



Scanning Electron Microscopy Scheme

BACKGROUND

This report covers Round 15B 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 62 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 430 results submitted.

The samples were as follows:

15BSEM1 – High density (51.6 fibres/mm²) – amosite & crocidolite fibres

15BSEM2 – High density (76.0 fibres/mm²) - chrysotile fibres

15BSEM3 – Medium density (33.4 fibres/mm²) – amosite & crocidolite fibres

15BSEM4 – Low density (13.9 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 750x to 4500x 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 15B 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 15B.

	Sample 1	Sample 2	Sample 3	Sample 4
Number of results	107	107	108	108
Median (fibres/mm²)	51.6	76.0	33.4	13.9
25th percentile (fibres/mm²)	38.6	55.1	25.1	11.2
75th percentile (fibres/mm²)	67.3	95.9	42.7	18.4
Interquartile range (fibres/mm²)	28.7	40.8	17.6	7.2
Mean (fibres/mm²)	54.5	79.6	36.3	16.4
Standard deviation (fibres/mm²)	21.4	33.5	15.7	10.9
Relative standard deviation (%)	39.2	42.1	43.1	66.7

*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.*

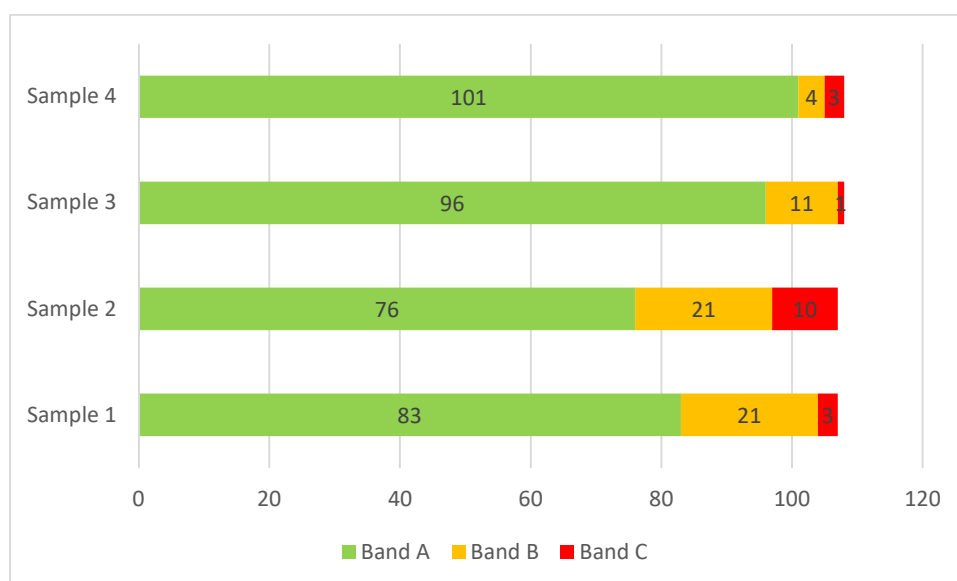


Figure 1: Banded scores for participants in SEMS Round 15B (categorised as per RICE scoring system - see Appendix 2)

