

HSE

PILBARA PORT AUTHORITY

SPODUMENE MONITORING

PORT HEDLAND

HJ.205940.WAa

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Executive Summary

Health Safety Environment Australia was requested by [REDACTED] at Pilbara Ports Authority, to conduct Spodumene monitoring at the port. The site work was undertaken by [REDACTED] Senior Consultant, Occupational Hygiene and Risk Management for Health and Safety Australia between the 8th and 9th March 2017.

Objectives

The objectives of the assessment were to determine whether:

- Workers are exposed to airborne concentrations of respirable dust that may cause adverse health effects based on current exposure standards;
- Workers are exposed to airborne concentrations of respirable silica quartz that may cause adverse health effects based on current exposure standards;
- Workers are exposed to airborne respirable asbestos fibre concentrations that are likely to result in adverse health effects based on current exposure standards;
- Workers are exposed to airborne concentrations of inhalable dust that are likely to result in adverse health effects based on current exposure standards; and
- Determine appropriate control strategies, including PPE to reduce exposure of personnel to hazardous material.

Findings

Based on the results of the static monitoring concentrations measured on the 8th to the 10th of March 2017 for respirable dust, respirable silica quartz, respirable asbestos fibres and inhalable dust being typical of airborne contaminants around the spodumene stockpiles and stackers, it appears that the risk to employees' health from exposure to airborne contaminants at the sampling locations at the Port Hedland site was low.

Although static measurements of air contaminants do not reflect personal occupational exposure, results can be an indication of potential exposure if personnel were to remain in the exact location of the monitoring position for the entire shift. Personal exposure can potentially be considerable higher than those recorded during this monitoring programme due to high dust generating activities such as ship loading, cleaning, maintenance and sampling. Therefore further monitoring is required to assess the risk to health for personnel.

Recommendations

The following recommendations should be taken into consideration:

- Repeat monitoring during ship loading operations at various locations that have a potential for generating airborne contaminants;
- Conduct personnel exposure monitoring to identify exposure risk during various activities e.g. ship loading, cleaning, maintenance, sampling etc.;
- Repeat monitoring regularly to capture different weather conditions and product variations to ensure risk is properly assessed; and
- During activities that have the potential for dust generation, personnel should wear respiratory protection.

1. Introduction

Health Safety Environment Australia was requested by [REDACTED] Acting Health and Safety Advisor at Pilbara Ports Authority, Port Hedland Western Australia to conduct Spodumene monitoring at the port. The site work was undertaken by [REDACTED] Senior Consultant, Occupational Hygiene and Risk Management for Health and Safety Australia between the 8th and 9th March 2017. This report was written by [REDACTED], Senior Consultant, Occupational Hygiene and Risk Management for Health and Safety Australia.

2. Background

Spodumene is a mineral that contains Lithium Aluminium Silicate and free silica quartz (approx. 5%) which is used as a source of lithium. This assessment is to aid Pilbara Ports Authority in determining the risk to health of exposed personnel during stockpile and ship loading activities.

3. Objectives

The objectives of the assessment were to determine whether:

- Workers are exposed to airborne concentrations of respirable dust that may cause adverse health effects based on current exposure standards;
- Workers are exposed to airborne concentrations of respirable silica quartz that may cause adverse health effects based on current exposure standards;
- Workers are exposed to airborne respirable asbestos fibre concentrations that are likely to result in adverse health effects based on current exposure standards;
- Workers are exposed to airborne concentrations of inhalable dust that are likely to result in adverse health effects based on current exposure standards; and
- Determine appropriate control strategies, including PPE to reduce exposure of personnel to hazardous material.

4. Methodology

To achieve the above objectives, HSE Australia undertook an assessment involving:

- A walkthrough assessment of the areas of concern;
- Discussions with relevant personnel including HSEC Advisor, [REDACTED] and
- Static monitoring for respirable dust and respirable silica quartz, airborne respirable asbestos fibre and inhalable dust.

4.1. Monitoring Program

Table 1 presents a summary of the Spodumene static monitoring that was undertaken during the assessment period:

Table 1: Spodumene Static Monitoring Plan	
Parameter	No of Samples
Respirable Dust and Quartz	8
Respirable Quartz	8
Inhalable Dust	8
Respirable Fibre	9

4.2. Respirable Dust and Quartz

Respirable dust and respirable quartz samples were collected based on guidelines in AS2985-2004 – *workplace atmospheres – Method for sampling and gravimetric determination of respirable dust* using a respirable dust cyclone, with air drawn through a 25 mm filter at a flow rate of 2.2 +/- 0.1 L/min using a calibrated air sampling pump. Flow rates were checked with a calibrated rotameter prior to, and at the completion of the sampling period.

Analysis for respirable dust was determined gravimetrically. Quartz was determined by FTIR in accordance with *NIOSH Method 7603 quartz in coal mine dust*. These analyses were conducted at MPL Laboratories NATA accredited Perth laboratory.

4.3. Airborne Fibres

Airborne fibre monitoring was conducted in accordance with the National Occupational Health and Safety Commission (NOHSC); *Guidance Note on the Membrane Filter Method for Estimating Airborne Asbestos Fibres 2nd Edition [NOHSC: 3003 (2005)]*. Flow rates were checked with a calibrated rotameter prior to, and at the completion of the sampling period. Filters were analyzed at MPL Laboratories' NATA accredited Perth laboratory.

