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INVESTIGATION REPORT

WORKER C – POSSIBLE SILICOSIS



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Executive Summary

On 15 June 2019, a metalliferous mine (the mine operator) notified the NSW Resources Regulator that it had received an adverse health monitoring report regarding a worker at one of its operations (the mine). The worker has been referred to as 'Worker C' and the mine operator de-identified to maintain anonymity of the worker.

Worker C is a male, aged in his forties, who has worked at the mine for approximately nine years, of which seven years involved work underground. It is believed that Worker C's pre-mining employment roles did not involve exposure to airborne contaminants.

The worker may have been exposed to high levels of dust for a total of two years between 2013 and 2017 when he worked underground. The worker was involved in drilling and charging work undertaken during mine development. The worker asserts that he used compressed air to eject loose material from drill holes prior to blasting and that this practice produced a lot of dust.

Worker C underwent diagnostic testing in December 2018 and January 2019 which was facilitated by iCare. The testing identified changes in his lungs. Having regard to the results of these tests, the worker's history and his clinical presentation a differential (possible) diagnosis of silicosis was made by iCare.

The mine operator facilitated further specialist review for Worker C. This review determined that Worker C's diagnosis was not certain. Other possible causes of the changes in Worker C's lungs include pneumonitis, sarcoidosis and smoking related bronchiolitis.

Finalisation of this investigation was delayed whilst the worker underwent further testing and specialist review in the hope that his diagnosis could be clarified. Although it is over two years since changes in the worker's lungs were first detected, the cause of these changes has not been confirmed. The reviewing specialist is of the opinion that the history provided by the worker about his exposure to airborne contaminants would be sufficient to produce silicosis, however, the worker's lung condition does not presently meet the criteria for a diagnosis of this kind. The worker will continue to be monitored by his reviewing specialist. The worker continues to be employed at the mine in an above ground role.

The worker declined to be interviewed or participate in the investigation. This restricted the level of inquiry that was able to be undertaken.

The Regulator closed the investigation on 21 January 2021.

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1. Relevant history of worker C

1.1. Personal history

1.1.1. General

The investigation did not identify any non-work related activities that may have exposed the worker to silica.

1.1.2. Health

The worker's reviewing specialist stated that his past medical history is unremarkable and that he has a good level of fitness. The worker has had asthma since he was a child. He smoked for ten years, averaging 15 cigarettes each day for five of those years and 30 cigarettes per day for the remainder. During 2020, he ceased smoking regularly but admitted to having an occasional cigarette in social settings.

1.1.3. Pre-employment medical health assessment

In June 2018, Worker C underwent a medical health assessment as part of his employment with the mine operator. The worker indicated that he had not previously been subjected to an occupational health surveillance test nor had he previously had a chest x-ray. The worker declared his asthma condition during the health assessment and stated that he was using Ventolin.

The examining doctor noted that the worker displayed prolonged expiration. This is likely to be associated with his asthma as the only follow up recommended by the doctor was that the worker's asthma be reviewed. No other abnormalities were detected and the worker's spirometry was within the normal range.

1.2. Work history

The worker performed non-mining work between 1996 and 2009 in environments which are not considered to be dusty.

He commenced working at the mine in 2010 and performed underground transport, drilling and installation work where he may have encountered dusty environments. Thereafter, he performed underground blasting work which is described in further detail in section 2 below. He stated that the work created a lot of rock dust which tended to remain in the work environment. In recent years, the

worker has undertaken various surface and underground roles which he believes had limited dust exposure.

2. Drilling and charging work at mine

2.1. Overview

For several years the worker was required to clear blast holes using compressed air. iCare recorded the following description of the practice:

He described the process of the blast holes being created up to a depth of 20 metres, and if the rock that was blasted from the hole did not blow out, this meant that the full depth of the hole was not reached. He would then blow this material using a compressed air hose, which resulted in a lot of rock dust, and as the areas he worked in were underground and confined the dust would end up circulating in the air and he would inhale this dust.

The worker stated that the task of using compressed air to blow out holes was predominantly undertaken during the development phases at the mine.

2.2. Personal protective equipment

The worker wore overalls, or a top and pants, while undertaking this task. He was provided with disposable P2 / N95 paper masks, but it is not known how regularly he wore masks or if he wore them correctly.

3. iCare assessment

3.1. Initial screening

Worker C underwent a chest x-ray in 2018 which was conducted by iCare's Lung Bus and facilitated by the mine operator as part of its workplace health monitoring regime.

The x-ray identified small non-specific abnormalities in Worker C's lungs and recommended that a CT scan be performed.

3.2. High resolution CT

Worker C underwent a CT scan in early 2019. The scan did not identify any accumulation of silica but found broad inflammatory changes in Worker C's airways. iCare's reviewing specialist gave a differential (possible) diagnosis of pneumoconiosis or pneumonitis (inflammation of the lung).

3.3. Additional information

In February 2020, iCare confirmed that Worker C's diagnosis of silicosis was differential and unconfirmed. The differential diagnosis was based on the worker's stated exposure history and clinical presentation.

