Zusammenfassung der Ergebnisse SEMS 8

Scanning Electron Microscopy Scheme - Round 8

Ergebnisse CRB	Ergebnisse Ringversuch

Sample 1 - 8SEM1 [fibres mm^{-2}]	Amphibole	Chrysotile	Other inorg. fibres	Total fibres	**Total Asbestos**
CRB, Lab 1640	**0,0**	**0,0**	**56,5**	**56,5**	**0,0**
Mean					0,0
Median					**0,0**
Min					0,0
Max					1,6
STDev					**0,2**
RICE A, lower / upper limit					**0 - 3,8**

Sample 2 - 8SEM2 [fibres mm^{-2}]	Amphibole	Chrysotile	Other Inorg. Fibres	Total Fibres	**Total Asbestos**
CRB, Lab 1640	**19,8**	**0,0**	**0**	**19,8**	**19,8**
Mean					15,8
Median					**15,0**
Min					5,2
Max					48,0
STDev					**7,0**
RICE A, lower / upper limit					**5,0 - 34,0**

Sample 3 - 8SEM3 [fibres mm^{-2}]	Amphibole	Chrysotile	Other Inorg. Fibres	Total Fibres	**Total Asbestos**
CRB, Lab 1640	**20,0**	**0,0**	**0,0**	**20,0**	**20,0**
Mean					22,6
Median					**20,6**
Min					7,3
Max					71,0
STDev					**11,1**
RICE A, lower / upper limit					**8,8 - 42,2**

Sample 4 - 8SEM4 [fibres mm^{-2}]	Amphibole	Chrysotile	Other Inorg. Fibres	Total Fibres	**Total Asbestos**
CRB, Lab 1640	**0**	**13,4**	**0,0**	**13,4**	**13,4**
Mean					14,2
Median					**11,5**
Min					0,0
Max					93,0
STDev					**11,7**
RICE A, lower / upper limit					**3,3 - 28,6**

SEMS

Group Report
Round 8

HEALTH & SAFETY LABORATORY

November 2018

Scanning Electron Microscopy Scheme

BACKGROUND

This report covers Round 8 of the SEMS asbestos fibre counting PT scheme. The scheme is operated by HSL, 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 HSL using the modified sputnik multi-port sampling instrument.

INTRODUCTION

A total of 51 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 339 results submitted.

The samples were as follows:

8SEM1 - Low density (0 fibres/mm^2) - no asbestos fibres

8SEM2 - Medium density (15.0 fibres/mm^2) - amosite fibres

8SEM3 - Medium density (20.6 fibres/mm^2) - amosite & crocidolite fibres

8SEM4 - Medium density (11.5 fibres/mm^2) - chrysotile fibres

INFORMATION SUBMITTED BY LABORATORIES

Laboratories were asked to supply the following information:

- Number of fibres >5µm in length counted (amphibole, chrysotile & other inorganic)
- Number of fields of view searched
- Area of the field of view
- Magnification used
- Method used

Laboratories were asked to calculate the fibre density (in fibres/mm^2) 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 of 4000x, 3000x, 2000x and 1000x 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 8 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 8.

	Sample 1	Sample 2	Sample 3	Sample 4
Number of results	84	85	85	85
Median (fibres/mm^2)	0.0	15.0	20.6	11.5
25th percentile (fibres/mm^2)	0.0	11.0	14.3	7.2
75th percentile (fibres/mm^2)	0.0	18.5	27.8	17.8
Interquartile range (fibres/mm^2)	0.0	7.5	13.5	10.6
Mean (fibres/mm^2)	0.0	15.8	22.6	14.2
Standard deviation (fibres/mm^2)	0.2	7.0	11.1	11.7
Relative standard deviation (%)	474.1	44.2	49.0	82.0