4.4. Inhalable Dust

Inhalable dusts were collected using an air-sampling pump calibrated to a flow rate of 2.0 +/- 0.2 L/min with air drawn through an IOM inhalable dust sampling head containing a pre-weighed 25 mm filter. Flow rates were checked with a calibrated rotameter prior to, and at the completion of the sampling period. Gravimetric analysis was conducted in accordance with AS 3640 (2009) at MPL Laboratories' NATA accredited Perth laboratory.

5. Applicable Guidelines

4.5. Air Contaminant Exposure Standards

The criteria used in the assessment of occupational exposure to hazardous substances are based on exposure standards as outlined in the Safe Work Australia's document *Guidance on the Interpretation of Workplace Exposure Standards for Airborne Contaminants*, April 2013 and *Workplace Exposure Standards for Airborne Contaminants* April 2013.

Exposure standards represent airborne concentrations of individual chemical substances which, according to current knowledge, should neither impair the health of, nor cause undue discomfort to nearly all workers. These standards normally apply to exposure to a substance over an 8 hour day, 5 day work week, over an entire working life.

These standards do not represent 'no effect' levels guaranteeing protection to all workers, nor are they fine dividing lines between satisfactory and unsatisfactory working conditions. They are best used as guides in the assessment of the working environment.

4.6. Exposure Standards for Extended Shifts

To provide people working extended work shifts with at least an equivalent degree of protection as there is for people working conventional work shifts, the 8-hour Time Weighted Average (TWA) exposure standard needs to be reduced by a suitable factor.

In June 1999 the Western Australia Department of Minerals and Energy (DOMEWA) recommended (under Regulation 9.2 of the Mines Safety and Inspection Regulations 1995) an adjustment regime of exposure standards for extended shifts for application in the West Australian mining industry, as indicated below in Table 2

Table 2: Exposure Reduction Factors for the Western Australian Mining Industry

Exposure Standard	Timeframe for Action	Health Effect	Typical Substances	Shift Roster	Exposure Reduction Factor
TWA	Long – over many shifts or years.	Cumulative poisoning, respiratory disease (silicosis, asbestosis, cancer).	Silica, Asbestos, Nickel, Lead, Welding fumes, Talc, Inspirable dust, Respirable dust, Diesel fume.	< 170 hr/mth	1
				> 170 hr/mth	170 / x*

* Average number of hours worked in the month; 170 are the typical hours worked in a month for a normal 8 h/day, 5 day/week work cycle.

TWA Time Weighted Average Exposure Standard

hr hours

mth Calendar month

At the Utah Bulk Port facility personnel work 12 hours shifts, seven days a week. The number of shifts worked at the port is determined by the number of ships which are waiting to be loaded. Since there is no fixed roster at the port it has been determined to use a reduction factor of 0.5 as outlined by the exposure factors for Western Australia Mining Industry. This shift adjusted exposure standard is based on calculating the total number of hour worked (26 days on 4 days off x12 hour shift/170 hours per month).

5. Observations & Comments

5.1. Observations & Comments

Table 4 presents the weather observations recorded by the Bureau of Meteorology's (BOM). Port Hedland station between the 8th and 9th of March 2017.

Table 4: Daily Weather Observations BOM Port Hedland for 8 th - 9 th March 2017								
Date	Min Temp °C	Max Temp °C	9 am			3 pm		
			Temp °C	Relative Humidity %	Wind Speed and Direction km/h	Temp °C	Relative Humidity %	Wind Speed and Direction km/h
8/03/2017	24.6	35.5	31.4	39	NE 15 km/h	33.9	-	NW 26 km/h
9/03/2017	25.6	39.1	33.9	46	ESE 15 km/h	34.4	52	NNE 28 km/h

6. Air Monitoring Results

6.1. Respirable Dust and Respirable Quartz Results

Table 5 presents the results of the static monitoring assessments for respirable dust and quartz that were undertaken between the 8th and 9th March 2017.

Table 5: Respirable Dust and Quartz Results 8 th – 9 th March 2017.					
Static Monitoring Location	Sample Date	Sample ID	Monitoring Period (mins)	Respirable Dust (mg/m ³)	Respirable Quartz (mg/m ³)
In load hopper	8/3/17	RHSEB3	11:33 - 17:13 (340 mins)	0.1	<0.007
Top of conveyor	8/3/17	RHSEB41	11:49 - 17:26 (337 mins)	<0.1	<0.007

Table 5: Respirable Dust and Quartz Results 8th – 9th March 2017.

Static Monitoring Location	Sample Date	Sample ID	Monitoring Period (mins)	Respirable Dust (mg/m ³)	Respirable Quartz (mg/m ³)
Beside fence – North of stock	8/3/17	RHSEB53	11:43 - 17:21 (338 mins)	0.1	<0.007
Bunker 8	9/3/17	RHSEB16	06:29 - 13:01 (392 mins)	<0.1	<0.006
Centre of stockpiles	9/3/17	RHSEB11	06:39 - 13:15 (393 mins)	<0.1	<0.006
West of stockpile	9/3/17	HF542	06:37 - 13:09 (392 mins)	<0.1	<0.006
North Wall	9-10/3/17	RHSEB23	17:26 - 06:28 (782 mins)	<0.1	<0.005
Beside stacker	9-10/3/17	RHSEB541	17:21 - 06:33 (792 mins)	<0.1	<0.005
Mines / ACIGH Australia 8 hour TWA Exposure Standard				3*	0.1*
Adjusted exposure standard for 12 hour days.				1.5*	0.05*

* Static measurements of air contaminants do not reflect personal occupational exposure; results can be an indication of potential exposure if personnel were to remain in the exact location of the monitoring position for the entire shift

6.2. Respirable Airborne Fibre Results

Table 6 presents the results of the static monitoring assessments for respirable fibre that were undertaken between the 8th and 9th March 2017.

