

INVESTIGATION REPORT

SILICOSIS – WORKER G

Dust disease illness



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Executive summary

A 38-year-old worker has been diagnosed with chronic simple silicosis and chronic bronchitis with chronic obstructive pulmonary disease (COPD).

The worker has worked in the coal industry in New South Wales since 2016. The worker is employed by a contracting company that conducts maintenance work at coal handling and preparation plants in the Hunter Valley.

The worker has previously worked at non-mining and mining workplaces in New South Wales and other states of Australia. He was exposed to airborne dust environments at the non-mining workplaces.

The NSW Resources Regulator has completed an investigation into how the worker may have contracted the disease.

The investigation found that:

- the worker had worked in the tunnel construction industry for twelve years with high-risk exposure to airborne dusts containing silica from 2004 to 2012
- there is a very high likelihood that the worker was first exposed to dusts containing respirable crystalline silica (RCS) during this work period, particularly when working in the tunnel projects in Sydney and further exposure in Brisbane tunnel construction.

The medical evidence and the worker's employment history reasonably establish that the worker's condition is connected to his work in tunnel construction.

Further, there was no evidence to support a finding that the worker was exposed to hazardous levels of atmospheric contaminant at any of his coal mining workplaces.

The respiratory specialist treating the worker reported that the worker's condition is not attributable to his work in the New South Wales coal industry.

The worker's condition is expected to remain stable if he remains out of dusty environments. The worker is encouraged to maintain his scheduled screening and lung function tests with Coal Service's - CS Health. The worker's continued health is under the management of his general practitioner (GP) and specialist treating doctor.

The Regulator determined the investigation closed on 3 September 2020.

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1. Background

1.1. The worker

Worker G (the worker) is a 38-year-old boilermaker employed by a fabrication and maintenance company that conducts work activities at coal handling and preparation plants (CHPP's) within the Hunter Valley of NSW.

The worker has undertaken work at CHPP's in NSW for the past four years (from 2016) and continues to do so. The worker previously worked at non-mining workplaces within NSW and QLD and mining workplaces outside of NSW for 17-years. He has been exposed to airborne dust environments at the non-mining workplaces.

Table 1 Work history

DATE	EMPLOYER	ROLE	COMMENT
1999-2002	Engineering 1 Engineering and maintenance of processing plants	Apprentice boilermaker	Muswellbrook NSW Work predominately in engineering workshop
2002-2004	Engineering 2 Engineering, mining services and industrial manufacturing	Boilermaker	Narellan NSW Work predominately in engineering workshop
Jan 2004-Feb 2006	Construction 1 Construction joint venture	Tunneller Roadheader operator	Sydney NSW City West Cable Tunnel Lane Cove Tunnel Cross City Tunnel
Feb 2006-Jan 2008	Construction 2 Alliance to construct and operate	Tunneller Tunnel and shafts	Tugun QLD Tunnel worker
Jan 2008-Jun 2012	Construction 3 Construction services	Tunneller Shift supervisor	Brisbane QLD Brisbane Airportlink Tunnel worker

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DATE	EMPLOYER	ROLE	COMMENT
Jun 2012-Mar 2013	Contractor 1 Underground mining construction and contract maintenance services	Leading hand boilermaker	Gold mine, Tanami Desert, NT Underground hard rock mining
Mar 2013-Jun 2014	Construction 4 Mining services provider	Boilermaker	Gas transmission pipeline project The 4.3 km under-sea tunnel at The Narrows off Gladstone QLD Tunnel worker
Jun 2014-Dec 2014	Labour-hire 1 Recruitment workforce provider	Boilermaker	Dredge, winch and cable-handling equipment manufacturing QLD
Dec 2014-Mar 2015	Contractor 2 Construction contractor WA	Boilermaker and Pipe fitter	Hematite project, magnetite and iron ore mine 110km south of Port Hedland, Pilbara WA
Apr 2015-Jun 2015	Labour-hire 2 Welding contractor and labour-hire NSW	Boilermaker	Central QLD Coal Mine Reject bin construction
Jul 2015-Aug 2016	Contractor 2 Construction contractor WA	Boilermaker and Pipe fitter	Iron ore project, Chichester Range, Pilbara WA Construction open cut and processing plant
Aug 2016-current	Contractor 3 Equipment refurbishment, fabrication, installation and modification	Boilermaker	Singleton and Muswellbrook NSW Contract maintenance work at several coal mine CHPP's

This matter was referred by NSW Coal Services to the Regulator on 14 May 2020.

Major Safety Investigations commenced an investigation into the matter on 8 July 2020.

