



Scanning Electron Microscopy Scheme

BACKGROUND

This report covers Round 15A of the SEMS asbestos fibre counting PT scheme. The scheme is operated by HSE, in collaboration with APC, Germany and TNO, Netherlands.

SAMPLES

Four samples were circulated representing a range of different fibre densities and fibre types. All samples were produced at HSE using the modified sputnik multi-port sampling instrument.

INTRODUCTION

A total of 66 laboratories participated in this round (including the validating laboratories). Laboratories were able to submit up to three results per sample and many laboratories took advantage of this with a total of 491 results submitted.

The samples were as follows:

15ASEM1 – High density (50.8 fibres/mm²) – amosite & crocidolite fibres

15ASEM2 – High density (71.5 fibres/mm²) - chrysotile fibres

15ASEM3 – Medium density (27.5 fibres/mm²) – amosite & crocidolite fibres

15ASEM4 – low density (14.0 fibres/mm²) – amosite & crocidolite fibres

INFORMATION SUBMITTED BY LABORATORIES

Laboratories were asked to supply the following information:

- Number of fibres >5µm in length counted (amphibole, chrysotile & other inorganic)
- The number of fields of view searched
- The area of the field of view
- The magnification and the method used

Laboratories were asked to calculate the fibre density (in fibres/mm²) for each fibre type identified. There was also an option to include the number of fibres ≤5µm in length.

LABORATORY ASSESSMENT

RESULTS

Calculations – No errors were identified in this round.

Screen area – The fibre densities submitted by laboratories have not been recalculated and the density calculation and therefore screen area has not been verified.

Magnification – As was the case in earlier rounds, some laboratories used an operating magnification outside the range defined in ISO 14966 (or VDI 3492).

Magnifications ranging from 900x to 4000x were recorded.

Results for total asbestos fibre densities for each laboratory are summarised in Appendix 1.

Data Analysis

Data analysis is based upon the total asbestos fibre densities (amphibole & chrysotile) derived from fibre numbers counted and the area of the filter searched. The distribution of fibres on a filter derived from airborne sampling is normally described as being Poisson-distributed. For Poisson-distributed counts, the variance (standard deviation squared) is equal to the mean. However, in practice the variation may be larger due to differences in sample production, laboratories and individual microscopists.

A comparison of the observed standard deviations with the expected standard deviations (expected under Poisson distribution) show that the observed variation is larger than that expected, and it is difficult to quantify how much of this may be due to differences in sample production, and how much is due to differences between labs/microscopists.

For this report, the data have been compared against the criteria used in the UK phase contrast fibre counting proficiency testing scheme RICE. Details of the analysis used can be found in Appendix 2.

Round 15A Overview

Summary statistics from this round of results are displayed in Table 1. Below this, Figure 1 displays the percentage of participants in each scoring band (as per the RICE scoring system). Figures 2 and 3 show the band scored by participants divided according to magnification and method used respectively.

Table 1: Summary statistics for results received in SEMS Round 15A.

	Sample 1	Sample 2	Sample 3	Sample 4
Number of results	123	123	122	123
Median (fibres/mm²)	50.8	71.5	27.5	14.0
25th percentile (fibres/mm²)	37.6	50.0	20.4	10.0
75th percentile (fibres/mm²)	61.3	111.6	37.9	19.0
Interquartile range (fibres/mm²)	23.8	61.6	17.6	9.0
Mean (fibres/mm²)	50.9	82.9	29.2	16.4
Standard deviation (fibres/mm²)	21.4	51.8	12.5	12.0
Relative standard deviation (%)	41.9	62.5	42.6	73.6

*Note: The relative standard deviation (RSD) is calculated by (standard deviation/mean)*100%. This statistic illustrates the variation relative to the size of the mean value. For very low values of the mean (e.g. Sample 1), the value of the RSD can be considered largely meaningless.*