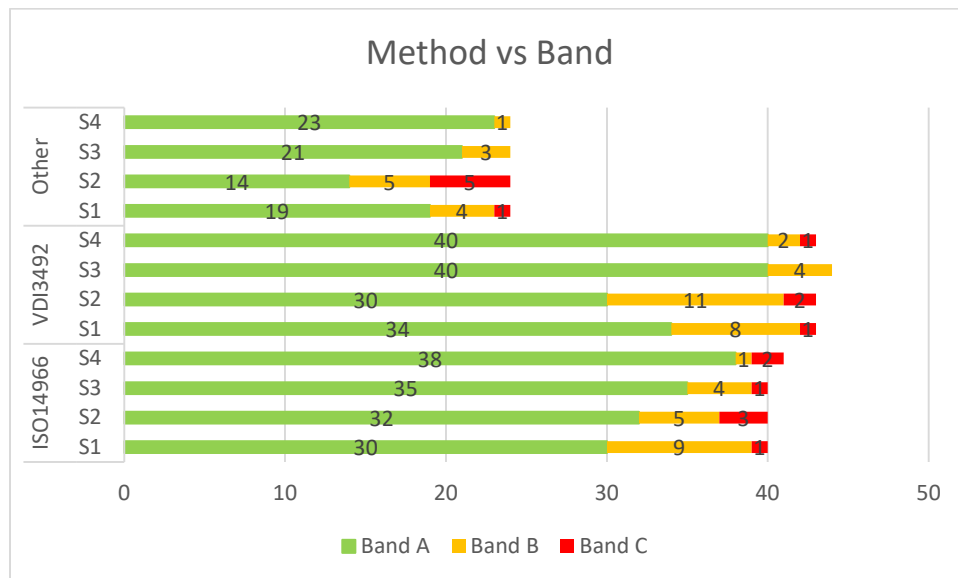


Figure 2: Banded scores for participants in SEMS Round 15B divided according to method used

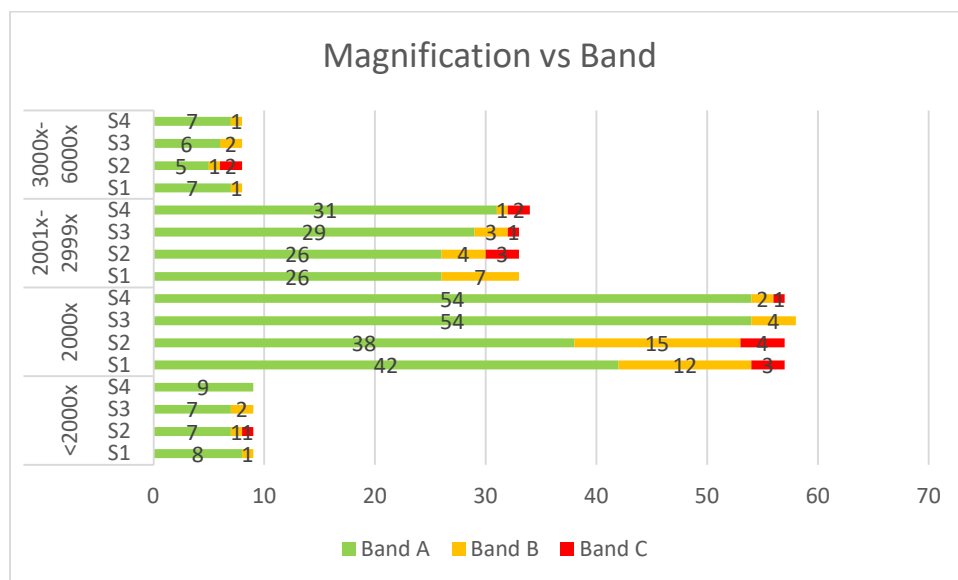


Figure 3: Banded scores for participants in SEMS Round 15B divided according to magnification use

APPENDIX 1

Sample 1 (15BSEM1) - High density (51.6 fibres/mm²) – amosite & crocidolite fibres

LAB NUMBER	METHOD	MAGNIFICATION	TOTAL ASBESTOS (fibres/mm ²)	BAND (RICE)
7	ISO14966:2019	2000	26.5	B
7	ISO14966:2019	2000	26.5	B
7	ISO14966:2019	2000	18.2	C
139	VDI3492	2000	55.61	A
139	VDI3492	2000	67.65	A
199	ISO14966:2019	2100	58.6	A
199	ISO14966:2019	2100	65.24	A
300	VDI3492	0	34	A
709	VDI3492	2000	32	A
709	VDI3492	2000	35.6	A
709	VDI3492	2000	26.7	B
818	Other	4500	75.1	A
818	Other	4500	84	B
1445	ISO14966:2019	2000	60	A
1456	VDI3492	2000	82.3	A
1477	VDI3492	2000	97.346	B
1477	VDI3492	2000	97.346	B
1477	VDI3492	2000	98.315	B
1507	ISO14966:2019	0	68.76	A
1510	VDI3492	2000	43.4	A
1510	VDI3492	2000	29.7	B
1579	Other	3000	58	A
1579	Other	3000	62.5	A
1592	VDI3492	2000	48	A
1638	VDI3492	2000	64	A
1640	VDI3492	2000	31.5	A
1646	ISO14966:2019	750	105.68	B
1649	Other	2000	26.8	B
1708	ISO14966:2019	2000	46.87	A
1708	ISO14966:2019	2000	48.3	A
1715	ISO14966:2019	2000	52.48	A
1717	ISO14966:2019	2325	41.2	A
1717	ISO14966:2019	2325	59.9	A
1717	ISO14966:2019	2325	60.7	A
1734	VDI3492	2096	58	A
1734	VDI3492	2096	29.5	B
1738	VDI3492	2429	65.5	A
1745	ISO14966:2019	2000	38	A
1768	ISO14966:2002	2100	46.93	A
1768	ISO14966:2002	2100	46.93	A

