were experienced with the upgraded package and the software was reverted back to the original package. At the suggestion of Inspector Atkinson, the relay boxes of these truck were inspected for signs of possible heating or damage. Photographic images of DT15 and DT16 showed signs that indicated evidence of heating and smouldering. Although it is not suspected that this has accounted for all of the original exposures it may possibly be explained for the incident that occurred in RT15 after a relatively short duration. The other exposures are most likely the result of accumulation of exhaust gas that has built up over the shift.

It was requested by Inspector Atkinson that a sample of the insulation board be taken and tests conducted to identify relationship between effect of heat and species of gas liberated.

- Details of available medical records of coal mine workers originally exposed to carbon monoxide

Inspector Djukic advised that he had been provided with the medical treatment records of two of the coal mine workers who were admitted to Dysart Hospital with suspected carbon monoxide "poisoning". Tests undertaken by the treating staff did not include intravenous sampling for carboxy haemoglobin levels. Without this test it cannot be confirmed that the exposure was due to carbon monoxide or the extent of the exposure. Inspector Djukic advised that when he has been provided with all medical treatment records he will forward these to the Department's Occupational Physician, Dr David Smith for review and advice. Sonia Finney advised that Middlemount Mines Nominated Medical Adviser (NMA) would also be reviewing the medical reports and provide a report.

The SSE is requested to provide a copy of the NMAs report to District Inspector, Darryl Casey.

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- Details of the most recent gas related incidents and the reported symptoms

Details of the most recent reported exposures were provided to the Inspectors. Some of these exposures have been confirmed to be unrelated to the workplace or operation of the EH3500's. The majority of them involve reports of mild irritation to the eyes and symptoms not consistent with carbon monoxide exposure.The mine has undertaken many lines of investigation to potential sources of exposure including a review of coolant usage.

Exposure to diesel exhaust including nitrogen dioxide (NO_2) may result in irritation to the eyes and upper airways. **As discussed above, ensure that all monitors have the capability to measure nitrogen dioxide.**

- Communication of these issues with the workforce

Issues around communication of the hazard, incident investigation and monitoring results were discussed. It is important that the senior management maintain a transparent and open dialogue with the coal mine workers. It is acknowledged that this could have been done better during the early stages of this process.

It is important that the coal mine workers have a clear understanding of the hazard and are regularly updated with relevant information.

It is important they have confidence in the process and are part of the solution.

It is important that SSHR continues to be included in the process.

- Other issues relating to the operation Hitachi EH 3500's

It was reported to the inspectors that sectors of the workforce do not like operating the EH 3500's. The reasons provided for this is based on comfort and "roughness" of ride. It is important that if these concerns are of a genuine health and safety nature than they be investigated and controlled. Inspector Djukic discussed the hazards of whole body vibration and techniques for measurement. Inspector Casey discussed truck design and the impact of road condition on whole body vibration.

Mr Mumme advised that the mine had already engaged Health Connect to come to site and review the ergonomics of the EH3500 cabin and provide training to operators. In addition Ms Finney advised that the mine has engaged Field Enviro to conduct a baseline survey of whole body vibration across the mobile fleet.

Inspector Djukic offered to provide Ms Finney with a copy of the Inspectorates Whole Body Vibration Kit. This includes tool box talks and fact sheets.

The SSE is requested to provide a copy of the whole body vibration assessment to Inspector of Mines (Occupational Health), Trudy Tilbury.

-

Site Inspection.

Following the meeting Inspector Djukic and Inspector Casey accompanied Alex Mumme (SSE) and Darren Cuthbertson (production Manager) to the south end of central pit to observe mining operations. There were two shovels working in an open area loading at two points. The Rear dump fleet could be observed adhering to the appropriate stand off distance.

It is plausible to see how an accumulation of gas could be produced with two shovels loading up against a closed face and dump trucks operating on short runs with extended periods of queuing. The effect would be intensified if the environmental conditions were favourable and if the rear dumps did not travel up out of the pit during their run, as was the case during the period 11 - 14 May 2013.