Table 6: Airborne Fibre Monitoring Results 8 th – 9 th March 2017.					
Static Monitoring Location	Sample Date	Sample ID	Monitoring Period (mins)	Airborne Fibre Count	Airborne Fibre (fibres/ml)
In load hopper	8/3/17	HSE02230	11:33 - 17:13 (340 mins)	0	<0.01
Top of conveyor	8/3/17	HSE02127	11:49 - 17:26 (337 mins)	0	<0.01
Beside fence – North of stock	8/3/17	HSE02173	11:42 - 17:42 (338 mins)	0	<0.01
Bunker 8	9/3/17	HSE02233	06:29 - 13:01 (392 mins)	1.0	<0.01
Centre of stockpiles	9/3/17	HSE02044	06:39 - 13:12 (393 mins)	0	<0.01
West of stockpiles	9/3/17	HSE02226	06:37 - 13:09 (392 mins)	0	<0.01
North Wall	9-10/3/17	HSE02180	17:26 - 06:28 (782 mins)	0.5	<0.01
Beside stockpile	9-10/3/17	HSE02203	17:21 - 06:33 (792 mins)	0	<0.01

Table 6: Airborne Fibre Monitoring Results 8th – 9th March 2017.

Static Monitoring Location	Sample Date	Sample ID	Monitoring Period (mins)	Airborne Fibre Count	Airborne Fibre (fibres/ml)
Bunker 8	9-10/3/17	HSE02186	17:15 - 06:45 (810 mins)	0	<0.01
Mines 8 hour TWA Exposure Standard*					0.1*
Adjusted exposure standard for 12 hour days.*					0.05*

* Static measurements of air contaminants do not reflect personal occupational exposure; results can be an indication of potential exposure if personnel were to remain in the exact location of the monitoring position for the entire shift

6.3. Inhalable Dust Results

Table 8 presents the results of the static monitoring assessments for inhalable dust that were undertaken between the 8th and 9th March 2017.

Table 8: Inhalable Dust Results 8th – 9th March 2017.

Static Monitoring Location	Sample Date	Sample ID	Monitoring Period (mins)	Inhalable Dust (mg/m ³)
In load hopper	8/3/17	IHSEB38	11:33 - 17:13 (340 mins)	0.3
Top of conveyor	8/3/17	IHSEB32	11:49 - 17:26 (337 mins)	0.2
North of stockpile	8/3/17	IHSEB54	11:43 - 17:21 (338 mins)	0.2

Table 8: Inhalable Dust Results 8th – 9th March 2017.

Static Monitoring Location	Sample Date	Sample ID	Monitoring Period (mins)	Inhalable Dust (mg/m ³)
Bunker 8	9/3/17	IHSEB19	06:29 - 13:01 (392 mins)	0.2
Centre of stockpile	9/3/17	IHSEB10	06:39 - 13:15 (393 mins)	0.3
North Wall	9-10/3/17	IHSEB34	17:26 - 6:28 (782 mins)	<0.1
Beside stacker	9-10/3/17	IHSEB15	17:21 - 06:33 (792 mins)	0.2
Bunker 8	9-10/3/17	IHSEB53	17:15 - 06:45 (810 mins)	0.2
MSIR 8 hour TWA Exposure Standard *				10*
Adjusted Exposure Standard for 12 hour shift.*				5*

* Static measurements of air contaminants do not reflect personal occupational exposure; results can be an indication of potential exposure if personnel were to remain in the exact location of the monitoring position for the entire shift

7. Discussion of Results

7.1. Respirable Dust and Quartz

A total of eight static respirable dust and quartz samples were undertaken at the Port Headland Port facilities at various locations around the spodumene stockpiles between the 8th and 10th of March 2017. The recorded concentrations of respirable dust ranged between less than 0.1 mg/m³ and 0.1 mg/m³. Although static measurements of air contaminants do not reflect personal occupational exposure, results can be an indication of potential exposure if personnel were to remain in the exact location of the monitoring position for the entire shift. All results were below the relevant shift adjusted exposure standard of 1.5 mg/m³. Therefore, the risk to these employees' health from exposure to respirable dust under the conditions of the monitoring appears to be low if they were to remain in the exact location of the static monitoring for the entire shift.

7.2. Respirable Silica Quartz

A total of eight static respirable silica quartz samples were undertaken at the Port Headland Port facilities at various locations around the spodumene stockpiles between the 8th and 10th of March 2017. The recorded concentrations of respirable silica quartz ranged between less than 0.005 mg/m³ and less than 0.007 mg/m³. Although static measurements of air contaminants do not reflect personal occupational exposure, results can be an indication of potential exposure if personnel were to remain in the exact location of the monitoring position for the entire shift. All results were below the relevant shift adjusted exposure standard of 0.05 mg/m³. Therefore, the risk to these employees' health from exposure to respirable silica quartz under the conditions of the monitoring appears to be low if they were to remain in the exact location of the static monitoring for the entire shift.

