Client: Trolex Ltd

Title: Respirable Crystalline Silica Monitoring 11th March 2024

Report No.: 21560094-3

Introduction

Bureau Veritas UK Ltd undertook a workplace air monitoring assessment at Trolex Ltd, Hazel Grove, Stockport on 11th March 2024. Trolex Ltd has developed a direct reading instrument, Air XS, providing real-time, airborne concentrations of respirable crystalline silica. As part of the development of the instrument, Trolex Ltd is seeking to obtain independent active monitoring data, in accordance with the methodology described in the HSE approved document Methods for the Determination of Hazardous Substances (MDHS) 101 (2015) *Crystalline silica in respirable airborne dust* and BS ISO 24095:2021 *Workplace air. Guidance for the measurement of respirable crystalline silica* in order to evaluate the accuracy of the Air XS instrument.

Sampling Methodology

Sampling was performed in accordance with the Health & Safety Executive Guidance, HS(G)173 "Monitoring strategies for toxic substances".

Table 1 identifies the specific sampling methodology used.

Table 1: Sampling Methodology

Substance	Methodology	Sampling Media	Flow Rate	Analytical Method
Respirable Crystalline Silica	MDHS 101	25mm PVC Filter in Cyclone Sampler	2.2 l/min +/- 0.1 l/min	X-Ray Diffraction (XRD)

ISO 24095:2021 references an uncertainty estimation of +/-30% variability at the exposure limit value stating "Performance criteria give limits to the expanded uncertainty in occupational hygiene analyses to reduce the potential for incorrect decisions due to the poor precision of results [ISO 20581]. This uncertainty includes the imprecision in the sampling and analytical methods and is specified as a maximum of +/- 30% at the exposure limit value and +/- 50% at about half the limit value."

Table 2 identifies the calibration equipment used during this assessment.

Table 2: Equipment

Use	Make	Model	Serial Number
Flow Calibrator	MesaLabs	200-520M Defender	133117

Note: At the time of the assessment all equipment was fully calibrated, where appropriate. Calibration certificates for all equipment used are available on request.

Test Chamber

1. The Trolex Test Chamber has a volume of 1 m^3. A simple schematic to show its design is provided in Figure 1.

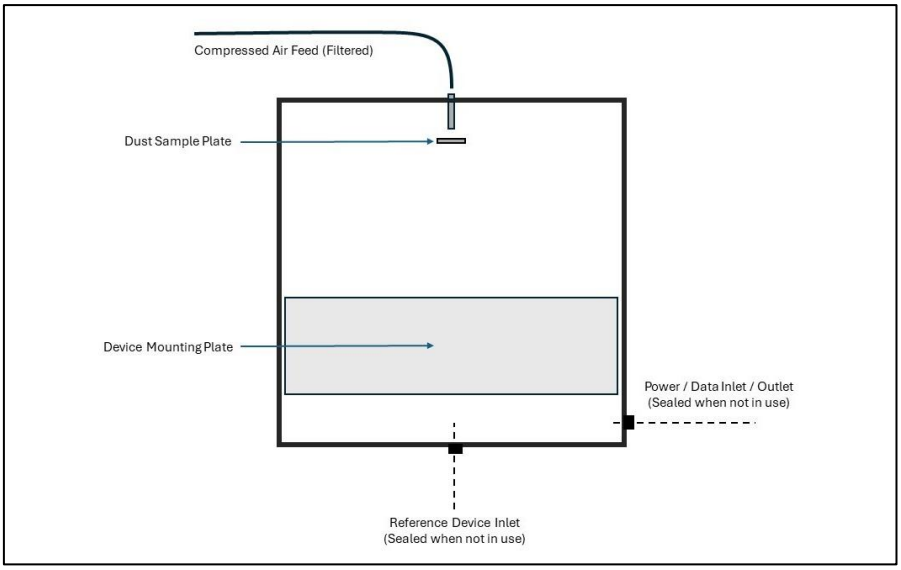

Figure 1: Schematic to show general design layout of Trolex Test Chamber

2. An air compressor, controllable via a ball valve, was connected to the chamber delivering 6 bar of clean air supply, filtered for moisture and additional particulates (2 x High Efficiency Particulate Air [HEPA] filters in line with a moisture and oil trap).

3. The Trolex Test Chamber had the facility to mount 3 x Air XS devices and multiple active pumped samplers (cyclone samplers) on the device mounting plate within it.