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LAB NUMBER	METHOD	MAGNIFICATION	TOTAL ASBESTOS (fibres/mm ²)	BAND (RICE)
1768	ISO14966:2002	2050	50.48	A
1774	Other	2000	68	A
1776	VDI3492	2000	48	A
1784	Other	2000	45.86	A
1812	VDI3492	2000	39	A
1812	VDI3492	2000	39.5	A
1812	VDI3492	2000	41	A
1813	Other	2000	63.3	A
1813	Other	2000	71.2	A
1813	Other	2000	79.1	A
1814	Other	4000	59.4	A
1826	ISO14966:2002	2000	31.44	B
1832	VDI3492	2100	38	A
1832	VDI3492	2100	70	A
1832	VDI3492	2100	94	B
1836	VDI3492	2500	60.81	A
1860	Other	2000	28.32	B
1885	VDI3492	2500	37	A
1885	VDI3492	2500	40	A
1885	VDI3492	2500	55	A
1889	ISO14966:2019	2000	44.28	A
1889	ISO14966:2019	2000	45.28	A
1910	VDI3492	2000	2	C
1922	ISO14966:2019	1500	49.2	A
1922	ISO14966:2019	1500	69.7	A
1923	Other	2000	48.1	A
1928	Other	2000	47.6	A
1928	Other	2000	54.3	A
1928	Other	2000	55	A
1937	Other	2000	37.2	A
1937	Other	2000	38.1	A
1937	Other	2000	25.6	B
1938	VDI3492	2000	41	A
1958	VDI3492	2000	66.9	A
1976	ISO14966:2019	1000	79	A
1976	ISO14966:2019	1000	80	A
1976	ISO14966:2019	1000	81	A
1984	Other	4500	55.03	A
1984	Other	4500	65.3	A
1984	Other	4500	81.44	A
1989	ISO14966:2019	2200	87.13	B
1989	ISO14966:2019	2200	93.07	B
1989	ISO14966:2019	2200	97.03	B

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LAB NUMBER	METHOD	MAGNIFICATION	TOTAL ASBESTOS (fibres/mm ²)	BAND (RICE)
2032	ISO14966:2019	1100	53	A
2045	VDI3492	2000	80	A
2045	VDI3492	2000	98	B
2069	VDI3492	2500	83	A
2107	ISO14966:2019	2222	60	A
2107	ISO14966:2019	2222	68	A
2150	ISO14966:2019	2000	58	A
2167	Other	2000	0	C
2168	ISO14966:2019	2000	36.1	A
2168	ISO14966:2019	2000	38	A
2168	ISO14966:2019	2000	43.5	A
2174	VDI3492	2000	46.87	A
2202	VDI3492	2095	46.2	A
2202	VDI3492	2095	59.5	A
2202	VDI3492	2095	59.5	A
2203	VDI3492	2000	51.64	A
2215	ISO14966:2019	2025	94.47	B
2229	Other	2000	37.8	A
2251	ISO14966:2019	2000	51.3	A
2317	ISO14966:2019	2419	46.86036	A
2329	VDI3492	2139	33.14	A
2329	VDI3492	2139	35	A
2329	VDI3492	2065	47.5	A
2360	ISO14966:2019	2277	29.27	B

Mean 54.5
 Median (Ref) 51.6
 STDev 21.4
 Min 0.0
 Max 105.7

RICE A (Lower)	RICE A (Upper)	RICE B (Lower)	RICE B (Upper)	RICE C (Lower)	RICE C (Upper)
31.5	83.6	23.5	109.9	<23.5	>109.9

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Sample 2 (15BSEM2) - High density (76.0 fibres/mm²) - chrysotile fibres