7.3. Airborne Fibre

A total of nine static respirable asbestos fibre samples were undertaken at the Port Headland Port facilities at various locations around the spodumene stockpiles between the 8th and 10th of March 2017. The recorded concentrations of respirable fibre were all less than 0.01 fibres /ml. The number of fibres identified on the filters ranged between 0 and 1 in 100 counted fields. Although static measurements of air contaminants do not reflect personal occupational exposure, results can be an indication of potential exposure if personnel were to remain in the exact location of the monitoring position for the entire shift. All results were below the relevant shift adjusted exposure standard of 0.05 fibres/ml. Therefore, the risk to these employees' health from exposure to respirable asbestos fibres under the conditions of the monitoring appears to be low if they were to remain in the exact location of the static monitoring for the entire shift.

7.4. Inhalable Dust

A total of eight static inhalable dust samples were undertaken at the Port Headland Port facilities at various locations around the spodumene stockpiles between the 8th and 10th of March 2017. The recorded concentrations of inhalable dust were between less than 0.1 mg/m³ and 0.3 mg/m³. Although static measurements of air contaminants do not reflect personal occupational exposure, results can be an indication of potential exposure if personnel were to remain in the exact location of the monitoring position for the entire shift. All results were below the relevant shift adjusted exposure standard of 5 mg/m³. Therefore, the risk to these employees' health from exposure to inhalable dust under the conditions of the monitoring appears to be low if they were to remain in the exact location of the static monitoring for the entire shift.

8. Conclusions

Based on the results of the static monitoring concentrations measured on the 8th to the 10th of March 2017 for respirable dust, respirable silica quartz, respirable asbestos fibres and inhalable dust being typical of airborne contaminants around the spodumene stockpiles and stackers, it appears that the risk to employees' health from exposure to airborne contaminants at the sampling locations at the Port Hedland site was low.

Although static measurements of air contaminants do not reflect personal occupational exposure, results can be an indication of potential exposure if personnel were to remain in the exact location of the monitoring position for the entire shift. Personal exposure can potentially be considerable higher than those recorded during this monitoring programme due to high dust generating activities such as ship loading, cleaning, maintenance and sampling. Therefore further monitoring is required to assess the risk to health for personnel.

9. Recommendations

The following recommendations should be taken into consideration:

- Repeat monitoring during ship loading operations at various locations that have a potential for generating airborne contaminants;
- Conduct personnel exposure monitoring to identify exposure risk during various activities e.g. ship loading, cleaning, maintenance, sampling etc.;
- Repeat monitoring regularly to capture different weather conditions and product variations to ensure risk is properly assessed; and
- During activities that have the potential for dust generation, personnel should wear respiratory protection.

APPENDIX 1: Analytical Results



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CERTIFICATE OF ANALYSIS 193206

Client:

Health Safety Environment Australia Pty Ltd
Unit 2
25 Belgravia Street
BELMONT
WA 6104

Attention: J Symcox

Sample log in details:

Your Reference:	<u>HJ.205940.Waa</u>
No. of samples:	31 cassettes, filters, cowls
Date/Time samples received:	13/03/2017 / 12:40
Date completed instructions received:	13/03/2017
Location:	

Analysis Details:

Please refer to the following pages for results, methodology summary and quality control data.
Samples were analysed as received from the client. Results relate specifically to the samples as received.

Please refer to the last pages of this report for any comments relating to the results.

Report Details:

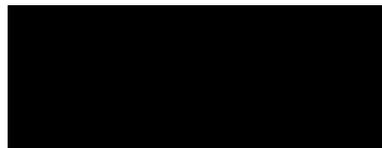
Date results requested by:	14/03/17
Date of Preliminary Report:	Not issued
Issue Date:	14/03/17

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Accredited for compliance with ISO/IEC 17025 - Testing

Tests not covered by NATA are denoted with *.

Results Approved By:



Occupational Hygiene and Microbiology Supervisor

MPL Reference: 193206
Revision No: R 00



Dust							
Our Reference:	UNITS	PQL	193206-2	193206-5	193206-8	193206-10	193206-14
Your Reference	--	--	IHSEB38	IHSEB32	IHSEB54	IHSEB19	IHSEB10
Sample ID	--	--					
Date Sampled			8/03/2017	8/03/2017	8/03/2017	9/03/2017	9/03/2017
Filter No			IHSEB38	IHSEB32	IHSEB54	IHSEB19	IHSEB10
Dust Type			INHL	INHL	INHL	INHL	INHL
Air Volume	m ³		0.680	0.691	0.676	0.784	0.786
Weight of Filter (initial)	mg	0.02	7.12	5.25	7.42	8.34	7.44
Weight of Filter (final)	mg	0.02	7.30	5.42	7.57	8.51	7.65
Dust	mg/filter	0.04	0.18	0.17	0.15	0.17	0.21
Dust in Air	mg/m ³	0.1	0.3	0.2	0.2	0.2	0.3

Dust							
Our Reference:	UNITS	PQL	193206-20	193206-22	193206-25	193206-28	193206-29
Your Reference	--	--	IHSEB34	IHSEB15	IHSEB53	HF654 blank	HF655 blank
Sample ID	--	--	9-10/03/17	9-10/03/17	9-10/03/17		
Date Sampled							
Filter No			IHSEB34	IHSEB15	IHSEB53	HF654	HF655
Dust Type			INHL	INHL	INHL	[NA]	[NA]
Air Volume	m ³		1.56	1.58	1.62	[NA]	[NA]
Weight of Filter (initial)	mg	0.02	7.44	8.21	8.71	5.69	5.77
Weight of Filter (final)	mg	0.02	7.58	8.45	9.03	5.69	5.75
Dust	mg/filter	0.04	0.14	0.24	0.32	<0.04	<0.04
Dust in Air	mg/m ³	0.1	<0.1	0.2	0.2	[NA]	[NA]