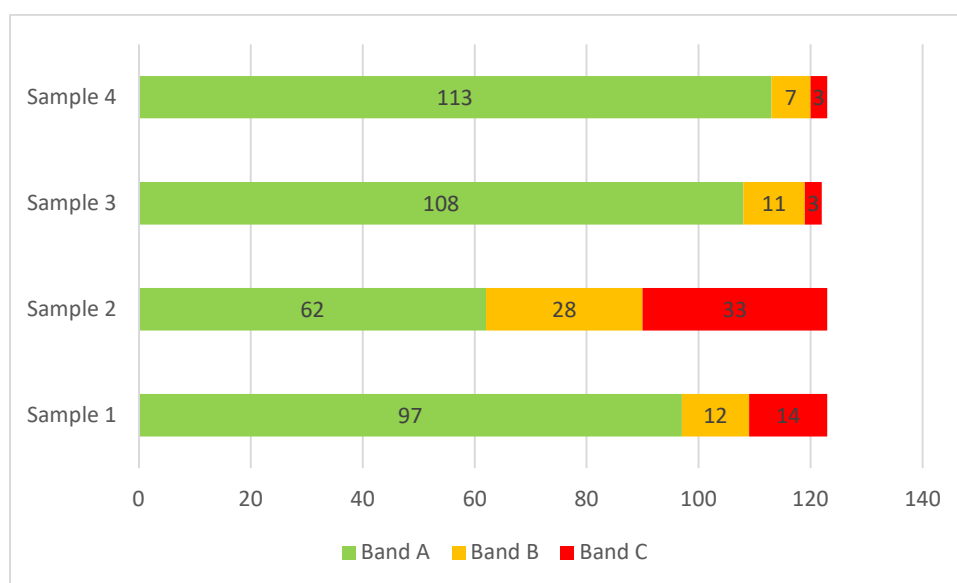


Figure 1: Banded scores for participants in SEMS Round 15A (categorised as per RICE scoring system - see Appendix 2)

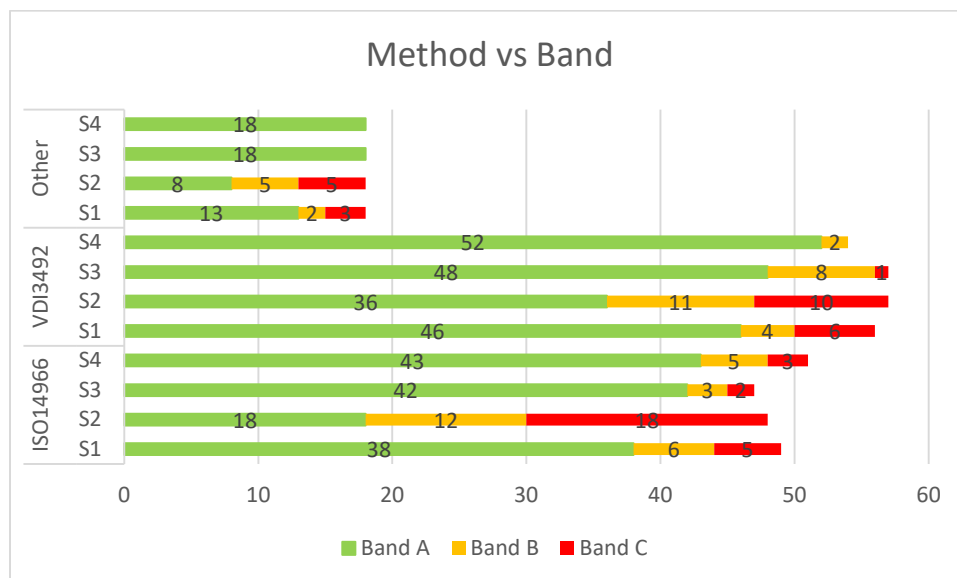


Figure 2: Banded scores for participants in SEMS Round 15A divided according to method used

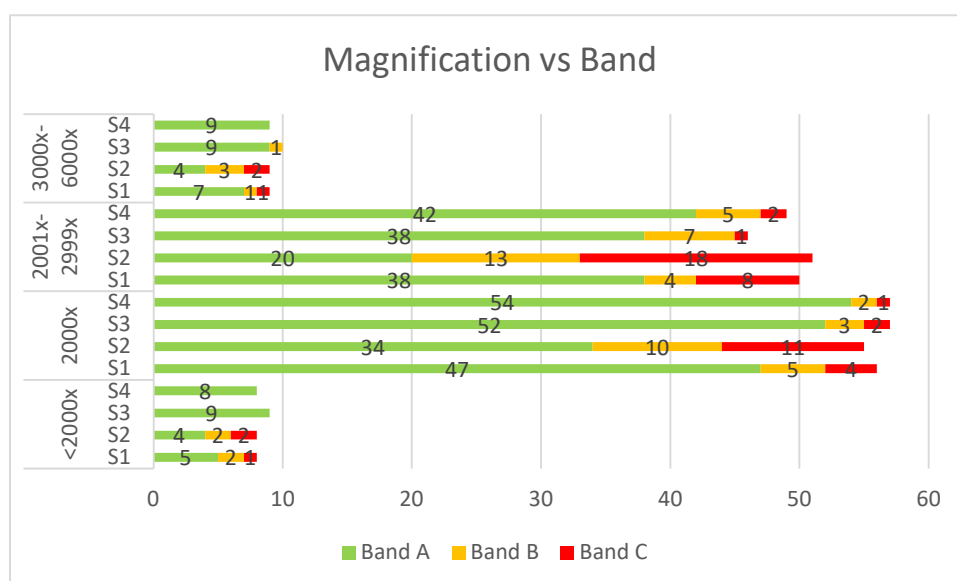


Figure 3: Banded scores for participants in SEMS Round 15A divided according to magnification use