RT16 Inspection

In the company of Mr Shankley (Maintenance Superintendent) and Mr Palmer (EEM), Inspector Atkinson conducted an inspection of truck DT16 which was located in the main workshop. During the inspection a discussion was held in regards to the tests that are to be conducted on the insulation board, located in the relay box. These tests are to confirm the fumes that are given off by this board when an over temperature event occurs involving the insulation board.
It was noted that the fresh air vent for the operators cabin was located at floor level directly under the windscreen.

Summary

After completion of the site meeting and inspection the following requests are addressed to the SSE.

I. Provide a copy of the ICAM Investigation to District Inspector, Darryl Casey.

II. Provide a copy of the NMA's report to the District Inspector, Darryl Casey.

III. It is requested that a sample of the insulation board be taken and tests conducted to identify relationship between effect of heat and species of gas liberated. Provide a copy of the report to District Inspector, Darryl Casey.

IV. The 6 hourly change out of operators may be discontinued provided there are no alarm triggers. Maintain current alarm level of 15 ppm for carbon monoxide.

V. Include capability to measure Nitrogen dioxide in all Hitachi EH3500s.

VI. Ensure that all relevant SOPs and underpinning risk assessments are reviewed with a cross section of the workforce to ensure that the hazard of toxic gas including carbon monoxide is identified and controlled. This should include the changes that have been made to mining practices and any other controls or recommendations identified during the ICAM process.

VII. The SSE is requested to provide a copy of the whole body vibration assessment to Inspector of Mines (Occupational Health), Trudy Tilbury.

VIII.

I.

Fritz Djukic

**Inspector of Mines; Senior Principal Occupational Hygienist
Central; Central Region**

Darryl Casey

**Inspector of Mines (Mining)
Central Region**

Neville Atkinson

**Inspector of Mines (Electrical)
Central Region**

Queensland Government

Safety & Health, Mines Inspectorate
Mackay District Office
P.O. Box 1801, MACKAY QLD 4740
Phone: (07) 4967 1450, Fax: (07) 4953 2761

Mine Name	File No.	Operator	Activity Type	Region	Activity Date
Middlemount Mine	1762	MIddlemount Mine Management Pty Ltd	Site Meeting	Central	07/03/2014

Vision: Our Industries Free of Safety and Health Incidents

Mine Record Entry

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Today Inspectors of Mines Fritz Djukic (Occupational Hygiene) and Neville Atkinson (Electrical) attended Middlemount Coal Mine. The purpose of the meeting was to review and close out actions that had been generated as a result of the inspection conducted on 20 June 2013.

On arrival to site a meeting was held and attended by Darren Cuthbertson (Mining Manager), Paul Shankley (Maintenance Superintendent), John Palmer (EEM) and Sonia Finney (Health Safety and Training Manager). Site Senior Executive (SSE) Alex Mumme had advised the Inspectors of his unavailability and nominated Darren Cuthbertson as the point of contact.

The following points summarise the discussions during this meeting.

- There have been no further reports of gas related symptoms or exposures relating to the operation of the E3500 rear dumps since the inspection on 20 June 2013.
- FIELD Enviro have provided the final report detailing results and findings from the intensive in cab continuous gas monitoring program. During the monitoring period there were no recorded exceedances of the Carbon monoxide or Nitrogen Dioxide exposure limits. Based on the results it was concluded that under current mining practices there was no relationship between operation of thee Hitachi E3500s and excessive Carbon Monoxide concentrations. A number of brief excursions were detected on several occasions. These excursions did not constitute an exceedance of the exposure limits and on investigation the most likely source of exposure was determined to be associated with the use of personal aerosols or air fresheners. The OEM of the gas monitoring devices has confirmed the potential for sensor interference associated with the use of hydrocarbon based aerosols.
- All corrective action items from the ICAM investigation have been closed out.
- The risk assessment for Flammable or Toxic Gas and the associated SOP has been reviewed.
- The SOP for *Spoil Dumps, Excavated Faces and Discharge of Loads* has been reviewed and updated to include mining practices to avoid vehicle congestion and the potential build up of toxic gases.
- Baseline whole body vibration (WBV) assessment has been conducted across site on all types of mobile plant. This process identified potential for excursions above the likely Health Risk Zones for the E3500 haul trucks. Maintenance actions conducted on these trucks including seat replacement/refurbishment and adjustment of strut pressures have resulted in reduction of the measured Vibration Dose Values (VDV). The VDV provides a good indication of the roughness of the ride.