*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.*

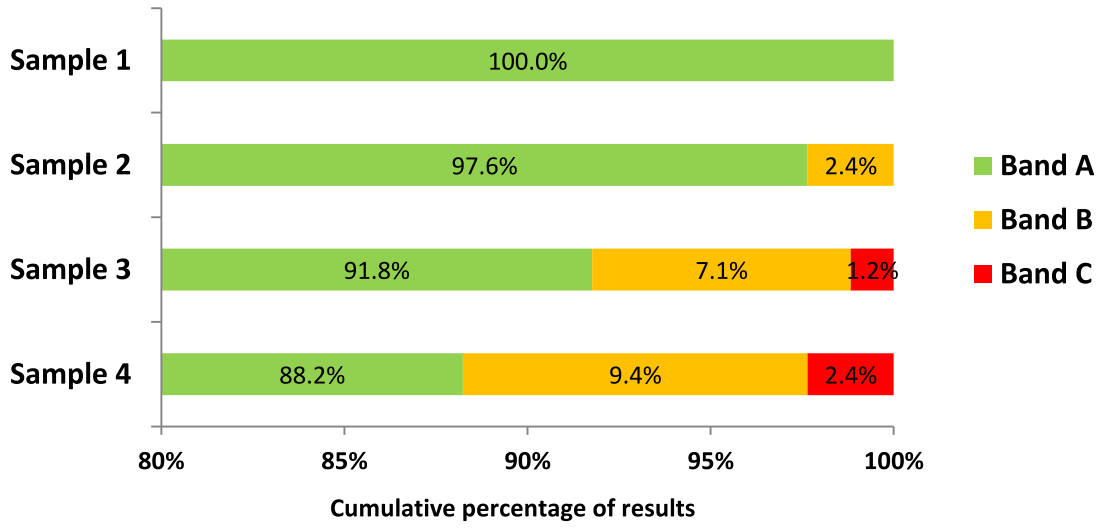

Figure 1: Banded scores for participants in SEMS Round 8 (categorised as per RICE scoring system - see Appendix 2)