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Sample 1 (15ASEM1) - High density (50.8 fibres/mm²) – amosite & crocidolite fibres

LAB NUMBER	METHOD	MAGNIFICATION	TOTAL ASBESTOS (fibre/mm ²)	BAND (RICE)
807	ISO14966:2019	2000	48.01	A
807	ISO14966:2019	2000	54.1	A
1181	ISO14966:2019	2400	75.21	A
1187	ISO14966:2019	2000	56.9	A
1187	ISO14966:2019	2000	58	A
1277	ISO14966:2019	2	21.8	C
1458	VDI3492	2100	47	A
1458	VDI3492	2100	49	A
1545	VDI3492	2000	55.6	A
1545	VDI3492	2000	57.6	A
1546	VDI3492	2000	0	C
1558	VDI3492	2000	43	A
1562	ISO14966:2019	2047	65.6	A
1562	ISO14966:2019	2047	71.8	A
1562	ISO14966:2019	2047	78.67	A
1569	Other	3100	43	A
1575	VDI3492	2777	21.6	C
1575	VDI3492	2777	25.3	B
1575	VDI3492	2777	53.2	A
1576	VDI3492	2000	44.2	A
1576	VDI3492	2000	47.1	A
1620	VDI3492	2200	54	A
1620	VDI3492	2300	57.5	A
1620	VDI3492	2226	79	A
1658	VDI3492	2000	38	A
1658	VDI3492	2000	47	A
1680	Other	2000	62.7	A
1680	Other	2000	71.3	A
1680	Other	2000	102.9	B
1684	Other	3500	50.8	A
1684	Other	3500	55.2	A
1716	VDI3492	2499	59.58	A
1718	VDI3492	2000	16	C
1718	VDI3492	2000	36	A
1718	VDI3492	2000	36	A
1720	VDI3492	2000	58	A
1722	VDI3492	2072	34.4	A
1722	VDI3492	2072	39.9	A
1722	VDI3492	2072	40.5	A
1759	ISO14966:2019	2000	43.6	A
1759	ISO14966:2019	2000	72.2	A
1759	ISO14966:2019	2000	79.1	A
1761	ISO14966:2002	2000	35	A
1761	ISO14966:2002	2000	57	A

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LAB NUMBER	METHOD	MAGNIFICATION	TOTAL ASBESTOS (fibres/mm ²)	BAND (RICE)
1764	VDI3492	2500	18	C
1764	ISO14966:2019	2500	34	A
1764	VDI3492	2500	36	A
1817	VDI3492	2000	57	A
1831	ISO14966:2019	2130	42.9	A
1831	ISO14966:2019	2130	43.7	A
1831	ISO14966:2019	2130	51.5	A
1838	VDI3492	2000	49	A
1838	VDI3492	2000	50	A
1838	VDI3492	2000	58	A
1841	ISO14966:2019	2000	34.8	A
1841	ISO14966:2019	2000	35.3	A
1848	VDI3492	2188	61	A
1848	VDI3492	2188	65.9	A
1903	VDI3492	4000	54	A
1903	VDI3492	4000	60	A
1918	ISO14966:2019	2550	37.6	A
1918	ISO14966:2019	2070	47.1	A
1918	ISO14966:2019	2130	65.2	A
1927	VDI3492	2100	55.8	A
1927	VDI3492	2100	57.3	A
1940	VDI3492	1000	83.5	B
1940	VDI3492	1000	85.4	B
1963	Other	2000	38	A
1966	VDI3492	1200	55.14	A
1977	ISO14966:2019	2000	47.61905	A
1993	ISO14966:2019	2130	45.3	A
1993	ISO14966:2019	2130	49.4	A
1993	ISO14966:2019	2130	52.1	A
2020	Other	2000	33.33	A
2020	Other	2000	33.33	A
2020	Other	2000	37.33	A
2024	VDI3492	2700	25	B
2051	ISO14966:2019	1100	48.22	A
2051	ISO14966:2019	1100	51.17	A
2051	ISO14966:2019	1100	56.09	A
2059	ISO14966:2019	2000	87.7	B
2059	Other	2000	124.3	C
2062	Other	3800	22	C
2062	Other	3800	23	B
2062	Other	3800	33	A
2066	ISO14966:2019	2050	8.2	C
2066	ISO14966:2019	2050	15.6	C
2066	ISO14966:2019	2050	18.8	C
2085	ISO14966:2019	900	79.6	A