LAB NUMBER	METHOD	MAGNIFICATION	TOTAL ASBESTOS (fibras/mm ²)	BAND (RICE)
7	ISO14966:2019	2000	54.4	A
7	ISO14966:2019	2000	50.6	A
7	ISO14966:2019	2000	49.2	B
139	VDI3492	2000	65.85	A
139	VDI3492	2000	55.88	A
199	ISO14966:2019	2100	85.7	A
199	ISO14966:2019	2100	92.9	A
300	VDI3492	0	71	A
709	VDI3492	2000	58.2	A
709	VDI3492	2000	76	A
709	VDI3492	2000	67	A
818	Other	4500	180.1	C
818	Other	4500	160.1	C
1445	ISO14966:2019	2000	91.5	A
1456	VDI3492	2000	138.7	B
1477	VDI3492	2000	95.409	A
1477	VDI3492	2000	95.893	A
1477	VDI3492	2000	97.83	A
1507	ISO14966:2019	0	104.16	A
1510	VDI3492	2000	76.9	A
1510	VDI3492	2000	51	A
1579	Other	3000	87.5	A
1579	Other	3000	93.5	A
1592	VDI3492	2000	90	A
1638	VDI3492	2000	121	B
1640	VDI3492	2000	0	C
1646	ISO14966:2019	750	210.89	C
1649	Other	2000	58.8	A
1708	ISO14966:2019	2000	74.26	A
1708	ISO14966:2019	2000	70.08	A
1715	ISO14966:2019	2000	60.4	A
1717	ISO14966:2019	2325	62.4	A
1717	ISO14966:2019	2325	70.5	A
1717	ISO14966:2019	2325	84	A
1734	VDI3492	2096	95.2	A
1734	VDI3492	2096	60	A
1738	VDI3492	2429	77.3	A
1745	ISO14966:2019	2000	96	A
1768	ISO14966:2002	2100	55.26	A
1768	ISO14966:2002	2100	53.73	A
1768	ISO14966:2002	2050	77.19	A

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LAB NUMBER	METHOD	MAGNIFICATION	TOTAL ASBESTOS (fibres/mm ²)	BAND (RICE)
1774	Other	2000	120.6	B
1776	VDI3492	2000	93	A
1784	Other	2000	48.57	B
1812	VDI3492	2000	48	B
1812	VDI3492	2000	39	B
1812	VDI3492	2000	48	B
1813	Other	2000	59.3	A
1813	Other	2000	52.4	A
1813	Other	2000	45.5	B
1814	Other	4000	44.9	B
1826	ISO14966:2002	2000	77.31	A
1832	VDI3492	2100	83	A
1832	VDI3492	2100	50	A
1832	VDI3492	2100	98	A
1836	VDI3492	2500	83.74	A
1860	Other	2000	82.59	A
1885	VDI3492	2500	65	A
1885	VDI3492	2500	39	B
1885	VDI3492	2500	35	C
1889	ISO14966:2019	2000	116.43	A
1889	ISO14966:2019	2000	104.99	A
1910	VDI3492	2000	137	B
1922	ISO14966:2019	1500	97.5	A
1922	ISO14966:2019	1500	142.3	B
1923	Other	2000	78.9	A
1928	Other	2000	85	A
1928	Other	2000	83.8	A
1928	Other	2000	73.1	A
1937	Other	2000	42.2	B
1937	Other	2000	31.4	C
1937	Other	2000	36.3	C
1938	VDI3492	2000	55	A
1958	VDI3492	2000	71.56	A
1976	ISO14966:2019	1000	95	A
1976	ISO14966:2019	1000	100	A
1976	ISO14966:2019	1000	93	A
1984	Other	4500	49.89	A
1984	Other	4500	51.36	A
1984	Other	4500	56.5	A
1989	ISO14966:2019	2200	73.21	A
1989	ISO14966:2019	2200	83.6	A
1989	ISO14966:2019	2200	89.53	A
2032	ISO14966:2019	1100	74	A