4. Specialist review

4.1. Thoracic specialist

The mine operator arranged for Worker C to be reviewed by a thoracic specialist who reported that Worker C's diagnosis was not certain. The worker's differential diagnosis includes sub-acute hypersensitivity pneumonitis, early silicosis, sarcoidosis and smoking related respiratory bronchiolitis.

4.2. Current information

The most recent medical advice concerning Worker C includes the following:

- He continues to be reviewed by a respiratory physician.
- He is stable and has good exercise tolerance. His condition has improved over the past 12 months which is most likely attributable to him reducing his smoking.
- His lung function is within normal limits but also compatible with asthma.
- There appears to be improvement in the worker's diagnostic imaging since the original scans were performed in January 2019. However, there are still nodules and changes compatible with the differential diagnosis above.
- The worker does not presently meet the criteria for a diagnosis of silicosis.

4.3. Employment

The worker remains employed at the mine, in a role that has been identified as presenting minimal dust exposure.

5. Use of compressed air to clear drill holes

The work being undertaken by Worker C to clear out drill holes was covered by the mine's preparation and charging procedures.

5.1. Preparation procedure

The procedure describes workers inserting a 'prep hose' in the drill hole and moving it forward and backwards while running compressed air through the hole. It states that workers should keep to the side of the hole to avoid being struck by rocks and drill fines ejected from the hole.

The procedure makes no reference to the dust produced by the operation nor does it specify any dust related controls for the task. The personal protective equipment (PPE) prescribed for the task is:

- rolled down sleeves
- ear protection
- eye protection (goggles).

The mine operator advised that the preparation procedure is no longer in use. It stated that the task was part of the blast process which hasn't been undertaken for several years.

5.2. Charging procedure

The procedure states that, as part of the inspection of the work area, workers should ensure that ventilation ducting is within 30 metres of the face and provide sufficient air movement to clear fumes and dust. Prior to charging, the procedure states workers should:

- inspect that the holes are drilled to the correct depth and are free of obstruction by inserting the charge hose into the drill hole
- use a copper scraper to clear obstructions from holes
- use an extra hose, using compressed air from the Normet to remove obstructions from holes.

Other than the brief requirement, the procedure makes no reference to the dust produced by the operation nor does it specify any dust related controls for the task. There is no PPE prescribed in the procedure for the task.

This procedure has been replaced by a new safe work procedure, but the above requirements are contained in the same form in the new procedure. The dust controls specified in the new procedure are:

- P2 dust mask
- ventilation
- sprays
- fit for purpose equipment.

6. Respiratory protection procedures

6.1. Personal protective equipment standard

The mine operator's personal protective equipment (PPE) standard commenced in 2007 and remains current, although various revisions have been made. The standard outlines the minimum requirements for PPE. Prior to 2019, the PPE standard outlined the mine operator's requirements for respiratory protective equipment (RPE). In 2019, the mine operator introduced an additional standard for RPE.

The PPE standard does not detail when RPE should be worn, but details the minimum requirements for various types of RPE and contains information about how to fit respirators.

6.2. Respiratory protection standard

The RPE standard was introduced in July 2019 and provides greater clarity about when, where and how to use RPE relative to the PPE standard. It operates in conjunction with various risk assessments and guidelines on tasks and work areas for which RPE is mandatory. The RPE standard details requirements in relation to training, selection of equipment, administration and the mine operator's clean-shaven policy.

6.3. Various procedures

In addition to the above specific procedures, the mine operator imposes respiratory protection standards for underground work in various plans, procedures and standards including:

- Principal Control Plan Health
- Safe Work Procedure – Apply Shotcrete
- Safe Work Procedure – Water Cannon Operations
- Safe Work Procedure – Accessing Bogging Districts
- Safe Work Procedure – Development Loader.

7. Risk assessments and underground air quality controls

7.1. Risk ranking by role

The mine operator provided iCare with a risk ranking in relation to dust exposures for its similar exposure groups (SEG). The crew which Worker C was part of was ranked high risk for exposure to respirable dust and silica.

7.2. Principal hazard management plan – Air quality or dust or other airborne contaminants

Under this plan, the mine operator states that its controls for minimisation of dust for its underground service crews includes:

- mine ventilation and air velocity standards
- water cart dust suppression
- shotcretors – P3 RPE
- RPE (P2) for dusty tasks
- job rotation
- task allocation
- up wind of heavy equipment
- re-entry procedures.

8. Airborne dust and silica monitoring

8.1. Relevant exposure standards at mines

Prior to 1 July 2020, the exposure standards in New South Wales were 3.0mg/m³ for respirable dust and 0.10mg/m³ for respirable crystalline silica.

8.2. Worker C

Worker C was sampled on three occasions between 2010 and 2020. On each occasion the results were lower than the legislated exposure limits. These results are shown in Table 1.

Table 1 Respirable dust and silica testing results – Worker C

YEAR	SUBSTANCE	RESULT	RPE
2011	Silica	0.016	No respiratory protection worn
	Respirable dust	0.38	
2016	Respirable dust	0.85	Not known
	Silica	0.1	
2019	Respirable dust	0.05	Not known
	Silica	0.01	

8.3. Mine operator

Between 2011 and 2020, 899 tests were conducted on samples taken from monitors worn by workers at the mine. The tests were for respirable dust and silica.