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LAB NUMBER	METHOD	MAGNIFICATION	TOTAL ASBESTOS (fibres/mm ²)	BAND (RICE)
2109	ISO14966:2019	2000	70.1	A
2116	Other	2000	37	A
2125	VDI3492	2172	66.5	A
2125	ISO14966:2019	2172	87	B
2125	ISO14966:2019	2172	98	B
2135	VDI3492	2000	42	A
2135	VDI3492	2000	63	A
2135	VDI3492	2000	70	A
2188	ISO14966:2019	2028	59.65	A
2188	ISO14966:2019	2028	63.16	A
2191	VDI3492	2850	75.4	A
2194	ISO14966:2019	2000	63	A
2194	ISO14966:2019	2000	73.8	A
2207	ISO14966:2019	2000	28	B
2211	VDI3492	2500	37.5	A
2211	VDI3492	2500	56.5	A
2211	VDI3492	2500	75.5	A
2226	VDI3492	2500	7.6	C
2226	VDI3492	2500	9.29	C
2230	VDI3492	2000	57.6	A
2235	VDI3492	2000	61	A
2254	VDI3492	2000	38.1	A
2284	VDI3492	4000	39	A
2289	VDI3492	2000	50.6	A
2332	ISO14966:2019	2000	97.8	B
2341	VDI3492	2400	41	A
2344	Other	2000	10.92	C
2346	ISO14966:2019	2000	98.8	B
2347	ISO14966:2019	2500	16.4	C
2373	Other	2000	53.1	A
2373	Other	2000	54.4	A
2379	ISO14966:2019	2000	49.72	A
2379	ISO14966:2019	2000	61.65	A
2388	ISO14966:2019	2016	43.2	A

Mean 50.9
 Median (Ref) 50.8
 STDev 21.4
 Min 0.0
 Max 124.3

RICE A (Lower)	RICE A (Upper)	RICE B (Lower)	RICE B (Upper)	RICE C (Lower)	RICE C (Upper)
30.9	82.6	22.9	108.7	<22.9	>108.7

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Sample 2 (15ASEM2) - High density (71.5 fibres/mm²) - chrysotile fibres

LAB NUMBER	METHOD	MAGNIFICATION	TOTAL ASBESTOS (fibre/mm ²)	BAND (RICE)
807	ISO14966:2019	2000	93.82	A
807	ISO14966:2019	2000	117.62	B
1181	ISO14966:2019	2400	55.55	A
1187	ISO14966:2019	2000	61.2	A
1187	ISO14966:2019	2000	71.1	A
1277	ISO14966:2019	2	27.2	C
1458	VDI3492	2100	60	A
1458	VDI3492	2100	86	A
1545	VDI3492	2000	56.6	A
1545	VDI3492	2000	58.6	A
1546	VDI3492	2000	17.86	C
1558	VDI3492	2000	53	A
1562	ISO14966:2019	2047	129.9	B
1562	ISO14966:2019	2047	159.4	C
1562	ISO14966:2019	2047	175.6	C
1569	Other	3100	34	C
1575	VDI3492	2777	13.8	C
1575	VDI3492	2777	45.1	B
1575	VDI3492	2777	62.4	A
1576	VDI3492	2000	53.9	A
1576	VDI3492	2000	58.57	A
1620	VDI3492	2300	75	A
1620	VDI3492	2200	132.5	B
1620	VDI3492	2226	158.5	C
1658	VDI3492	2000	72	A
1658	VDI3492	2000	77	A
1680	Other	2000	131.2	B
1680	Other	2000	141.7	B
1680	Other	2000	156.7	C
1684	Other	3500	131.7	B
1684	Other	3500	133.1	B
1716	VDI3492	2499	91	A
1718	VDI3492	2000	22	C
1718	VDI3492	2000	43	B
1718	VDI3492	2000	88	A
1720	VDI3492	2000	80	A
1722	VDI3492	2072	20.5	C
1722	VDI3492	2072	23.2	C
1722	VDI3492	2072	29	C
1759	ISO14966:2019	2000	69.2	A
1759	ISO14966:2019	2000	111.1	B
1759	ISO14966:2019	2000	162.4	C
1761	ISO14966:2002	2000	38	B