4. The Air XS unit was installed elevated above the chamber floor to prevent any restriction to airflow movement.

5. The Trolex Test Chamber had the facility for power and data cables to be attached.

6. The Trolex Test Chamber was sealed during test operations (taped closed to further ensure the unit being sealed).

7. The design of the Trolex Test Chamber allows for an 'ambient to peak' dose followed by a transient return to ambient conditions (based on previous data obtained by Trolex Ltd).

8. Depending on the test regime, a single dose or periodic single doses (every 2 hours) are chosen due to previous data obtained by Trolex Ltd highlighting 2 hours as being approximately the decay window for the dust to almost fully settle.

9. The room was not temperature-controlled but the conditions remained stable throughout the test period.

Test Conditions

1. The premise of the developmental testing of the Air XS direct reading instrument is to introduce a known mass of compliance dust to the Trolex Test Chamber in which the Air XS is set up, then disperse this dust throughout the Test Chamber using a jet of compressed air. The mass of dust introduced is determined by the intensity of the test ('low', 'medium' or 'high' dust levels).

2. Three (3) static cyclone samplers were placed into the Trolex Test Chamber at set locations to sample for a period of approximately 8 hours. One (1) cyclone sampler was located on either side of the Air XS device, with the third positioned on the right hand wall of the Test Chamber, as shown in Figure 2.

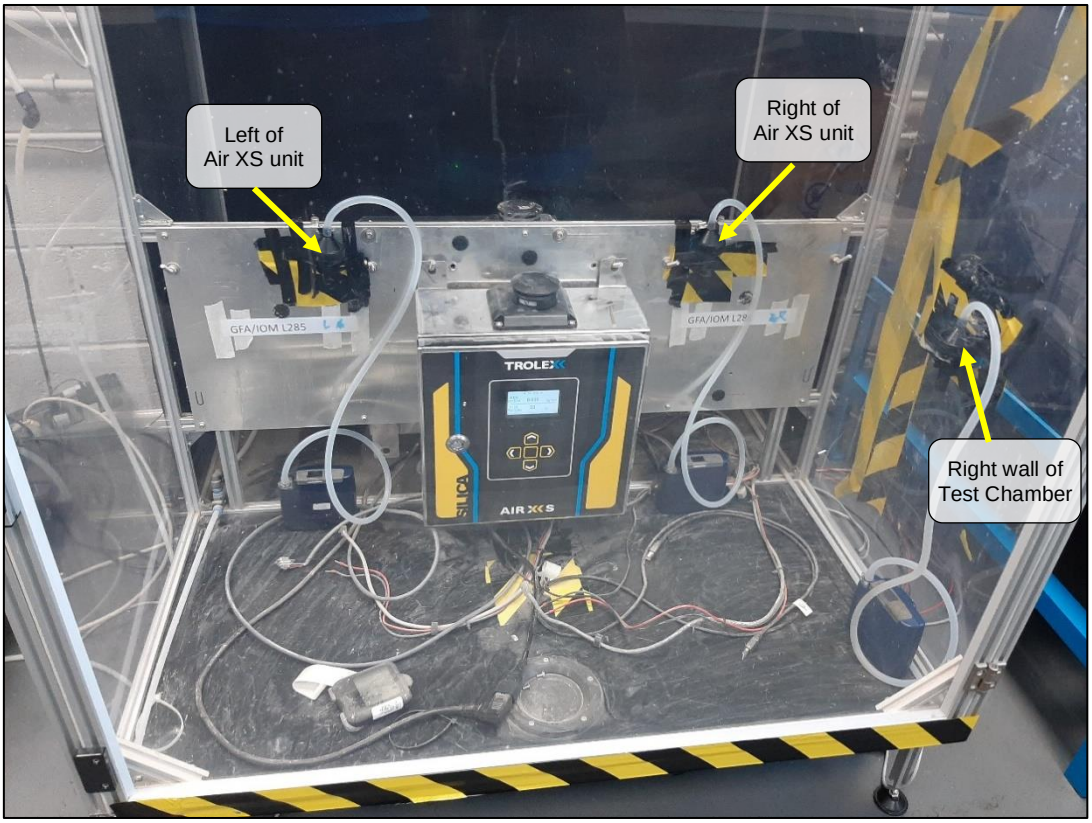

Figure 2: Chamber and equipment set-up on showing locations of the cyclone samplers.

3. The compliance dust used on the day of the assessment was 'Nominal 0-10 micron Arizona Test Dust'. The dust was stored in a dedicated container and sealed with tape to prevent moisture ingress.