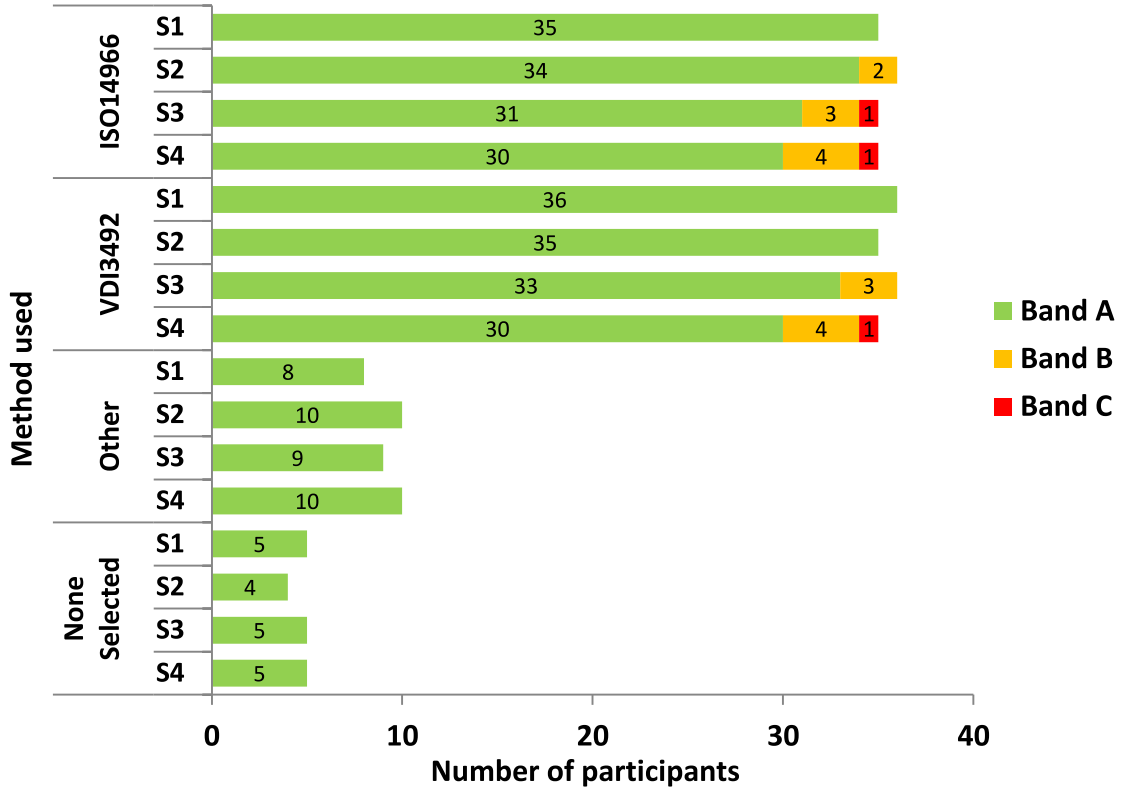

Figure 2: Banded scores for participants in SEMS Round 8 divided according to method used

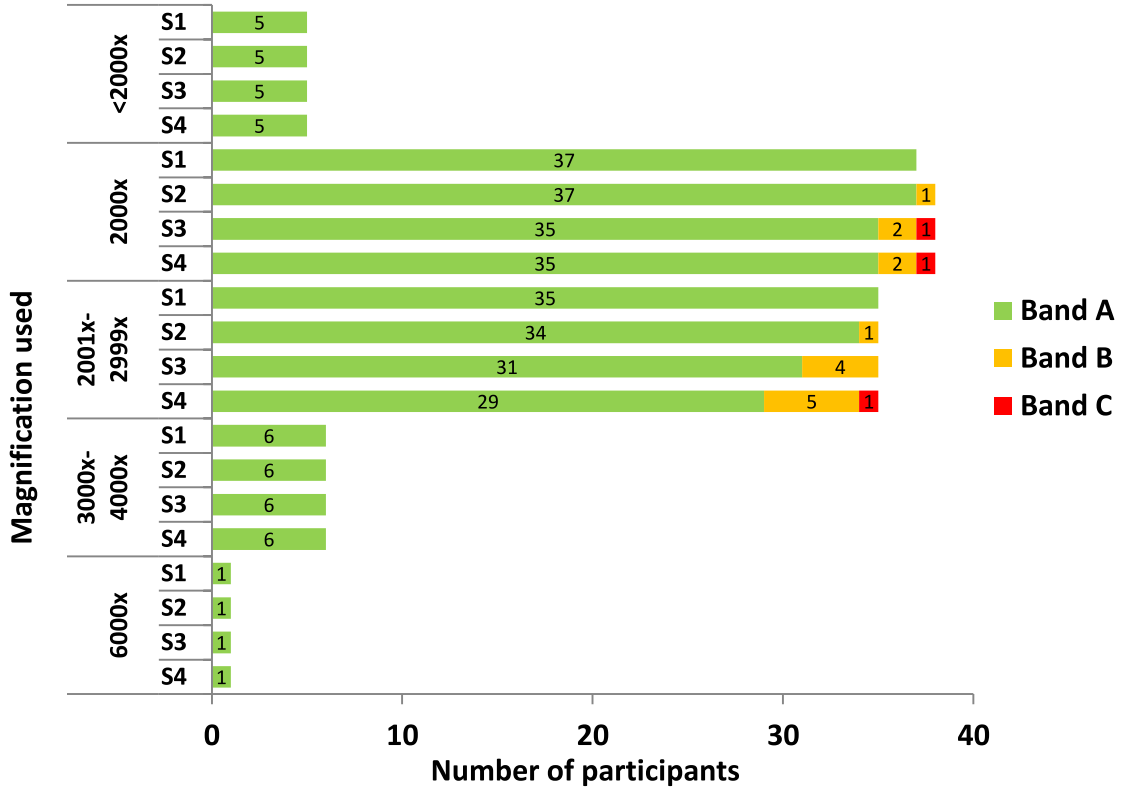

Figure 3: Banded scores for participants in SEMS Round 8 divided according to magnification used