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LAB NUMBER	METHOD	MAGNIFICATION	TOTAL ASBESTOS (fibres/mm ²)	BAND (RICE)
1761	ISO14966:2002	2000	50	A
1764	VDI3492	2500	33.5	C
1764	ISO14966:2019	2500	34.5	C
1764	VDI3492	2500	61.5	A
1817	VDI3492	2000	111	B
1831	ISO14966:2019	2130	13.6	C
1831	ISO14966:2019	2130	14.8	C
1831	ISO14966:2019	2130	15.5	C
1838	VDI3492	2000	57	A
1838	VDI3492	2000	59	A
1838	VDI3492	2000	65	A
1841	ISO14966:2019	2000	87	A
1841	ISO14966:2019	2000	108	A
1848	VDI3492	2188	44.3	B
1848	VDI3492	2188	61.5	A
1903	VDI3492	4000	90	A
1903	VDI3492	4000	91	A
1918	ISO14966:2019	2550	56.4	A
1918	ISO14966:2019	2070	77.3	A
1918	ISO14966:2019	2130	90.2	A
1927	VDI3492	2100	115.6	B
1927	VDI3492	2100	165.6	C
1940	VDI3492	1000	99	A
1940	VDI3492	1000	100	A
1963	Other	2000	27	C
1966	VDI3492	1200	104.25	A
1977	ISO14966:2019	2000	40.13605	B
1993	ISO14966:2019	2130	116.5	B
1993	ISO14966:2019	2130	122.1	B
1993	ISO14966:2019	2130	174.1	C
2020	Other	2000	56.67	A
2020	Other	2000	56.67	A
2020	Other	2000	59.33	A
2024	VDI3492	2700	69	A
2051	ISO14966:2019	1100	94.47	A
2051	ISO14966:2019	1100	112.19	B
2051	ISO14966:2019	1100	140.72	B
2059	ISO14966:2019	2000	188.2	C
2059	Other	2000	266.5	C
2062	Other	3800	34	C
2062	Other	3800	45	B
2062	Other	3800	46.5	A
2066	ISO14966:2019	2050	0	C
2066	ISO14966:2019	2050	0	C
2066	ISO14966:2019	2050	0	C
2085	ISO14966:2019	900	209.731	C

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LAB NUMBER	METHOD	MAGNIFICATION	TOTAL ASBESTOS (fibres/mm ²)	BAND (RICE)
2109	ISO14966:2019	2000	95.9	A
2116	Other	2000	100	A
2125	VDI3492	2172	122	B
2125	ISO14966:2019	2172	136	B
2125	ISO14966:2019	2172	143	B
2135	VDI3492	2000	82	A
2135	VDI3492	2000	88	A
2135	VDI3492	2000	108	A
2188	ISO14966:2019	2028	72.51	A
2188	ISO14966:2019	2028	80.12	A
2191	VDI3492	2850	124.2	B
2194	ISO14966:2019	2000	163.1	C
2194	ISO14966:2019	2000	169.2	C
2207	ISO14966:2019	2000	31	C
2211	VDI3492	2500	41.5	B
2211	VDI3492	2500	50	A
2211	VDI3492	2500	58.5	A
2226	VDI3492	2500	54.47	A
2226	VDI3492	2500	57.85	A
2226	VDI3492	2500	59.96	A
2230	VDI3492	2000	137	B
2235	VDI3492	2000	292	C
2254	VDI3492	2000	71.5	A
2284	VDI3492	4000	54	A
2289	VDI3492	2000	46.62	A
2332	ISO14966:2019	2000	56.5	A
2341	VDI3492	2400	46	B
2344	Other	2000	70	A
2346	ISO14966:2019	2000	138.3	B
2347	ISO14966:2019	2500	7.23	C
2373	Other	2000	80.1	A
2373	Other	2000	81.3	A
2379	ISO14966:2019	2000	59.67	A
2388	ISO14966:2019	2016	72.1	A

Mean 82.9
 Median (Ref) 71.5
 STDev 51.8
 Min 0.0
 Max 292.0

RICE A (Lower)	RICE A (Upper)	RICE B (Lower)	RICE B (Upper)	RICE C (Lower)	RICE C (Upper)
46.5	110.8	35.8	143.0	<35.8	>143.0

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Sample 3 (15ASEM3) - Medium density (27.5 fibres/mm²) – amosite & crocidolite fibres