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LAB NUMBER	METHOD	MAGNIFICATION	TOTAL ASBESTOS (fibres/mm ²)	BAND (RICE)
2045	VDI3492	2000	126	B
2045	VDI3492	2000	132	B
2069	VDI3492	2500	139	B
2107	ISO14966:2019	2222	36	C
2107	ISO14966:2019	2222	32	C
2150	ISO14966:2019	2000	106	A
2167	Other	2000	61	A
2168	ISO14966:2019	2000	68.5	A
2168	ISO14966:2019	2000	79.6	A
2168	ISO14966:2019	2000	69.4	A
2174	VDI3492	2000	125.43	B
2202	VDI3492	2095	113.8	A
2202	VDI3492	2095	98.1	A
2202	VDI3492	2095	100.5	A
2203	VDI3492	2000	52.13	A
2215	ISO14966:2019	2025	127.6	B
2229	Other	2000	21.53	C
2251	ISO14966:2019	2000	46.8	B
2317	ISO14966:2019	2419	127.6945	B
2329	VDI3492	2139	64.39	A
2329	VDI3492	2139	72.9	A
2329	VDI3492	2065	61.5	A
2360	ISO14966:2019	2277	104.47	A

Mean 79.6
 Median (Ref) 76.0
 STDev 33.5
 Min 0.0
 Max 210.9

RICE A (Lower)	RICE A (Upper)	RICE B (Lower)	RICE B (Upper)	RICE C (Lower)	RICE C (Upper)
49.4	117.8	38.0	152.0	<38	>152

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Sample 3 (15BSEM3) - Medium density (33.4 fibres/mm²) – amosite & crocidolite fibres

LAB NUMBER	METHOD	MAGNIFICATION	TOTAL ASBESTOS (fibres/mm ²)	BAND (RICE)
7	ISO14966:2019	2000	30.5	A
7	ISO14966:2019	2000	27.5	A
7	ISO14966:2019	2000	25.1	A
139	VDI3492	2000	43.42	A
139	VDI3492	2000	38.24	A
139	VDI3492	2000	33.33	A
199	ISO14966:2019	2100	55.2	A
199	ISO14966:2019	2100	44.8	A
300	VDI3492	0	26	A
709	VDI3492	2000	35.6	A
709	VDI3492	2000	55.5	A
709	VDI3492	2000	46.7	A
818	Other	4500	72.1	B
818	Other	4500	73.6	B
1445	ISO14966:2019	2000	44	A
1456	VDI3492	2000	39.9	A
1477	VDI3492	2000	53.274	A
1477	VDI3492	2000	62.476	B
1477	VDI3492	2000	71.678	B
1507	ISO14966:2019	0	44.6	A
1510	VDI3492	2000	34.9	A
1510	VDI3492	2000	16.5	B
1579	Other	3000	40	A
1579	Other	3000	40	A
1592	VDI3492	2000	27	A
1638	VDI3492	2000	54	A
1640	VDI3492	2000	30	A
1646	ISO14966:2019	750	52.03	A
1649	Other	2000	32.7	A
1708	ISO14966:2019	2000	32.49	A
1708	ISO14966:2019	2000	32.02	A
1715	ISO14966:2019	2000	57.43	A
1717	ISO14966:2019	2325	22.6	A
1717	ISO14966:2019	2325	30	A
1717	ISO14966:2019	2325	39	A
1734	VDI3492	2096	19	A
1734	VDI3492	2096	16.2	B
1738	VDI3492	2429	27	A
1745	ISO14966:2019	2000	25	A
1768	ISO14966:2002	2100	29.82	A
1768	ISO14966:2002	2100	31.8	A