1.2. The disease

The worker has been diagnosed with chronic simple silicosis and chronic bronchitis with chronic obstructive pulmonary disease (COPD).

1.2.1. Chronic silicosis

Silicosis is a lung disease characterised by inflammation and fibrosis of the lungs caused by exposure to respirable crystalline silica. Development of silicosis in miners usually takes 10-20 years from the first exposure. The clinical type 'chronic' has a long latency and is often accompanied with chronic bronchitis.

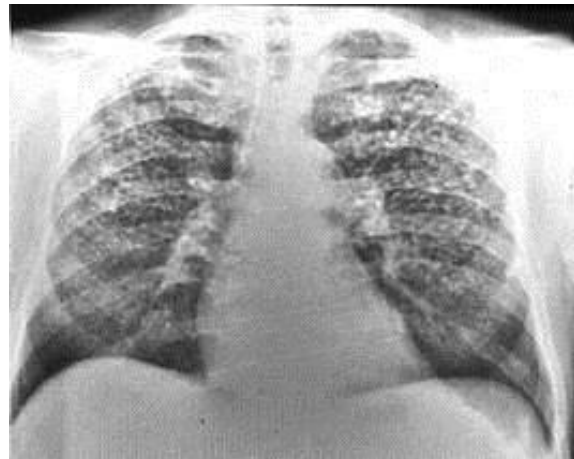
If a worker is exposed to and breathes in silica dust, they could develop chronic silicosis. *Chronic simple silicosis* stems from long-term exposure to small amounts of silica dust, which results in the formation of nodules of chronic inflammation and scarring in the lungs and chest lymph nodes.¹

These lung diseases are diagnosed through health monitoring which includes lung function testing and an X-ray. Example x-rays are shown below.²

Photograph 1 Normal x-ray



Photograph 2 X-ray showing silicosis



Silicosis may progress even after removal from silica dust exposure. This disease may resemble chronic obstructive pulmonary disease.

¹ Safe Work Australia, *What diseases can silica dust cause?* <https://www.safeworkaustralia.gov.au/silica#what-diseases-can-silica-dust-cause>.

² Australian Tunnelling Society, *Silica Dust Awareness Package* (2018) ats.org.au/resources/working-group-papers/.

1.2.2. COPD

Chronic obstructive pulmonary disease (COPD) is a progressive lung condition that causes narrowing of the bronchial tubes in the lungs (sometimes called bronchi or airways), making it difficult to breathe. Sometimes air gets trapped in the lungs causing the feeling of breathlessness. When the condition occurs it is chronic (long-term) in nature and, therefore, the airflow obstruction is usually permanent or irreversible.

COPD is an umbrella term for a group of lung conditions including:

- emphysema
- chronic bronchitis
- chronic asthma.

Around one in seven Australians aged 40 years and over have some form of COPD, however, around half of these people living with COPD symptoms do not know they have the condition.³

Causes of COPD may include:

- **smoking** - this includes if you smoke, have smoked in the past, or are exposed to passive smoking
- **environmental factors** - such as working or living in areas where there is dust, gas, chemical fumes, smoke or air pollution
- **genetic** - a small number of people have a form of emphysema caused by a protein disorder called alpha-1 antitrypsin deficiency (AATD). This is where the body finds it difficult to produce one of the proteins (Alpha-1) which protects the lungs.

Contracting COPD normally requires extended periods of exposure to harmful substances for significant lung damage to develop. In addition, there is a substantial literature to indicate that silicosis caused by the inhalation of respirable silica or quartz dust, also known as RCS, is a cause of COPD.⁴

1.3. Medical history

Coal Services Health Monitoring Requirements for Coal Mine Workers Order No. 43 under the *Coal Industry Act 2001* requires that all workers working at a coal mine have medical assessments and chest x-rays. The assessor is either a member of Coal Services Health (CS Health) or is on the Coal Services list of approved providers.

³ Lung Foundation Australia, *Factsheet COPD* (2018) lungfoundation.com.au/patients-carers/living-with-a-lung-disease/copd/overview/.

⁴ Hedges et al., 'Occupational exposure to respirable crystalline silica in Queensland quarries, exploration sites and small mines', conference paper, Queensland Mining Industry Safety and Health Conference (2008), p 2.