LAB NUMBER	MAGNIFICATION	METHOD	TOTAL ASBESTOS (fibre/mm ²)	BAND (RICE)
807	ISO14966:2019	2000	27.31	A
807	ISO14966:2019	2000	34.31	A
1181	ISO14966:2019	2400	30.48	A
1187	ISO14966:2019	2000	36.7	A
1187	ISO14966:2019	2000	39.7	A
1277	ISO14966:2019	2	19.2	A
1458	VDI3492	2100	21	A
1458	VDI3492	2100	23	A
1545	VDI3492	2000	38.7	A
1545	VDI3492	2000	39.7	A
1546	VDI3492	2000	16.43	A
1558	VDI3492	2000	33	A
1562	ISO14966:2019	2047	34.8	A
1562	ISO14966:2019	2047	37.7	A
1562	ISO14966:2019	2047	45.4	A
1569	Other	3100	22.5	A
1575	VDI3492	2777	8.8	B
1575	VDI3492	2777	22.6	A
1575	VDI3492	2777	25.7	A
1576	VDI3492	2000	24.3	A
1576	VDI3492	2000	33.3	A
1576	VDI3492	2000	54.3	B
1620	VDI3492	2226	13	B
1620	VDI3492	2200	27	A
1620	VDI3492	2300	43	A
1658	VDI3492	2000	17	A
1658	VDI3492	2000	21.5	A
1680	Other	2000	30	A
1680	Other	2000	45	A
1680	Other	2000	45.7	A
1684	Other	3500	30.5	A
1684	Other	3500	39.2	A
1716	VDI3492	2499	39	A
1718	VDI3492	2000	7	C
1718	VDI3492	2000	28	A
1718	VDI3492	2000	61	B
1720	VDI3492	2000	32.5	A
1722	VDI3492	2072	19.3	A
1722	VDI3492	2072	21.4	A
1722	VDI3492	2072	31.7	A
1759	ISO14966:2019	2000	45.3	A
1759	ISO14966:2019	2000	46.2	A
1759	ISO14966:2019	2000	84.2	C

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LAB NUMBER	MAGNIFICATION	METHOD	TOTAL ASBESTOS (fibres/mm ²)	BAND (RICE)
1761	ISO14966:2002	2000	18	A
1761	ISO14966:2002	2000	47	A
1764	ISO14966:2019	2500	13.5	A
1764	VDI3492	2500	25	A
1764	ISO14966:2019	2500	33	A
1817	VDI3492	2000	39	A
1838	VDI3492	2000	19	A
1838	VDI3492	2000	20	A
1838	VDI3492	2000	20	A
1841	ISO14966:2019	2000	27	A
1841	ISO14966:2019	2000	30	A
1848	VDI3492	2188	22.1	A
1848	VDI3492	2188	30	A
1903	VDI3492	4000	19	A
1903	VDI3492	4000	24	A
1903	VDI3492	4000	28	A
1918	ISO14966:2019	2550	12.7	B
1918	ISO14966:2019	2130	15.2	A
1918	ISO14966:2019	2070	16	A
1927	VDI3492	2100	54.4	B
1940	VDI3492	1000	27.2	A
1940	VDI3492	1000	29.1	A
1963	Other	2000	16	A
1966	VDI3492	1200	49.11	A
1977	ISO14966:2019	2000	46.2585	A
1993	ISO14966:2019	2130	23.2	A
1993	ISO14966:2019	0	27.7	A
1993	ISO14966:2019	2130	38.2	A
2020	Other	2000	20.67	A
2020	Other	2000	20.67	A
2020	Other	2000	22	A
2024	VDI3492	2700	11	B
2051	ISO14966:2019	1100	26.57	A
2051	ISO14966:2019	1100	31.49	A
2051	ISO14966:2019	1100	33.46	A
2059	Other	2000	32	A
2059	ISO14966:2019	2000	42.2	A
2062	Other	3800	17.5	A
2062	Other	3800	21	A
2062	Other	3800	23	A
2066	ISO14966:2019	2050	9.7	B
2066	ISO14966:2019	2050	13.3	B
2066	ISO14966:2019	2050	13.6	A
2085	ISO14966:2019	900	47.374	A
2109	ISO14966:2019	2000	42.9	A