Quartz in Dust							
Our Reference:	UNITS	PQL	193206-1	193206-6	193206-7	193206-12	193206-15
Your Reference	--	--	RHSEB3	RHSEB41	RHSEB53	RHSEB16	RHSEB11
Sample ID	--	--					
Date Sampled			8/03/2017	8/03/2017	8/03/2017	9/03/2017	9/03/2017
Filter No			RHSEB3	RHSEB41	RHSEB53	RHSEB16	RHSEB11
Dust Type			RESP	RESP	RESP	RESP	RESP
Air Volume	m ³		0.748	0.741	0.744	0.862	0.865
Weight of Filter (initial)	mg	0.02	5.07	6.41	6.14	5.69	5.26
Weight of Filter (final)	mg	0.02	5.15	6.43	6.22	5.77	5.25
Dust	mg/filter	0.04	0.08	<0.04	0.08	0.08	<0.04
Dust in Air	mg/m ³	0.1	0.1	<0.1	0.1	<0.1	<0.1
a-Quartz on Filter	µg	5	<5	<5	<5	<5	<5
a-Quartz in Air	mg/m ³	0.005	<0.007	<0.007	<0.007	<0.006	<0.006

Quartz in Dust							
Our Reference:	UNITS	PQL	193206-17	193206-18	193206-23	193206-26	193206-27
Your Reference	--	--	HF542	RHSEB23	HF541	HF652 blank	HF653 blank
Sample ID	--	--		9-10/03/17	9-10/03/17		
Date Sampled			9/03/2017				
Filter No			HF542	RHSEB23	HF541	HF652	HF653
Dust Type			RESP	RESP	RESP	[NA]	[NA]
Air Volume	m ³		0.862	1.72	1.74	[NA]	[NA]
Weight of Filter (initial)	mg	0.02	7.21	6.42	7.75	5.81	5.99
Weight of Filter (final)	mg	0.02	7.21	6.46	7.78	5.83	5.99
Dust	mg/filter	0.04	<0.04	0.04	<0.04	<0.04	<0.04
Dust in Air	mg/m ³	0.1	<0.1	<0.1	<0.1	[NA]	[NA]
a-Quartz on Filter	µg	5	<5	<5	<5	<5	<5
a-Quartz in Air	mg/m ³	0.005	<0.006	<0.005	<0.005	[NA]	[NA]

Airborne Fibre Analysis* Mine Site Crite							
Our Reference:	UNITS	PQL	193206-3	193206-4	193206-9	193206-11	193206-13
Your Reference	--	--	HSE02230	HSE02127	HSE02173	HSE02233	HSE02044
Sample ID	--	--					
Date Sampled			8/03/2017	8/03/2017	8/03/2017	9/03/2017	9/03/2017
Filter No							
Air Volume	L		340	337	507	588	590
Fibres*	-		0	0	0	1.0	0
Fields*	-		0	100	100	100	100
Effective Filter Area*	mm ²		368.9845	368.9845	368.9845	368.9845	368.9845
Graticule Area*	mm ²		0.007854	0.007854	0.007854	0.007854	0.007854
Concentration*	Fibres/mL	0.01	<0.01	<0.01	<0.01	<0.01	<0.01

Airborne Fibre Analysis* Mine Site Crite							
Our Reference:	UNITS	PQL	193206-16	193206-19	193206-21	193206-24	193206-30
Your Reference	--	--	HSE02226	HSE02180	HSE02203	HSE02186	HSE02201 blank
Sample ID	--	--		9-10/03/17	9-10/03/17	9-10/03/17	
Date Sampled			9/03/2017				
Filter No							
Air Volume	L		588	1,173	1,188	1,215	[NA]
Fibres*	-		0	0.5	0	0	0
Fields*	-		100	100	100	100	100
Effective Filter Area*	mm ²		368.9845	368.9845	368.9845	368.9845	368.9845
Graticule Area*	mm ²		0.007854	0.007854	0.007854	0.007854	0.007854
Concentration*	Fibres/mL	0.01	<0.01	<0.01	<0.01	<0.01	[NA]

Airborne Fibre Analysis* Mine Site Crite			
Our Reference:	UNITS	PQL	193206-31
Your Reference	--	--	HSE02169 blank
Sample ID	--	--	
Date Sampled			
Filter No			
Fibres*	-		0
Fields*	-		100
Effective Filter Area*	mm ²		368.9845
Graticule Area*	mm ²		0.007854

Method ID	Methodology Summary
DUST-004	Airborne samples analysed according to AS 2985 for Respirable Dust or AS 3640 for Inhalable Dust . Sample results based on volume data supplied by client. Samples tested as received, *accreditation does not cover sampling.
DUST-004	<p>Respirable Quartz determined after ashing, redeposition and FTIR determination.</p> <p>The Quartz exposure standard is 100µg/m³, therefore where sampling follows MDHS 101 guidelines and at least 500L of air is sampled, this is equivalent to a dust weight of 50µg/filter. The estimated measurement uncertainty for the laboratory analysis of Quartz is 40% at 50µg at 95% confidence limit (i.e. statistically the true value lies between 30-70µg / filter (60 – 140µg/m³) at 95% confidence). The estimated measurement uncertainty was determined during method validation.</p>
ASB-006	<p>Estimation of Airborne Asbestos Fibres by the Membrane Filter Method using the variations authorised by the Department of Mines and Petroleum WA. Filters are examined using the Envirolab in-house method ASB-006.</p> <p>Note - Air volumes are supplied by Client</p>

