



# **PORTAL MISTING SYSTEM CASE STUDY**

***Air Quality Working Group  
Information Package - Part 8 of 12***

**December 2018**

## Portal Misting System Case Study

This document was produced to provide information on control measures that can be used to reduce exposure to dusts and silica during tunnel construction. It has been developed by volunteers of the ATS Air Quality Working Group drawing on the collective experience of those working across some of Australia's largest tunnelling projects.

The AQWG membership collectively produced reference material for purposes of communicating information that currently does not exist in the tunnel construction industry's body of knowledge. There are 12 parts to the information package, and each part must be considered in the context of the other. This document represents Part 8 of 12 total parts as listed in **Table 1**. Documented material is considered to benefit the wider tunnelling industry and therefore is freely available on the ATS website.

**Table 1 – Complete list of material produced by the AQWG**

Part	Document Title	Document Reference
Part 1	NSW Air Quality Working Group Background & Methodology – Silica Dust Exposure and the Tunnelling Industry	Doc No. AQWG_0_0.07
Part 2	Good Practice to Control Silica Dust Exposure During NSW Tunnel Construction	Doc No. AQWG_1_0.08
Part 3	Silica Dust Awareness Package	Doc No. AQWG_2_0.21
Part 4	Silica Dust Awareness Package Speakers Notes	Doc No. AQWG_2a_0.04
Part 5	Design and Procurement - Industry Considerations	Doc No. AQWG_3_0.09
Part 6	Scrubber System - Case Study	Doc No. AQWG_4_0.09
Part 7	Ventilation During Tunnel Construction - Industry Considerations	Doc No. AQWG_5_0.08
Part 8	Portal Misting System - Case Study	Doc No. AQWG_6_0.05
Part 9	Roadheader Cabin Air Filtration - Case Study	Doc No. AQWG_7_0.06
Part 10	Respiratory Protective Equipment - Industry Considerations	Doc No. AQWG_8_0.07
Part 11	Monitoring RCS Exposure - Industry Considerations	Doc No. AQWG_9_0.07
Part 12	Health Monitoring for NSW Tunnel Construction Workers – Industry Considerations	Doc No. AQWG_10_0.14

This case study provides information on an air atomizing dust suppression system that was used in a tunnel portal to prevent silica dusts from transferring from the portal to adjacent operations.

## Detail

Respirable crystalline silica or “silica dust” refers to quartz that is present in the respirable fraction of dust. The median diameter of respirable dust is 4.25 micron (with a geometric standard deviation of 1.5 micron) (SAI, 2009). In order to suppress a dust particle in that size range, either high-pressure hydraulic nozzles or air-atomising nozzles are typically used.



**Figure 1:** ¼ J Series Nozzle

Air atomising nozzles that have been found to be effective include the “¼ J Series Nozzle” pictured in **Figure 1** (Spraying-Systems). The Pressure Spray set-up “SU42” was employed (refer **Figure 2**).

PERFORMANCE DATA: PRESSURE SPRAY SET-UPS   INTERNAL MIX   ROUND SPRAY																			
Spray Set-up No.	Spray Set-up Consists of Fluid and Air Cap Combination	Liquid Capacity (liters per hour)* and Air Capacity (liters per minute)*												Spray Dimensions					
		Liquid Pressure																	
		0.7 bar		1.5 bar			2 bar			3 bar			4 bar			Spray Angle A (°)	B (cm)	C (m)	
Air Press.	l/h	Air l/min	Air Press.	l/h	Air l/min	Air Press.	l/h	Air l/min	Air Press.	l/h	Air l/min	Air Press.	l/h	Air l/min					
SU42	Fluid Cap 100150 + Air Cap 1891125	1.0	44	86	1.4	125	79	2.0	123	108	2.2	199	88	3.0	250	99	19 - 22	89 - 117	6.1 - 9.1
		1.1	32	102	1.5	106	91	2.1	108	119	2.5	174	110	3.2	225	120			
		-	-	-	1.7	87	105	2.2	95	130	2.8	146	133	3.5	205	141			
		-	-	-	1.8	70	118	2.4	79	143	3.1	121	154	3.8	182	163			
		-	-	-	2.0	55	130	2.5	64	155	3.2	108	166	4.1	159	184			
		-	-	-	-	-	-	2.7	52	166	3.4	95	176	4.6	121	225			
		-	-	-	-	-	-	2.8	42	178	3.5	84	187	4.9	93	255			

\*At the stated pressure in bar.

Drip Free™ spray set-ups ensure positive shut-off and are provided for air atomizing assemblies containing a shut-off needle. For more information, call 1.630.655.5000.