Under Order 43, the person conducting a business or undertaking that employs, contracts or otherwise engages a worker or coal mine worker to carry out work for the business or undertaking at a coal mine must ensure that the worker:

- undergoes a pre-placement medical assessment
- undergoes, or has undergone a chest x-ray
- undergoes a medical assessment every three years which is carried out by an approved medical practitioner or a registered nurse supervised by an approved medical practitioner
- undergoes a chest x-ray (for surface coal mine workers involved in production, processing or maintenance tasks) every three years or the shorter interval recommended in the worker's last Pre-Placement Medical Assessment Report or Periodic Medical Assessment Report (whichever was completed later)
- is offered an exit medical assessment if they are retiring or otherwise ceasing work for the business or undertaking.

A **coal mine worker** means a person who carries out work at a coal mine for a person conducting a business or undertaking. It does not include a person who works in an environment in which they are not exposed to coal dust, unless the person has previously worked in an area of a coal mine in which they were exposed to coal dust.

The worker attended CS Health for a pre-placement medical assessment and chest x-ray prior to his employment with a contracting company that conducts maintenance at coal mines on 10 August 2016.

Coal Services provided the following information concerning the worker's medical assessments and diagnosis managed by CS Health.

Table 2 CS Health medical history

DATE	TYPE OF MEDICAL	RESULTS
10 Aug 2016	Preplacement medical assessment – contracting company	<ul style="list-style-type: none"> ▪ Mildly obstructive spirometry ▪ Normal chest x-ray ▪ Smoker ▪ Nil symptoms declared on respiratory questionnaire ▪ Nil other active medical concerns noted ▪ Doctor noted mildly obstructive spirometry, asymptomatic and normal chest x-ray

DATE	TYPE OF MEDICAL	RESULTS
12 Jul 2019	Site access and periodic health surveillance medical – contracting company	<ul style="list-style-type: none"> Obstructive spirometry mildly worsened since 2016 medical. Referred to GP for consideration of treatment Repeat spirometry recommended in twelve months Smoker
30 Sep 2019	Respiratory Specialist Consultation	<ul style="list-style-type: none"> Suggested chronic simple silicosis with smoking related chronic bronchitis and mild COPD Review in six months
16 Mar 2020	Respiratory Specialist Consultation	<ul style="list-style-type: none"> Chronic simple silicosis (sarcoidosis unlikely given the CT scan appearance, and changes on x-ray predated the introduction of Adalimumab which can cause a sarcoid-like reaction in the lungs) Active asthma and bronchitis. Current smoker of one cigarettes/day with a total smoking exposure of approximately nine pack years. Chronic daily cough productive of small amounts of sputum Worker under GP management as condition is not related to work in NSW coal industry. Worker will be seen in July 2020 for Order 43 annual medical review.

2. Investigation

The investigation generally examined the illness including the factors leading up to the diagnosis, the cause of the illness, the actions of the employer of the worker and that of the operator of the coal mines where the worker currently undertakes work.

The investigation into this case of silicosis and COPD more particularly examined:

- the employment history of the worker
- the environmental factors at each workplace
- locations and activities at the coal mine where harmful dust exposure may have occurred
- the likely exposure levels and contributing factors at each workplace
- compliance with the relevant work health and safety legislation.

Activities of the investigation included:

- collating data and research on lung diseases
- interviewing the worker
- issuing *Work Health and Safety Act 2011* section 155 notices for information and documents.

3. Findings

The investigation found that the worker's lung disease is attributable to one or more of the following factors.

3.1. Boilermaker

Worker G is a boilermaker. He started as an apprentice with an engineering company at Muswellbrook NSW in 1999 and continues in the trade. As such, the worker is potentially exposed to a number of hazards during welding and abrasive blasting.

Welding fume, which includes irritating gases such as oxides of nitrogen and ozone, can cause irritation and 'metal fume fever'.

Abrasive blasting produces a great deal of dust that includes metals, metal oxides and may contain respirable crystalline silica (RCS). Each situation is different. The risk depends on the process; the metal, the rod and flux, surface contaminants, and location of the task. A person exposed to RCS is at risk of developing silicosis. Silicosis usually follows many years of exposure to RCS.⁵

The worker moved from Muswellbrook to Sydney and was employed, via recruitment provider, as a labour-hire boilermaker at an engineering company at Narellan NSW from March 2012 to June 2012.

⁵ UK Health and Safety Executive, *Welding – Lung disease* (2019) www.hse.gov.uk/lung-disease/welding.

The privately owned organisation provides engineering, services and industrial manufacturing to mining, construction and transport companies. His work involved fabrication in the engineering workshop at Narellan.

The worker was again employed as a boilermaker from June 2014 to December 2014. He was contracted as labour-hire by a recruiting services provider to a leading winch, equipment and dredge manufacturer based in Currumbin QLD.

The worker stated that both the above work environments were 'good' and he considered that he was exposed to little, if any, airborne dusts.