QUALITY CONTROL	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results	Spike Sm#	Spike % Recovery
Quartz in Dust						Base II Duplicate II %RPD		
a-Quartz on Filter	µg	5	DUST-004	<5	[NT]	[NT]	LCS-1	104%
QUALITY CONTROL Airborne Fibre Analysis* Mine Site Crite	UNITS	PQL	METHOD	Blank				
Air Volume	L			[NT]				
Fibres*	-		ASB-006	[NT]				
Fields*	-		ASB-006	[NT]				
Effective Filter Area*	mm ²		ASB-006	[NT]				
Graticule Area*	mm ²		ASB-006	[NT]				
Concentration*	Fibres/m L	0.01	ASB-006	<0.01				

Report Comments:

Asbestos Signatories:

Asbestos was analysed by Approved Identifier:

Not applicable for this job

Airborne Fibres were analysed by Approved Counter:

████████████████████

Definitions:

DOL: Sample rejected due to particulate overload RPF: Sample rejected due to Pump Failure.

RFD: Sample rejected due to Filter Damage. RUD: Sample rejected due to uneven deposition.

PQL: Practical Quantitation Limit

APPENDIX 2: Terms and Conditions

Health Safety Environment Australia Pty Ltd
ACN 119 603 986

Standard Terms and Conditions

These terms and conditions (**Standard Terms**) apply to the provision of our Services.

Capitalised terms not otherwise defined in the Standard Terms will have the meaning given to them in the Proposal.

If there is any inconsistency between these Standard Terms and the Proposal, the Proposal will prevail to the extent of that inconsistency.

1. Definitions

Australian Consumer Law means the Australian Consumer Law set out in Schedule 2 to the *Competition and Consumer Act 2010* (Cth) as given effect under Part XI of the *Competition and Consumer Act 2010* (Cth), and under the same or similar provisions of the *Fair Trading Act 1987* (SA) or any consolidations, amendments or replacements of any such acts from time to time.

Business Day means a day that is not a Saturday, Sunday or public holiday in South Australia.

Client means the person, firm or company engaging HSE Australia to provide the Services.

Client Information means all information provided to HSE Australia by, or on behalf of, the Client regarding the Client or the Services.

Confidential Information means in relation to HSE Australia and the Client, information relating to the relevant party's business, operations, finances, computer systems, plans or Clients and includes:

- a) trade secrets, know-how, scientific and technical information;
- b) product, Client, marketing or pricing information;
- c) any information in relation to the Services;
- d) any information contained in HSE Australia's Services and Terms of Engagement; and
- e) any information which either party notifies to the other is confidential, or which the other party knows or ought to know is confidential,

but does not include information which:

- f) is in the possession of HSE Australia or the Client without restriction in relation to disclosure on or before the date on which it is disclosed to or acquired by HSE Australia or the Client; or
- g) has been independently developed or acquired by HSE Australia or the Client.

Disbursements means any out of pocket expenses incurred by HSE Australia specifically on the Client's behalf in carrying out the Services, including telephone, photocopying, printing, travel and accommodation, word processing, secretarial, facsimile and courier charges.

Fees means the fees for the Services as set out in the Proposal.

GST means the tax payable on taxable supplies under the *GST Act*.

GST Act means the *A New Tax System (Goods and Services Tax) Act 1999* (Cth) and any related Acts imposing such tax, and includes any subordinated legislation in respect of those Acts.

HSE Australia means Health Safety Environment Australia Pty Ltd ACN 119 603 986.

HSE Australia's Background IP means any Intellectual Property Rights of HSE Australia (or licensed to HSE Australia by a third party) which HSE Australia makes available, contributes, brings to or uses in connection with the Services.

Intellectual Property Rights means all copyright and analogous rights (including Moral Rights), all rights in relation to inventions (including patent rights), registered and unregistered trademarks (including service marks), registered designs, confidential information (including trade secrets), know-how, circuit layouts and all other rights throughout the world resulting from intellectual activity in the industrial, scientific or artistic fields. These rights include:

- a) all rights in all applications to register these rights; and
- b) all renewals and extensions of these rights.

Related Bodies Corporate has the meaning given in the *Corporations Act 2001* (Cth).

Proposal means the scoping document (or such other form of document) countersigned by the Client, accepting the terms of HSE Australia's engagement to provide the Services.

Services means as applicable:

- a) the Services described in the Proposal; or
- b) any additional Services as agreed between the Client and HSE Australia,

which may include verbal or written advice, reports, data, laboratory test results, general findings or recommendations.

Technical Material means models, software (including source code and object code versions), information, audio, video, drawings, programmes, schedules, manuals, diagrams, graphs, charts, projections, specifications, estimates, records, concepts, accounts, plans, formulae, calculations, methods, techniques and processes, including all copies of and extracts from them and data stored by any means.

Terms of Engagement means together the Proposal and these Standard Terms.

2. Interpretation

In these terms (unless the context otherwise requires):

- a) a reference to the Standard Terms means the Standard Terms as amended, supplemented, varied or replaced from time to time;
- b) words in the singular include the plural and vice-versa;
- c) a reference to 'including', 'includes' or 'include' must be read as if it is followed by '(without limitation)';
- d) a reference to any legislation or legislative provision includes any statutory modification or re-enactment of, or legislative provision substituted for, and any subordinated legislation issued under, that legislation or legislative provision;
- e) a reference to the Client or HSE Australia includes their executors, administrators, substitutes, successors and permitted assigns;

- f) a reference to '\$', 'AUD' or 'dollar' is to Australian currency; and
- g) no rule of construction applies to the disadvantage of HSE Australia on the basis that it put forward the Standard Terms or any part of the Standard Terms.