APPENDIX 1

Sample 1 (8SEM1) - Low density (0 fibres mm^{-2}) - no asbestos fibres

LAB NUMBER	TOTAL ASBESTOS	BAND (RICE)
7	0.0	A
7	0.0	A
139	0.0	A
139	0.0	A
300	0.0	A
709	0.0	A
807	0.0	A
807	0.9	A
818	0.0	A
1181	0.0	A
1187	0.0	A
1267	0.0	A
1267	1.6	A
1445	0.0	A
1456	0.0	A
1458	0.0	A
1458	0.0	A
1477	0.0	A
1477	0.0	A
1477	0.7	A
1507	0.0	A
1558	0.0	A
1562	0.0	A
1569	0.0	A
1575	0.0	A
1575	0.0	A
1576	0.0	A
1576	0.0	A
1579	0.0	A
1579	0.0	A
1579	0.0	A

1582	0.0	A
1592	0.0	A
1628	0.0	A
1628	0.0	A
1628	0.0	A
1638	0.0	A
1639	0.0	A
1640	0.0	A
1649	0.0	A
1658	0.0	A
1658	0.0	A
1680	0.0	A
1680	0.0	A
1680	0.0	A
1687	0.0	A
1715	0.0	A
1717	0.0	A
1717	0.0	A
1717	0.0	A
1720	0.0	A
1722	0.0	A
1722	0.0	A
1722	0.0	A
1727	0.0	A
1727	0.0	A
1734	0.0	A
1734	0.0	A
1734	0.0	A
1737	0.0	A
1738	0.0	A
1738	0.0	A
1738	0.0	A
1745	1.0	A
1759	0.0	A

APPENDIX 1

1761	0.0	A
1764	0.0	A
1767	0.0	A
1767	0.0	A
1767	0.0	A
1768	0.0	A
1768	0.0	A
1768	0.0	A
1774	0.0	A
1812	0.0	A
1812	0.0	A
1814	0.0	A
1817	0.0	A
1826	0.0	A
1828	0.0	A
1828	0.0	A
1828	0.0	A
2156	0.0	A
2156	0.0	A

Mean	0.0
Median (Ref)	**0.0**
STDev	0.2
Min	0.0
Max	1.6

RICE A (Lower)	RICE A (Upper)	RICE B (Lower)	RICE B (Upper)	RICE C (Lower)	RICE C (Upper)
-	3.8	-	10.9	-	>10.9

APPENDIX 1

Sample 2 (8SEM2) - Medium density (15.0 fibres mm^{-2}) - amosite fibres

LAB NUMBER	TOTAL ASBESTOS	BAND (RICE)
7	14.7	A
7	17.2	A
139	19.0	A
139	21.0	A
300	8.0	A
709	15.5	A
807	10.5	A
807	10.5	A
818	17.0	A
1181	27.3	A
1187	11.8	A
1267	15.0	A
1267	17.0	A
1445	34.0	A
1456	11.8	A
1458	9.6	A
1458	13.9	A
1477	16.0	A
1477	24.3	A
1477	29.8	A
1507	24.8	A
1558	18.0	A
1562	11.7	A
1569	22.5	A
1575	11.9	A
1575	11.9	A
1576	15.2	A
1576	17.1	A
1579	17.0	A
1579	17.5	A
1579	18.5	A

1582	20.0	A
1592	15.0	A
1628	6.6	A
1628	10.3	A
1628	11.3	A
1638	18.0	A
1639	12.0	A
1640	19.8	A
1649	7.0	A
1658	12.0	A
1658	16.0	A
1680	16.0	A
1680	16.8	A
1680	20.1	A
1687	33.0	A
1715	48.0	B
1717	9.9	A
1717	10.8	A
1717	13.8	A
1720	25.0	A
1722	11.0	A
1722	11.0	A
1722	12.8	A
1727	15.3	A
1727	23.0	A
1734	8.0	A
1734	12.0	A
1734	13.0	A
1737	18.0	A
1738	7.9	A
1738	12.4	A
1738	20.4	A
1745	15.2	A
1759	10.0	A