In his current employment with a contracting company, as a boilermaker and pipe fitter, the worker conducts little welding and no abrasive blasting.

3.2. Tunnel worker

Silica is silicon dioxide, a naturally occurring and widely abundant mineral that forms the major component of most rocks and soils. Tunnel construction workers have an increased risk of developing silicosis relative to those in the broader construction industry.

The worker worked as a tunneller, roadheader operator and shift supervisor in tunnel construction for about ten years from 2004 to 2014. Work was undertaken at the face where he was potentially exposed to hard rock and sandstone dusts at tunnelling locations listed below.

- **Jan 2004-Feb 2006** on Lane Cove, Cross City and City West Cable Tunnels, Sydney NSW
- **Feb 2006-Jan 2008** on Gold Coast desalination project, Tugun QLD
- **Jan 2008-Jun 2012** on Brisbane Airportlink, Brisbane QLD
- **Mar 2013-Jun 2014** on gas transmission pipeline project, The Narrows, Gladstone QLD

When questioned on the work environment of the three Sydney tunnel projects, the worker stated that the work environments were 'dusty'. The worker asserted that his exposure to dusts at the other projects was minimal.

3.3. FIFO mine worker

The worker had four stints as a fly-in-fly-out (FIFO) mine worker, based out of the Gold Coast QLD. The mines and locations are listed below.

- **Jun 2012-Mar 2013** leading hand boilermaker with contractor, drill and blast at underground hard rock gold mine in the Tanami Desert NT – experienced minimal, if any, dust exposure
- **Dec 2014-Mar 2015** boilermaker and pipe fitter with contractor, construction of the processing plant at a magnetite and iron ore mine near Port Hedland, Pilbara WA – experienced minimal dust exposure

- **Apr 2015-Jun 2015** labour-hire worker supplied to contractor installing coal reject bin at underground and open cut coal mine is located near Mackay QLD – experienced minimal dust exposure
- **Jul 2015-Aug 2016** boilermaker and pipe fitter with contractor, construction of the processing plant at iron ore project, Chichester Range, Pilbara region, WA – experienced minimal, if any, dust exposure

3.4. Current occupation

The worker continues in his chosen profession as a boilermaker and pipe fitter. Boilermakers are trades persons who cut, shape, assemble and weld steel to construct and repair metal products and structures for boilers, ships, iron and steel structures and other vessels.

The worker has only recently returned to the coal mining industry through his employment with a contracting company (Contractor 3). The worker commenced employment with Contractor 3 on 11 August 2016. Contractor 3 provides qualified and experienced trade and operating staff to service coal washery (CHPP) needs, including plant and equipment refurbishment, fabrication, installation and modification.

The worker, over the last four years, has undertaken work at several coal mines CHPP's near Muswellbrook and Singleton in the Hunter Valley.

In general, the worker worked Monday to Friday on dayshift between 8 and 12-hours, subject to scheduled site shutdowns, and some weekend shifts. Most shifts are 6.00 am to 2.00 pm daily.

3.4.1. Coal workplaces dust monitoring

Coal Services undertook personal dust monitoring pursuant to Order 42 of atmospheric respirable dust and silica and inhalable dust at the worker's coal mining workplaces.

The table below represents selected monitoring results for workers for the coal mine CHPP locations and the work periods of worker G.

Table 2 Selected personal dust monitoring results at coal mine CHPP locations during relevant periods

PERIOD	LOCATION WORKER	CONTAMINANT	RESULT (mg/m ³)	EXPOSURE LIMIT (mg/m ³)	OBSERVATION
Aug 2016 to Jan 2017	Mine 1 Operator	Inhalable dust	0.5	10	Control room and plant cleaning
	Mine 2 Mechanic	Respirable dust	1.51	2.5	No respirator

PERIOD	LOCATION WORKER	CONTAMINANT	RESULT (mg/m ³)	EXPOSURE LIMIT (mg/m ³)	OBSERVATION
	Mine 1 Operator	Respirable quartz	0.01	0.1	No respirator
	Mine 3 Operator	Respirable dust	0.38	2.5	No respirator
	Mine 4 Operator	Inhalable dust	5.4	10	No respirator Dozer on stockpiles
	Mine 3 Apprentice	Inhalable dust	4.1	10	No respirator Raw coal area inspections
Feb 2017 to current	Mine 5 Worker G	Inhalable dust	2.1	10	No respirator Removing old grid mesh top floor CHPP Welding nearby ⁶
22 Jul 2020	Mine 5 Operator	Respirable quartz	<0.01	0.05	No respirator Inspect plant 4.5 hrs

Dust monitoring results from Coal Services identifies that the worker has had limited exposure to dusts containing silica in coal mining workplaces.