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LAB NUMBER	METHOD	MAGNIFICATION	TOTAL ASBESTOS (fibres/mm ²)	BAND (RICE)
1768	ISO14966:2002	2050	31.24	A
1774	Other	2000	47	A
1776	VDI3492	2000	36	A
1784	Other	2000	26.75	A
1812	VDI3492	2000	21	A
1812	VDI3492	2000	20.5	A
1812	VDI3492	2000	23	A
1813	Other	2000	49.5	A
1813	Other	2000	41.5	A
1813	Other	2000	39.6	A
1814	Other	4000	39.9	A
1826	ISO14966:2002	2000	29.83	A
1832	VDI3492	2100	25	A
1832	VDI3492	2100	24	A
1832	VDI3492	2100	23	A
1836	VDI3492	2500	23.92	A
1860	Other	2000	16.99	B
1885	VDI3492	2500	19	A
1885	VDI3492	2500	21	A
1885	VDI3492	2500	19	A
1889	ISO14966:2019	2000	39.8	A
1889	ISO14966:2019	2000	38.81	A
1910	VDI3492	2000	40	A
1922	ISO14966:2019	1500	41.4	A
1922	ISO14966:2019	1500	39.5	A
1923	Other	2000	39.9	A
1928	Other	2000	33.5	A
1928	Other	2000	20.8	A
1928	Other	2000	28.8	A
1937	Other	2000	22	A
1937	Other	2000	35	A
1937	Other	2000	26.9	A
1938	VDI3492	2000	33	A
1958	VDI3492	2000	34.1	A
1976	ISO14966:2019	1000	54	A
1976	ISO14966:2019	1000	67	B
1976	ISO14966:2019	1000	66	B
1984	Other	4500	23.48	A
1984	Other	4500	22.01	A
1984	Other	4500	23.48	A
1989	ISO14966:2019	2200	50.46	A
1989	ISO14966:2019	2200	41.55	A
1989	ISO14966:2019	2200	42.54	A

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LAB NUMBER	METHOD	MAGNIFICATION	TOTAL ASBESTOS (fibres/mm ²)	BAND (RICE)
2032	ISO14966:2019	1100	30	A
2045	VDI3492	2000	33	A
2045	VDI3492	2000	34	A
2069	VDI3492	2500	43	A
2107	ISO14966:2019	2222	14	B
2107	ISO14966:2019	2222	12	B
2150	ISO14966:2019	2000	25	A
2167	Other	2000	30	A
2168	ISO14966:2019	2000	24.1	A
2168	ISO14966:2019	2000	33.3	A
2168	ISO14966:2019	2000	23.1	A
2174	VDI3492	2000	36.22	A
2202	VDI3492	2095	29.5	A
2202	VDI3492	2095	48.095	A
2202	VDI3492	2095	43.3	A
2203	VDI3492	2000	37.38	A
2215	ISO14966:2019	2025	126.01	C
2229	Other	2000	25.84	A
2251	ISO14966:2019	2000	33.3	A
2317	ISO14966:2019	2419	35.14527	A
2329	VDI3492	2139	36.9	A
2329	VDI3492	2139	22.7	A
2329	VDI3492	2065	44.6	A
2360	ISO14966:2019	2277	46.79	A

Mean 36.3
 Median (Ref) 33.4
 STDev 15.7
 Min 12.0
 Max 126.0

RICE A (Lower)	RICE A (Upper)	RICE B (Lower)	RICE B (Upper)	RICE C (Lower)	RICE C (Upper)
17.7	59.9	11.8	82.4	<11.8	>82.4

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Sample 4 (15BSEM4) - Low density (13.9 fibres/mm²) – amosite & crocidolite fibres

LAB NUMBER	METHOD	MAGNIFICATION	TOTAL ASBESTOS (fibre/mm ²)	BAND (RICE)
7	ISO14966:2019	2000	11.3	A
7	ISO14966:2019	2000	13.3	A
7	ISO14966:2019	2000	14.3	A
139	VDI3492	2000	15.61	A
139	VDI3492	2000	14.22	A
199	ISO14966:2019	2100	12.8	A
199	ISO14966:2019	2100	3.8	B
300	VDI3492	0	12	A
709	VDI3492	2000	22.1	A
709	VDI3492	2000	11.5	A
709	VDI3492	2000	21.9	A
818	Other	4500	31.8	A
818	Other	4500	35.8	B
1445	ISO14966:2019	2000	18.5	A
1456	VDI3492	2000	18.1	A
1477	VDI3492	2000	30.996	A
1477	VDI3492	2000	41.651	B
1477	VDI3492	2000	32.933	B
1507	ISO14966:2019	0	19.65	A
1510	VDI3492	2000	11.3	A
1510	VDI3492	2000	18.9	A
1579	Other	3000	18	A
1579	Other	3000	20	A
1592	VDI3492	2000	7	A
1638	VDI3492	2000	22.5	A
1640	VDI3492	2000	0	C
1646	ISO14966:2019	750	16.58	A
1649	Other	2000	11.4	A
1708	ISO14966:2019	2000	12.99	A
1708	ISO14966:2019	2000	14.85	A
1715	ISO14966:2019	2000	13.86	A
1717	ISO14966:2019	2325	7.88	A
1717	ISO14966:2019	2325	7.38	A
1717	ISO14966:2019	2325	18.7	A
1734	VDI3492	2096	7.6	A
1734	VDI3492	2096	8.6	A
1738	VDI3492	2429	8.1	A
1745	ISO14966:2019	2000	16	A
1768	ISO14966:2002	2100	17.98	A
1768	ISO14966:2002	2100	14.04	A
1768	ISO14966:2002	2050	14.04	A