- The Inspectors were advised that enquiries conducted by on site maintenance personnel had indicated that OEM had provided incorrect information on the strut pressure setting in their procedures manual. The pressures were too high resulting in an elevated Vibration Dose Value (VDV) and increased jars and jolts for operators.
- A WBV worker education program and communication of results has been provided to the work force. An ongoing monitoring and control programme with respect to WBV will continue on site. This will include ensuring high standard of road maintenance, rotation of operators performing certain tasks (eg. dozer ripping), enforcing maximum speed limits and worker education.
- EEM John Palmer provided a section of insulation board similar to that which had undergone testing at Simtars. Testing conducted by Simtars had investigated the potential for heating and thermal decomposition of the insulation board when electrical current was applied to the stainless steel terminal studs. Evidence of smouldering had been found in two of the E3500 haul trucks. Operators of these trucks had complained of odour and symptoms of irritation not consistent with CO exposure. The report prepared by Simtars identifies the potential for significant concentration of irritant gases to be produced. However the report outlines that comparison of the measured levels with exposure standards should be done with caution. Repeat testing conducted after replacing the stainless steel terminal bolts with brass bolts indicates that the maximum temperature reached at the terminal was 160^{o} when applying much higher electrical currents than those used on the stainless steel bolts. At this temperature no fumes were emitted. Subsequently all stainless steel components on the insulation boards have been replaced with brass or copper. It is of concern that the OEM may have been aware of this issue prior to the incidents on site and failed to communicate this to the mine.

The following documentation was provided to the Inspectors for review and to assist in close out.

I. Incident Investigation Report - CO exposure to Haul Truck Operators 11/5/2013 - 11/06/2013.

II. NMA medical summary report on Operator illnesses in May 2013 at Middlemount Mine.

III. Middlemount Coal Mine Gaseous Contaminant Monitoring Hitachi 3500ACII Haul Truck Fleet: Final Report.

IV. Middlemount Coal Mine Whole Body Vibration Assessment 2013.

V. Middlemount Coal Mine Whole Body Vibration Assessment Haul Truck Fleet.

VI. Flammable and Toxic Gas Risk Assessment, RA 138-002.

VII. Flammable an Toxic Gas Standard Operating Procedure.

VIII. Spoil Dumps, Excavated Faces and Discharge of Loads Standard Operating Procedure.

IX. Tool Box Talk - Operators suffering effects of Carbon Monoxide Poisoning, May - June 2013.

X. Tool Box Talk - Harmful Gases, May - June 2013.

XI. Tool Box Talk - Potable Water Tests - January 2014.

XII. Tool Box Talk - Occupational Hygiene Monitoring - January 2014.

It is apparent to the inspectors that the mine has devoted significant effort and resources into this investigation. In particular significant emphasis has been placed on the communication of both Health and Safety matters with the workforce. It is acknowledged that this may not have been handled well initially but it is pleasing to see that the importance of communication has been a significant learning from this incident.

The mining manager and his team are thanked for the assistance provided to the inspectors on this day.