Furthermore, the worker has been diagnosed with **chronic simple silicosis** that has a latency period of 10 to 20 years. If the worker had developed silicosis in the past four years, it would have resulted in a diagnosis of either:

- **acute silicosis** that can develop after a short exposure to very high levels of silica dust, within a few weeks or years, and causes severe inflammation and an outpouring of protein into the lung

⁶ Welder exceeded occupational exposure level with result of 11 mg/m³.

- **accelerated silicosis** that can develop after exposures of three to ten years to moderate to high levels of silica dust and causes inflammation, protein in the lung and scarring of the lung (fibrotic nodules).⁷

As discussed in Section 1.3, the worker exhibited signs of lung and respiratory issues at his pre-employment medical with CS Health in August 2016. The report noted 'mild obstruction' spirometry with a normal chest x-ray. The worker's lung function has deteriorated since that medical. However, it is noted that the reports do not include severe inflammation, protein in the lungs or scarring as noted above for the two short-term silicosis diagnoses.

3.5. Smoking

It is well known that smoking not only increases the risk of COPD but is the main cause of COPD.

The worker has been a heavy smoker during his adult life. He has gone from a previous 15-20 cigarettes a day habit to now two or three a day. The worker understands that it is in his best interest to quit.

4. Conclusion

The available evidence does not establish that the worker's condition was caused by exposure to silica containing airborne dusts at coal mines in New South Wales.

Worker G worked in the tunnel construction industry for 12 years with high-risk exposure to airborne dusts containing silica. There is a very high likelihood that the worker was first exposed to dusts containing respirable crystalline silica (RCS) during this work period, particularly when working in the tunnel projects in Sydney and further exposure in the Brisbane tunnel construction. RCS, depending on factors such as how much dust a worker breathes in and for how long, can cause silicosis.⁸

The medical evidence, the worker's employment history and evidence the worker was not exposed to hazardous levels of atmospheric contaminant at any of his coal mining workplaces, supports the finding that the worker's condition is not related to his work within the NSW coal industry.

The worker's condition is expected to remain stable if he remains out of dusty environments.

The management and control of airborne contaminants is a priority of the NSW Resources Regulator and for the NSW mining industry.

On 21 February 2020, the Minister for Better Regulation Kevin Anderson announced a new plan to reduce cases of the deadly lung disease silicosis, caused by ingesting harmful dust. Notably, this includes the introduction of a new silica workplace exposure standard of 0.05mg/m³ from 1 July 2020 (previous-

⁷ Safe Work Australia, *Crystalline silica and silicosis – What diseases can silica cause?*, www.safeworkaustralia.gov.au/silica.

⁸ SafeWork NSW, *Crystalline silica – technical fact sheet*, www.safework.nsw.gov.au/resource-library/hazardous-chemicals/crystalline-silica-technical-fact-sheet.

0.10mg/m³). A new exposure standard for respirable coal dust to 1.5mg/m³ was introduced on 1 February 2021 (previous-2.5mg/m³).

NSW has a comprehensive regulatory scheme in place under the Resources Regulator and Coal Services, with specific mining health and safety legislation. The Regulator continues its campaign to eradicate silicosis and other lung diseases in the mining industry.

The investigation established that the origin, cause and circumstances of the illness are consistent with exposure to silica containing airborne dusts in tunnel construction for 12 years from as early as 2004. The worker's diagnosis is chronic simple silicosis which has a latency period of 10 to 20-years.

The respiratory specialist treating the worker reported that the worker's condition is not attributed to his work in the New South Wales coal industry. The management of his illness has been handed to the worker's general practitioner (GP) and treating specialist.

CS Health will continue to monitor the worker via Order 43 health surveillance.

5. Recommendations

5.1. Mine operators

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

- application of the hierarchy of controls
- dust suppression measures, including the method of mining and measures within and without coal handling and processing plants (CHPP) and associated infrastructures
- CHPP measures and ventilation to prevent and remove dust
- the provision of effective and properly fitted respiratory protection equipment (RPE)
- the provision of training on proper use, fit and maintenance of RPE
- atmospheric monitoring
- worker monitoring
- worker education and supervision.

6. Guidance materials

6.1. Resources Regulator

- [Airborne contaminants and dust](#)
- [Dust diseases](#)
- [Investigation information release - Open cut coal mine worker contracts CWP - Aug 2020](#)
- [Airborne contaminants principal hazard management plan](#)

6.2. Coal Services

- [Protecting against airborne dust exposure in coal mines](#)