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LAB NUMBER	MAGNIFICATION	METHOD	TOTAL ASBESTOS (fibres/mm ²)	BAND (RICE)
2116	Other	2000	20	A
2125	VDI3492	2172	38	A
2125	ISO14966:2019	2172	45	A
2125	ISO14966:2019	2172	48.5	A
2135	VDI3492	2000	26	A
2135	VDI3492	2000	36	A
2135	VDI3492	2000	37	A
2188	ISO14966:2019	2028	16.37	A
2188	ISO14966:2019	2028	19.89	A
2191	VDI3492	2850	20.7	A
2194	ISO14966:2019	2000	43.3	A
2194	ISO14966:2019	2000	43.3	A
2207	ISO14966:2019	2000	20	A
2211	VDI3492	2500	36	A
2211	VDI3492	2500	38	A
2211	VDI3492	2500	39.5	A
2226	VDI3492	2500	20.27	A
2226	VDI3492	2500	21.53	A
2226	VDI3492	2500	24.07	A
2230	VDI3492	2000	25.8	A
2235	VDI3492	2000	14	A
2254	VDI3492	2000	11.1	B
2284	VDI3492	4000	9	B
2289	VDI3492	2000	21.83	A
2332	ISO14966:2019	2000	43.5	A
2341	VDI3492	2400	26	A
2344	Other	2000	31.86	A
2346	ISO14966:2019	2000	32.9	A
2347	ISO14966:2019	2500	7.72	C
2373	Other	2000	30.3	A
2373	Other	2000	31.2	A
2379	ISO14966:2019	2000	26.85	A
2379	ISO14966:2019	2000	33.81	A
2388	ISO14966:2019	2016	30.7	A

Mean 29.2
 Median (Ref) 27.5
 STDev 12.5
 Min 7.0
 Max 84.2

RICE A (Lower)	RICE A (Upper)	RICE B (Lower)	RICE B (Upper)	RICE C (Lower)	RICE C (Upper)
13.5	51.9	8.4	73.0	<8.4	>73.0

APPENDIX 2

Sample 4 (15ASEM4) - low density (14.0 fibres/mm²) – amosite & crocidolite fibres

LAB NUMBER	MAGNIFICATION	METHOD	TOTAL ASBESTOS (fibre/mm ²)	BAND (RICE)
807	ISO14966:2019	2000	10.5	A
807	ISO14966:2019	2000	12.6	A
1181	ISO14966:2019	2400	28.02	A
1187	ISO14966:2019	2000	15.4	A
1187	ISO14966:2019	2000	18.3	A
1277	ISO14966:2019	2	5.8	A
1458	VDI3492	2100	12	A
1458	VDI3492	2100	13	A
1545	VDI3492	2000	28.3	A
1545	VDI3492	2000	28.8	A
1546	VDI3492	2000	6.43	A
1558	VDI3492	2000	17	A
1562	ISO14966:2019	2047	21.66	A
1562	ISO14966:2019	2047	26.84	A
1562	ISO14966:2019	2047	28	A
1569	Other	3100	10	A
1575	VDI3492	2777	5.5	A
1575	VDI3492	2777	9.8	A
1575	VDI3492	2777	13.8	A
1576	VDI3492	2000	13.8	A
1576	VDI3492	2000	16.2	A
1576	VDI3492	2000	18.6	A
1620	VDI3492	2200	13	A
1620	VDI3492	2300	13.5	A
1620	ISO14966:2019	2226	26.5	A
1658	VDI3492	2000	5	A
1658	VDI3492	2000	10	A
1680	Other	2000	10	A
1680	Other	2000	14.7	A
1680	Other	2000	19	A
1684	Other	3500	16.5	A
1684	Other	3500	16.5	A
1716	VDI3492	2499	16	A
1718	VDI3492	2000	5	A
1718	VDI3492	2000	6	A
1718	VDI3492	2000	10	A
1720	VDI3492	2000	23.5	A
1722	VDI3492	2072	8.45	A
1722	VDI3492	2072	10.6	A
1722	VDI3492	2072	14.2	A
1759	ISO14966:2019	2000	18.8	A
1759	ISO14966:2019	2000	44	B
1759	ISO14966:2019	2000	57.7	C