3. Acceptance

These Standard Terms are subject to the Proposal.

The Client agrees that the Terms of Engagement constitute the terms and conditions of the relationship between the Client and HSE Australia.

By countersigning the Proposal, or:

- a) instructing HSE Australia to provide the Client with the Services or other consulting services; or
- b) allowing HSE Australia to continue to provide the Client with the Services or other consulting services,

the Client will be taken to have accepted the Terms of Engagement, and HSE Australia will proceed on the basis that the Client has accepted the Terms of Engagement.

4. Payment

The Client must pay HSE Australia the Fees as specified in the Proposal.

The Client agrees to pay all necessary additional duties and taxes and charges incurred by HSE Australia in performing the Services.

HSE Australia may request the Client to pay HSE Australia an up-front amount to enable payment of expenses or to provide security for HSE Australia and HSE Australia's Fees. If such a request is made, HSE Australia will assume (upon receipt of the Client's payment) the Client's authority to draw on the amounts paid for HSE Australia's Fees and expenses as they become due.

The Fees and Disbursements will be billed to the Client on a monthly basis and are due for payment to HSE Australia within 30 days of receipt of the invoice.

5. Late Payment

If payment of any amount owing to HSE Australia is not made by the due date, HSE Australia reserves the right to charge interest monthly at a rate not exceeding 4% per annum.

HSE Australia also retains the right, in the event payment is not made by the due date, to treat such non-payment as a breach of the Standard Terms and to cease immediately all work being performed as part of the Services until such time as payment is made or as HSE Australia may determine. It is understood that these rights are in addition to and do not derogate from any other rights HSE Australia may have for breach of the Standard Terms.

If HSE Australia's account is not paid in accordance with the Standard Terms and the amount is referred for debt collection, any collection or legal expenses which have or will be incurred as a result of late payment will be due and payable by the Client as if they were part of the original debt.

6. GST

In the event that any supply made under a contract by HSE Australia to the Client is subject to GST, HSE Australia may in addition to the amount payable under the Contract but subject to having issued a valid Tax Invoice (as defined by the GST Act) recover from the Client an additional amount on account of GST, such amount to be

calculated by multiplying the amount payable in respect of that supply by the rate at which GST is imposed by the GST Act at that time.

7. Confidentiality

Subject to this clause 7, neither HSE Australia nor the Client may disclose Confidential Information of the other party (either during the Services or after the termination of the Services) without the prior written consent of the other party (which consent must not be unreasonably withheld).

Either party may disclose Confidential Information of the other party which:

- a) at the time of disclosure is in the public domain, but not as a result of a breach of this clause 7;
- b) is required to be disclosed for the purposes of properly performing its obligations under these Terms of Engagement or in the performance of the Services; and
- c) is required by law, court order or the listing rules of the Australian Securities Exchange to be disclosed.

For the avoidance of doubt, each party must refer to the other party any enquiries from the media concerning the Services or the other party's Confidential Information.

8. Retention of Documents

All Technical Material and other documents belonging to HSE Australia in the Client's possession must be returned to HSE Australia immediately upon completion or termination of the Services.

9. Reliance on Client and Client Information

In order to allow HSE Australia to provide the Services in accordance with the Client's instructions and the Terms of Engagement, the Client agrees to promptly provide such assistance as is reasonably requested by HSE Australia to enable HSE Australia to have access to (amongst other things and including):

- a) the Client's personnel (including any relevant directors, officers, project employees);
- b) the Client's Confidential Information; and
- c) the Client's premises or facilities, including any project sites or areas relevant to the Services.

In providing the Services, HSE Australia will be relying upon the completeness and accuracy of the Client Information. HSE Australia will be entitled to rely upon, and assumes no obligation to independently verify, the completeness or accuracy of the Client Information. The Client must ensure the completeness and accuracy of all Client Information, and advise HSE Australia immediately of any material change in the Client or Client Information.

10. Benefit of Services

The Services (and any work product produced by HSE Australia for the Client including written reports) are provided for the Client's exclusive use and benefit and are not provided for use by, or the benefit of, any other third party and may not be relied upon by any other person, unless HSE Australia agrees otherwise in writing.

11. Intellectual Property

Subject to the terms and conditions of this clause 11, the Client's Background IP remains vested in the Client.

All Intellectual Property Rights relating to the provision of the Services (including all of HSE Australia's Background IP and all Intellectual Property Rights contained in reports, recommendations or conclusions provided by HSE Australia) vest with HSE Australia.

The rights and obligations under this clause 11 continue upon completion or after termination of the Services.

12. Indemnity

Despite any other provision of these Standard Terms, the Client agrees to indemnify and keep indemnified, to the maximum extent permitted by law, HSE Australia against all expenses, losses, damages, costs (including legal costs), charges, fines, penalties and liabilities suffered by HSE Australia or any other party (whether direct, indirect or consequential) arising out of or in connection with HSE Australia's engagement to provide the Services, including (but not limited to) HSE Australia's use of and reliance on the Client Information (or any other information relied upon by HSE Australia in providing the Services).