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LAB NUMBER	METHOD	MAGNIFICATION	TOTAL ASBESTOS (fibres/mm ²)	BAND (RICE)
1774	Other	2000	17.5	A
1776	VDI3492	2000	18	A
1784	Other	2000	14	A
1812	VDI3492	2000	8	A
1812	VDI3492	2000	10	A
1812	VDI3492	2000	9	A
1813	Other	2000	16.2	A
1813	Other	2000	13.4	A
1813	Other	2000	12.9	A
1814	Other	4000	16	A
1826	ISO14966:2002	2000	13.47	A
1832	VDI3492	2100	15	A
1832	VDI3492	2100	12	A
1832	VDI3492	2100	11	A
1836	VDI3492	2500	18.94	A
1860	Other	2000	7.55	A
1885	VDI3492	2500	9	A
1885	VDI3492	2500	11	A
1885	VDI3492	2500	11	A
1889	ISO14966:2019	2000	11.44	A
1889	ISO14966:2019	2000	14.43	A
1910	VDI3492	2000	13	A
1922	ISO14966:2019	1500	7.3	A
1922	ISO14966:2019	1500	14.6	A
1923	Other	2000	20	A
1928	Other	2000	10.1	A
1928	Other	2000	13.4	A
1928	Other	2000	12.1	A
1937	Other	2000	14.8	A
1937	Other	2000	22	A
1937	Other	2000	12.1	A
1938	VDI3492	2000	8	A
1958	VDI3492	2000	12.8	A
1976	ISO14966:2019	1000	30	A
1976	ISO14966:2019	1000	24	A
1976	ISO14966:2019	1000	25	A
1984	Other	4500	24.95	A
1984	Other	4500	17.61	A
1984	Other	4500	18.34	A
1989	ISO14966:2019	2200	25.72	A
1989	ISO14966:2019	2200	24.24	A
1989	ISO14966:2019	2200	22.75	A
2032	ISO14966:2019	1100	13	A

APPENDIX 1

LAB NUMBER	METHOD	MAGNIFICATION	TOTAL ASBESTOS (fibres/mm ²)	BAND (RICE)
2045	VDI3492	2000	11	A
2045	VDI3492	2000	10	A
2069	VDI3492	2500	20	A
2107	ISO14966:2019	2222	14	A
2107	ISO14966:2019	2222	10	A
2150	ISO14966:2019	2000	12	A
2167	Other	2000	8.5	A
2168	ISO14966:2019	2000	7.4	A
2168	ISO14966:2019	2000	13	A
2168	ISO14966:2019	2000	12.5	A
2174	VDI3492	2000	10.92	A
2202	VDI3492	2095	17.6	A
2202	VDI3492	2095	15.7	A
2202	VDI3492	2095	9.5	A
2203	VDI3492	2000	13.28	A
2215	ISO14966:2019	2025	65.94	C
2215	ISO14966:2019	2025	89.32	C
2229	Other	2000	5.26	A
2251	ISO14966:2019	2000	12.6	A
2317	ISO14966:2019	2419	24.60169	A
2329	VDI3492	2139	18	A
2329	VDI3492	2139	11.36	A
2329	VDI3492	2065	17.8	A
2360	ISO14966:2019	2277	12.77	A

Mean 16.4
 Median (Ref) 13.9
 STDev 10.9
 Min 0.0
 Max 89.3

RICE A (Lower)	RICE A (Upper)	RICE B (Lower)	RICE B (Upper)	RICE C (Lower)	RICE C (Upper)
4.7	32.4	1.9	49.4	<1.9	>49.4

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.mm⁻² 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.