Fritz Djukic
Inspector of Mines
Central Region

Neville Atkinson
Inspector of Mines (Electrical)
Central Region

Queensland Government

Mackay District Office
P.O. Box 1801, MACKAY QLD 4740
Phone: (07) 4967 1450, Fax: (07) 4953 2761

Mine Name	File No.	Operator	Activity Type	Region	Activity Date
Middlemount Mine	1762	Middlemount Mine Management Pty Ltd	Postal Mine Record Entry	Central	16/09/2013

Vision: Our Industries Free of Safety and Health Incidents

Mine Record Entry

This report forms part of the Mine Record under s68 of the Coal Mining Safety and Health Act 1999. It must be placed in the Mine Record and displayed on Safety Notice Boards.

Review of Whole-Body Vibration and Vehicle ergonomics issues at Middlemount

As part of the investigation into the Hitachi EH 3500 complaints that formed part of the Mine Record Entry of the 20th of June 2013, Inspector of Mines (Occupational Hygiene) Fritz Djukic and District Inspector Darryl Casey discussed the ergonomics and Whole-Body Vibration issues that may be contributing to coal mine worker complaints with these vehicles. Inspector Djukic asked the site to provide a copy of the Whole-Body vibration assessment report to myself. The inspectors were told that Middlemount had already engaged a provider to undertake ergonomics assessments of their vehicles.

In addition, as the previous responses provided to a survey of Whole-Body Vibration management by the site in August 2012 were incorrect and required updating, the baseline WBV assessment would allow the site to resubmit the survey with current information.

I discussed the general ergonomics and WBV findings with the site on the 12th of September, and it was apparent that there were still some issues with equipment that required further investigation and advice. I explained that mining equipment ergonomics was a specialised area, and the combination of Whole-Body vibration issues and potential seating/equipment ergonomics issues would likely require more specialised advice that their current consultants had the background and expertise to provide.

In general terms, I explained that musculoskeletal injuries or disorders from operating mining equipment was dependent on the tasks performed, the duration of exposure, and in some cases, how well the seating integrated with the equipment. For example, ergonomics hazards and therefore injuries found in haul truck operators could be different to those ergonomics hazards and injuries found in dozer operators. As the exposures and equipment differed between Similar Exposure Groups (or SEGs), risk management and control measures, including monitoring would also be different. For example, appropriate seating and training of all operators in seating will usually manage the risk of WBV exposure for haul truck operators, but this requires an effective identification of seats that will dampen the vibration at the appropriate resonance, and training for operators to adjust the seats as well as identify road conditions that cause high vibration exposure or jolts/jars.

Review of WBV assessment and report

On reviewing the Whole-Body vibration assessment and report, I believe that the WBV report addresses all of the key factors, including associated strata/face conditions, road conditions, maintenance, seating and operator skill contributions. As with any monitoring exercise, only a selection of equipment and a small number of operators can be captured during the measurement. It will always be the case that some results may underestimate or overestimate the actual exposures of equipment operators. In addition, the monitoring is only capturing the conditions at the time.

There should be sufficient information in the report, along with the contents of the WBV toolkit, to assist the site to prioritise management of WBV on site, and the key role of the maintenance superintendent and well as drill/blast crews for managing the 'hardness' of the material for bladed equipment handling.

The interaction between equipment ergonomics, seating and vibration exposure with the Hitachi EH 3500 under the situations mentioned in the WBV report is of concern. Although it was expected that dozers and light vehicles would have higher vibration exposures (as this is the norm in the mining sector), the results at Middlemount showing a number of higher exposures in dump trucks due to seating/anthropometrics (worker size/height) interactions requires further advice.

Recommendation

Middlemount should consider obtaining specialised advice from consultants with significant experience in mining seating ergonomics and whole-body vibration to develop a plan to manage the higher than expected level of vibration exposure for some of their haul trucks operators. With specific reference to the Hitachi EH 3500, it would be important to also involve the Maintenance Superintendent and the expert in discussions with the OEM to determine if the seating provided with the equipment is effective in reducing the risk.

Finally, as mining equipment ergonomics, including seating and cab design/control placement, access and egress is a specialised area, the site should ensure that they engage consultants with appropriate knowledge and skills.

Trudy Tilbury
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Central Region