The testing produced a total of 27 exceedances for respirable dust and 17 for silica over that ten-year period. The majority of those exceedances occurred in 2014 and 2015 around the time that development work was occurring. A summary of those year by year experiences is provided in Table 2.

Table 2 Respirable dust and silica exceedances 2011 to 2020

YEAR	TESTS	RESPIRABLE DUST EXCEEDANCES – WORKER EXPOSURE	RESPIRABLE DUST EXCEEDANCES – STATIC TEST	SILICA EXCEEDANCES – WORKER EXPOSURE	SILICA EXCEEDANCES – STATIC TEST
2011	48	0	1	0	0
2012	16	0	0	0	0
2013	64	1	5	0	1
2014	78	10	4	4	1
2015	163	7	9	5	2
2016	184	5	0	2	0
2017	93	3	0	2	0
2018	52	1	0	2	0
2019	114	0	0	2	0
2020	87	0	0	1 *	0
Total	899	27	19	17	4
Average	89.9	2.7	1.9	1.7	0.4

* Exceedance of 0.05 limit post 1 July 2020

The majority of exceedances that occurred at the mine in 2014 and 2015 related to service crew workers undertaking charge up work. Some of the respirable dust exceedances that occurred during that period were extremely high including levels of 11.09mg/m³, 8.19mg/m³ and 12.62mg/m³.

9. Proposed improvements

The mine operator stated that it is making the following improvements to its dust management practices:

- the formation of a dust committee aimed at lowering the exposure of workers to dust and silica

- conducting ongoing reviews of work area ventilation
- installation of additional intake and exhaust in new production areas
- investigating and developing a remote charging and prepping process for development activities.

10. Findings

10.1. Exposure

10.1.1. Information provided by worker

Worker C provided a history to medical practitioners of being exposed to significant levels of silica and dust while working underground at the mine, particularly when he compressed air to eject rocks and drill fines from drill holes as part of development work.

10.1.2. Atmospheric testing of worker

Worker C participated in atmospheric testing for respirable dust and silica in 2011, 2016 and 2019. Testing of his samples produced results below exposure limits. This testing does not appear to have been conducted while the worker was involved in the work of clearing the drill holes.

10.1.3. Atmospheric testing at the mine

Atmospheric testing conducted at the mine showed that there were elevated levels of respirable dust between 2014 and 2015. Since that time, there have only been small numbers of exceedances. This is likely to be attributable to the limited amount of development work undertaken at the mine in recent years.

10.2. Diagnosis

10.2.1. Medical opinion

Worker C has a differential diagnosis which includes silicosis, hypersensitivity pneumonitis, bronchiolitis of any cause and follicular bronchitis related to rheumatoid arthritis. However, the worker does not meet the criteria for a diagnosis of silicosis. The cause of the markings on his lungs shown in diagnostic scans is not known at this time.

The worker no longer smokes on a regular basis. This change has produced a significant improvement in his lung health from the time that the above diagnosis was made. According to his reviewing specialist, the improvement is evident in the results of diagnostic testing undertaken since the original diagnosis.

10.2.2. Health

Worker C presently enjoys good health and normal lung function albeit that he continues to experience asthma which he has experienced since he was a child.

Worker C remains employed at the mine in an above ground role.

10.3. Practice of using compressed air to clear drill holes

10.3.1. Procedures

The process of using compressed air to clear drill holes by the worker was undertaken in compliance with the mine operator's procedures.

10.3.2. RPE

The mine operator's procedures did not prescribe that RPE was required when undertaking this task. It appears that Worker C was provided with P2 masks while undertaking the task, but it has not been able to be determined how frequently Worker C wore RPE or if he wore the supplied equipment correctly.

10.3.3. Current development

The mine operator has formed a dust committee to implement improvements to dust management which include the installation of additional intake and exhaust fans and developing a remote charging and prepping capability.

11. Recommendations

11.1. Mine operators

Mine operators should ensure the adequacy of their principal hazard management plan for airborne contaminants. The review should include:

- the hierarchy of controls

- all dust suppression measures, including the method of mining
- mine ventilation to remove dust
- all personal protective equipment (PPE) supplied to filter dust
- atmospheric monitoring
- worker monitoring.

12. Worker education and supervision

12.1. Workers

12.1.1. PPE

Although personal protective equipment (PPE) is a lower order control, it is recommended that workers utilise respiratory protective equipment (RPE) to complement higher order controls in the workplace. As illustrated above, it is the last line of defence against dust exposure.

12.1.2. Medical assessment

Existing and former mine workers are encouraged to attend periodic health screening and to contact their medical practitioner if they have any concerns about their respiratory health.

12.1.3. Smoking

In addition to the well-known health issues that smoking produces, it may exacerbate the effects of silica exposure. Mine workers are encouraged to seek assistance in order to stop smoking.

13. Further information

Further information about airborne contaminants and dust is available on our [website](#).

Information about silica exposure and the effects of smoking when quartz dust is retained in the lungs is available in this [factsheet](#) produced by Lung Foundation Australia.