APPENDIX 2

LAB NUMBER	MAGNIFICATION	METHOD	TOTAL ASBESTOS (fibres/mm ²)	BAND (RICE)
1761	ISO14966:2002	2000	16	A
1761	ISO14966:2002	2000	30	A
1764	ISO14966:2019	2500	8	A
1764	ISO14966:2019	2500	8.5	A
1764	VDI3492	2500	13	A
1817	VDI3492	2000	23	A
1831	ISO14966:2019	2130	37.8	B
1831	ISO14966:2019	2130	71.6	C
1831	ISO14966:2019	2130	92.9	C
1838	VDI3492	2000	10	A
1838	VDI3492	2000	11	A
1838	VDI3492	2000	15	A
1841	ISO14966:2019	2000	13.1	A
1841	ISO14966:2019	2000	14.6	A
1848	VDI3492	2188	8.9	A
1848	VDI3492	2188	16.2	A
1903	VDI3492	4000	16	A
1903	VDI3492	4000	22	A
1918	ISO14966:2019	2070	5.3	A
1918	ISO14966:2019	2550	6.7	A
1918	ISO14966:2019	2130	13.4	A
1927	VDI3492	2100	9.8	A
1940	VDI3492	1000	26.2	A
1940	VDI3492	1000	28.2	A
1963	Other	2000	14	A
1966	VDI3492	1200	21.13	A
1977	ISO14966:2019	2000	19.04762	A
1993	ISO14966:2019	2130	15.7	A
1993	ISO14966:2019	2130	18	A
1993	ISO14966:2019	2130	24.7	A
2020	Other	2000	6	A
2020	Other	2000	7.33	A
2020	Other	2000	10	A
2024	VDI3492	2700	22	A
2051	ISO14966:2019	1100	11.81	A
2051	ISO14966:2019	1100	14.76	A
2051	ISO14966:2019	1100	16.73	A
2059	ISO14966:2019	2000	8.7	A
2059	Other	2000	22.8	A
2062	Other	3800	11	A
2062	Other	3800	11.5	A
2062	Other	3800	12.5	A
2066	ISO14966:2019	2050	3.9	B
2066	ISO14966:2019	2050	5.5	A
2066	ISO14966:2019	2050	7.3	A

APPENDIX 2

LAB NUMBER	MAGNIFICATION	METHOD	TOTAL ASBESTOS (fibres/mm ²)	BAND (RICE)
2085	ISO14966:2019	900	18.752	A
2109	ISO14966:2019	2000	31.97	A
2116	Other	2000	10	A
2125	ISO14966:2019	2172	12.5	A
2125	VDI3492	2172	16	A
2125	ISO14966:2019	2172	20	A
2135	VDI3492	2000	8	A
2135	VDI3492	2000	12	A
2135	VDI3492	2000	19	A
2188	ISO14966:2019	2028	7.02	A
2188	ISO14966:2019	2028	11.7	A
2191	VDI3492	2850	21.69	A
2194	ISO14966:2019	2000	17.4	A
2194	ISO14966:2019	2000	21.3	A
2207	ISO14966:2019	2000	14	A
2211	VDI3492	2500	15.5	A
2211	VDI3492	2500	16	A
2226	VDI3492	2500	4.22	B
2226	VDI3492	2500	5.06	A
2226	VDI3492	2500	7.6	A
2230	VDI3492	2000	10.9	A
2235	VDI3492	2000	20	A
2254	VDI3492	2000	4.6	B
2284	VDI3492	4000	7	A
2289	VDI3492	2000	8.93	A
2332	ISO14966:2019	2000	28.3	A
2341	VDI3492	2400	14	A
2344	Other	2000	10.92	A
2346	ISO14966:2019	2000	26.3	A
2347	ISO14966:2019	2500	3.86	B
2373	Other	2000	15.2	A
2373	Other	2000	16	A
2379	ISO14966:2019	2000	15.91	A
2379	ISO14966:2019	2000	16.91	A
2388	ISO14966:2019	2016	3.2	B

Mean 16.4
 Median (Ref) 14.0
 STDev 12.0
 Min 3.2
 Max 92.9

RICE A (Lower)	RICE A (Upper)	RICE B (Lower)	RICE B (Upper)	RICE C (Lower)	RICE C (Upper)
4.7	32.5	2.0	49.6	<2.0	>49.6

APPENDIX 2

DATA ANALYSIS

Regular Inter-laboratory Counting Exchange (RICE) Criteria

Where R is the reference value – in this case the Median value.

High density samples ($R > 63.7$ fibres/mm²)

Target band A: $> 0.65R$ to $< 1.55R$

Target band B: $> 0.50R$ to $0.65R$ [band -B] and $> 1.55R$ to $2.00R$ [band +B]

Target band C: $< 0.50R$ [band -C] and $> 2.00R$ [band +C]

Low density samples ($R \leq 63.7$ fibres/mm²)*

Target band A: $(\sqrt{R-1.57})^2$ to $(\sqrt{R+1.96})^2$ [band A]

Target band B: $< (\sqrt{R-2.34})^2$ to $(\sqrt{R-1.57})^2$ [band -B]
 $> (\sqrt{R+1.96})^2$ to $(\sqrt{R+3.30})^2$ [band +B]

Target band C: $< (\sqrt{R-2.34})^2$ [band -C]
 $> (\sqrt{R+3.30})^2$ [band +C]

* For samples less than 5.5 fibres/mm² the lower limit is set to zero when the component within the brackets $(\sqrt{R-n})$ is less than zero.

The plot below shows the positions of the performance limits in relation to the reference counts up to reference density 500 fibres/mm².