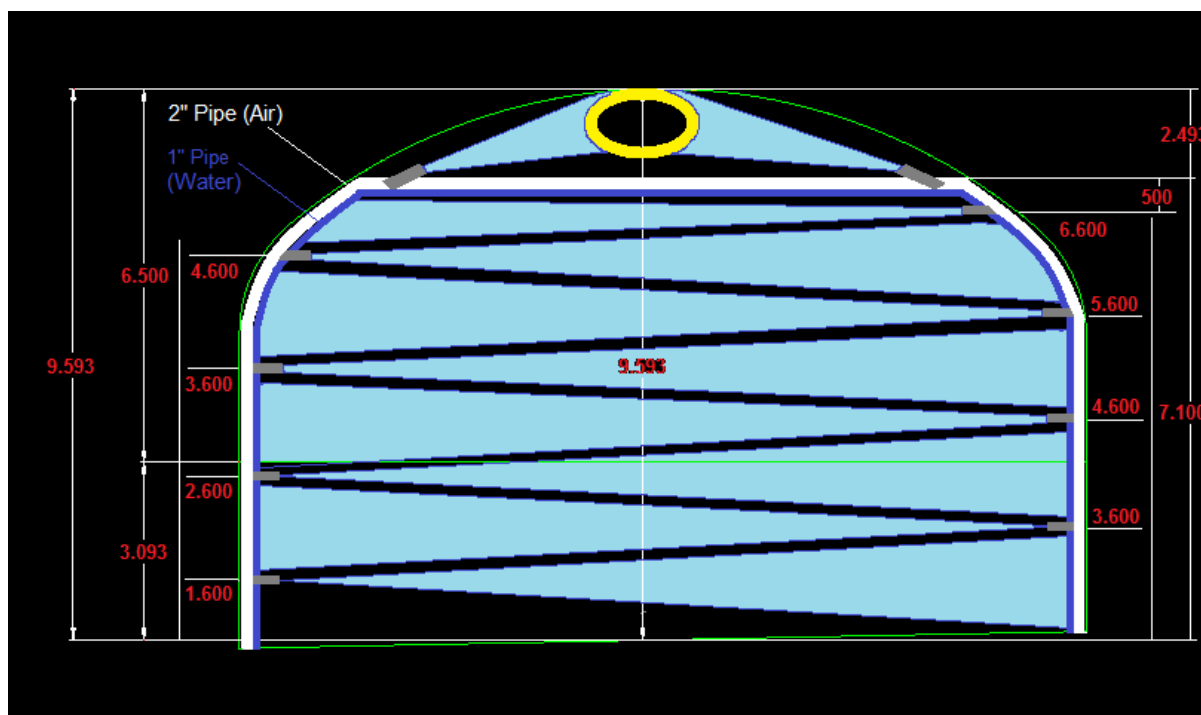
**Figure 2: Pressure Spray Set-Up (Spraying-Systems, Spray Performance Data)**

Other suppliers known to provide similar systems include Techpro.

An air curtain can be constructed as per **Figure 3** using the following listed components. Note that pressure drop can be reduced through using recommended polyline sizes, and that the capacity of compressed air available is a typical constraint of such systems.

Component listing:

- 2 inch polyline appropriate length for Air
- 1 inch polyline for water
- Water regulator
- Air regulator
- In-line water/ air strainer
- Valves and adapter to suit.
- Constant 4 bar water pressure with flow of 159 l/hr
- And constant 4 bar Compressed air with a flow of 184 l/min.



**Figure 3: Typical portal misting system set up**

The portal misting system was found to be effective when setup at least 50m to 100m inside the tunnel portal.

Items that should be considered during the design and operation of such a system include the fact that when operational, the misting system can reduce visibility downwind of the curtain; and when the air velocity in the tunnel exceeds 0.5 m/s, the mist can be carried to around 50m to 100 m before dropping off.

## References and Further Information

- SAI. (2009). *AS 2985 Workplace atmospheres - Method for sampling and gravimetric determination of respirable dust*. SAI Global.
- Spraying-Systems. (n.d.). *Air Atomising Spray Nozzles - Catalogue*. Retrieved from [www.spray.com](http://www.spray.com)
- Spraying-Systems. (n.d.). *Spray Performance Data*.

## Disclaimer

This document has been developed by volunteers of the ATS Air Quality Working Group and draws on the collective experience of those working across some of Australia's largest tunnelling projects. The publication comprises 12 parts, and each part should be considered in the context of the other parts.

The information contained in this document is for general information and educational purposes only; it is not a comprehensive list of all factors to be considered and is not a substitute for legal or technical advice.

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The ATS acknowledges and thanks Matt Lennon and Adroito Xavier for providing the information contained herein.