4. Compliance dust was introduced on four (4) separate occasions – once at the start of the test and then on three further occasions at 2-hour intervals. The dust was weighed prior to the start of the test on a calibrated balance (to 3 significant figures as required). The mass of dust required is determined by whether the test is to be undertaken with 'low', 'medium' or 'high' dust levels (+/- 2% of acceptable tolerance on the dust mass). For this assessment, under 'high' dust conditions, a mass of 300 mg per dose (4 doses in total) was used.

5. Before weighing out the compliance dust, the dust container was gently 'tumbled' to reagitate the dust and encourage an even distribution of particle sizes (as recommended by the supplier). Using a laboratory spatula the compliance dust was weighed onto a sample disc prior to being manually transferred to the dust chamber funnel. The funnel was then charged with the dust onto a circular collection plate. The collection plate was then subject to a 3-second burst of compressed air for omni-directional distribution/dispersion of the dust.

6. The three (3) cyclone samplers were positioned to ensure there was no bias/hot spots. The samplers were located at a suitable distance from each respective air inlet on the Air XS device but close enough to be representative of the same air space. Visual signage within the Trolex Test Chamber (visible in Figure 2) allows for the same sample locations to be used each time the sampling is undertaken.

Table A1: Respirable Crystalline Silica Results (Quartz + Cristobalite), 11-03-2024 – High Dose, 300 mg (Total 1200 mg)								
Sample No.	Sample ID	Sample Description	Run Time	Ave Flow Rate	Sample Volume	Substance	Analytical Results*	Measured Concentration
			mins	l/min	m^3		mg	mg/m^3
F556	Sample 1	LHS of Trolex Unit	485	2.217	1.075	Respirable Crystalline Silica (Quartz + Cristobalite)	0.219	0.20
F554	Sample 2	RHS of Trolex Unit	485	2.152	1.044	Respirable Crystalline Silica (Quartz + Cristobalite)	0.143	0.14
F555	Sample 3	RHS of Trolex Test Chamber	485	2.181	1.058	Respirable Crystalline Silica (Quartz + Cristobalite)	0.155	0.15
F562	Field Blank	Reference Sample 1	-	-	-	Respirable Crystalline Silica (Quartz + Cristobalite)	< 0.010	-
F563	Field Blank	Reference Sample 2	-	-	-	Respirable Crystalline Silica (Quartz + Cristobalite)	< 0.010	-
F564	Field Blank	Reference Sample 3	-	-	-	Respirable Crystalline Silica (Quartz + Cristobalite)	< 0.010	-

* Where the 'less than' symbol (<) is used, this denotes that the results for both Quartz and Cristobalite were below the analytical limit of detection.

Trolex Air XS average RCS concentration over 8h	Average Concentration
	mg/m^3
	0.238

CERTIFICATE OF ANALYSIS

MSSL reference: 24-68536

Report date: 25-03-2024

Customer: Bureau Veritas
2nd Floor Atlantic House
Atlas Business Park
Wythenshawe
M22 5PR

Customer contact(s): nicholas.gregory@bureauveritas.com

Customer reference: 21560094/001
Customer PO: -
Customer sampling date: -
Date received: 18-03-2024

Analysis started: 19-03-2024
Analysis complete: 25-03-2024
Conforming: Yes

Results only relate to the items tested. Results apply to the samples as received.

Conformance is contingent upon accurate information being provided by the customer and customer compliance with relevant sample handling and storage conditions prior to receipt at the laboratory.

All opinions and interpretations expressed within this report are outside Marchwood's scope of accreditation.

Accreditation Key:
Y : ISO 17025 UKAS M : MCERTS
N : Non Accredited (S) : Subcontracted

Notes:

Reported by: Rosie Daffern
Position: Senior Analytical Chemist

Approved by: Sebastian Dahl
Position: Laboratory Manager
For/on behalf of Marchwood Scientific Services Ltd

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Analysis of respirable crystalline silica by XRD from PVC Filter(s) (WI MCR 006)

	MSSL sample ref:	24-68536-001	24-68536-002	24-68536-003	24-68534-004
	Customer sample ref:	F556	F554	F555	F562 Blank

Determinand		Units	LOD	Acc.				
Respirable crystalline silica	Quartz	mg	0.005	Y	**0.20**	**0.13**	**0.14**	<0.005
	Cristobalite	mg	0.005	Y	**0.019**	**0.013**	**0.015**	<0.005

	MSSL sample ref:	24-68534-005	24-68534-006
	Customer sample ref:	F563 Blank	F564 Blank

Determinand		Units	LOD	Acc.		
Respirable crystalline silica	Quartz	mg	0.005	Y	<0.005	<0.005
	Cristobalite	mg	0.005	Y	<0.005	<0.005