13. Limitation of liability

The Client agrees that if HSE Australia is held liable for any expenses, losses, damages, costs (including legal costs), charges, fines, penalties and liabilities suffered by the Client or any other party (whether direct, indirect, special or consequential) arising out of or in connection with the provision of the Services, including liability for any negligent act or omission or misrepresentation of HSE Australia, HSE Australia's liability will be limited to the amount of the Fee payable for the relevant Services, and the Client agrees to release HSE Australia from all claims arising as a result of or in connection with the relevant Services to the extent that HSE Australia's liability in respect of such claims would exceed the amount of the Fee.

HSE Australia will not be liable to the Client in any circumstances for any indirect, special or consequential loss or damage, including loss of revenue, loss of production, loss of product, loss of contract or loss of profit howsoever arising and whether in an action in contract, tort (including negligence), in equity, product liability, under statute or on any other basis.

Nothing in these Standard Terms operates to exclude, restrict or modify the application of any implied condition or warranty, provision, the exercise of any right or remedy, or the imposition of any liability, implied or conferred under the Australian Consumer Law or any other statute, the exclusion, restriction or modification of which would contravene that statute or cause any term of these Standard Terms to be void (**Non-excludable Obligations**).

Except in relation to Non-excludable Obligations, all conditions, warranties, guarantees, rights, remedies, liabilities or other terms implied or conferred by statute, custom, or the general law that impose any liability or obligation on HSE Australia are expressly excluded under these Standard Terms.

14. Termination

The engagement of HSE Australia to provide the Services may be terminated at any time by HSE Australia or the Client upon giving 20 Business Days' written notice to the other party.

Without limiting the remainder of this clause 14, if the Services are terminated by the Client under this clause 14, HSE Australia will issue to the Client (and the Client is obliged to pay) a final invoice that includes:

- a) the amount of any Fees outstanding for Services provided to the Client prior to the date of termination not included in any previous payment by the Client; and

- b) the costs HSE Australia actually and reasonably incurred prior to the date of termination of the Services in the expectation of providing the Services, and not included in any previous payment by the Client.

If the Client terminates or postpones the Services within 7 days before the agreed commencement date for the Services, the Client must pay to HSE Australia 100% of the total Fees, as a genuine pre-estimate of HSE Australia's losses due to termination of the Services at that time.

If the Client terminates or postpones the Services in the period between 14 days before and 7 days before the agreed commencement date for the Services, the Client must pay to HSE Australia 50% of the total Fees, as a genuine pre-estimate of HSE Australia's losses due to termination [or postponement] of the Services at that time.

If the Client terminates or postpones the Services in the period between 28 days before and 14 days before the agreed commencement date for the Services, the Client must pay to HSE Australia 25% of the total Fees, as a genuine pre-estimate of HSE Australia's losses due to termination [or postponement] of the Services at that time.

The ending of the Services does not affect:

- a) any rights of the parties which may have accrued before the ending of the Services; and
- b) the rights and obligations of the parties under any clause or part of the Standard Terms which, expressly or by implication from its nature, are intended to continue after the ending of the Services.

15. Force Majeure

If HSE Australia's performance of the Services is prevented or restricted by reason of fire, storm, flood, earthquake, war, act of terror, labour dispute, transportation embargo, law, order or directive of any government in matters relating to the Services, or any other act or condition beyond the reasonable control of HSE Australia, then HSE Australia may delay, cancel or vary the Fees in relation to performance of the Services.

16. Costs

Except as otherwise set out in our Terms of Engagement, HSE Australia and the Client must pay their own costs in relation to preparing, reviewing and signing the acceptance of our Terms of Engagement.

17. General disclaimers

All reviews, surveys, projections, conclusions and recommendations contained or made in any reports or studies in relation to or associated with the Services are based on the Client information available to HSE Australia at the date of preparation.

The Client acknowledges and agrees that the Services involve making judgements which may be affected by unforeseen future events, Client operations, economic disruption, industrial relations, labour difficulties, political action, changes of government, change of laws and other factors the effects of which are not capable of precise assessment at the commencement of the Services. In many cases, HSE Australia is required to make value judgements based on material compiled by government agencies, scientific organisations, research organisations, industrial, commercial and professional organisations and others. It may also be necessary for HSE Australia to rely on data received from third parties or to use data which is not able to be substantiated by publicly available information or sources when providing the Services.

18. Miscellaneous

- a) HSE Australia's engagement may not be assigned by the Client to any other party without the prior written approval of HSE Australia.
- b) Our Terms of Engagement contain the entire agreement between HSE Australia and the Client in relation to the Services.
- c) Our Terms of Engagement are governed by the laws of South Australia. HSE Australia and the Client each submit to the non-exclusive jurisdiction of the courts of South Australia and courts of appeal from them.
- d) Nothing in our Terms of Engagement (including, for the avoidance of doubt, these Standard Terms) constitutes a joint venture, employment, agency, partnership or other fiduciary relationship between HSE Australia and the Client.
- e) If a clause or part of a clause of these Standard Terms can be read in a way that results in it being illegal, unenforceable or invalid, but can also be read in a way that results in it being legal, enforceable and valid, it must be read in the latter way. If any clause or part of a clause is illegal, unenforceable or invalid, that clause or part is to be treated as removed from these Standard Terms, but the rest of the Standard Terms are not affected.
- f) Any indemnity or any obligation of confidence under these Standard Terms is independent and survives termination of the Services or the Proposal. Any other term by its nature intended to survive termination of the Services will survive termination of the Services.
- g) No variation of the Services (including, for the avoidance of doubt, any of these Standard Terms) will be of force or effect until it is in writing and signed by both HSE Australia and the Client.