APPENDIX 1

1759	12.6	A
1761	20.0	A
1764	8.5	A
1767	5.2	B
1767	10.6	A
1767	16.7	A
1768	7.5	A
1768	7.9	A
1768	10.1	A
1774	15.0	A
1812	10.0	A
1812	10.5	A
1814	16.5	A
1817	21.0	A
1826	9.0	A
1828	11.0	A
1828	14.0	A
1828	26.0	A
2156	23.9	A
2156	26.9	A

Mean	15.8
Median	15.0
STDev	7.0
Min	5.2
Max	48.0

RICE A	RICE A	RICE B	RICE B	RICE C	RICE C
(Lower)	(Upper)	(Lower)	(Upper)	(Lower)	(Upper)
5.3	34.0	2.4	51.5	<5.3	>34.0

APPENDIX 1

Sample 3 (8SEM3) - Medium density (20.6 fibres mm^{-2}) - amosite & crocidolite fibres

LAB NUMBER	TOTAL ASBESTOS	BAND (RICE)
7	21.1	A
7	22.1	A
139	25.0	A
139	32.5	A
300	20.0	A
709	8.0	B
807	16.3	A
807	21.6	A
818	37.0	A
1181	33.8	A
1187	13.6	A
1267	18.0	A
1267	23.0	A
1445	40.0	A
1456	14.7	A
1458	13.9	A
1458	16.3	A
1477	31.6	A
1477	41.4	A
1477	58.1	B
1507	41.3	A
1558	25.0	A
1562	23.5	A
1569	24.5	A
1575	7.3	B
1575	12.8	A
1576	21.0	A
1576	22.4	A
1579	20.0	A
1579	21.0	A
1579	22.0	A

1582	28.0	A
1592	11.0	A
1628	13.7	A
1628	13.9	A
1628	19.2	A
1638	34.5	A
1639	15.0	A
1640	20.1	A
1649	12.4	A
1658	18.5	A
1658	19.5	A
1680	21.5	A
1680	31.0	A
1680	31.2	A
1687	29.5	A
1715	71.0	C
1717	10.8	A
1717	13.8	A
1717	14.8	A
1720	28.0	A
1722	21.0	A
1722	22.1	A
1722	25.9	A
1727	7.7	B
1727	13.2	A
1734	12.0	A
1734	13.5	A
1734	32.0	A
1737	25.5	A
1738	10.9	A
1738	16.4	A
1738	27.8	A
1745	14.2	A
1759	14.3	A

1759	16.5	A
1761	31.4	A
1764	19.0	A
1767	12.1	A
1767	23.2	A
1767	46.9	B
1768	11.0	A
1768	18.9	A
1768	18.9	A
1774	24.0	A
1812	14.5	A
1812	25.0	A
1814	20.6	A
1817	34.5	A
1826	13.0	A
1828	14.0	A
1828	15.0	A
1828	20.0	A
2156	39.8	A
2156	43.8	B

Mean	22.6
Median (Ref)	20.6
STDev	11.1
Min	7.3
Max	71.0

RICE A (Lower)	RICE A (Upper)	RICE B (Lower)	RICE B (Upper)	RICE C (Lower)	RICE C (Upper)
8.8	42.2	4.8	61.4	<4.8	>61.4

APPENDIX 1

Sample 4 (8SEM4) - Medium density (11.5 fibres mm^{-2}) - chrysotile fibres

LAB NUMBER	TOTAL ASBESTOS	BAND (RICE)
7	14.7	A
7	15.2	A
139	5.0	A
139	6.0	A
300	18.0	A
709	7.5	A
807	18.7	A
807	22.2	A
818	25.0	A
1181	10.9	A
1187	10.1	A
1267	7.7	A
1267	15.0	A
1445	10.0	A
1456	35.3	B
1458	5.8	A
1458	6.7	A
1477	13.5	A
1477	17.4	A
1477	28.3	A
1507	23.8	A
1558	17.0	A
1562	31.4	B
1569	5.5	A
1575	3.7	A
1575	4.6	A
1576	17.6	A
1576	17.6	A
1579	13.5	A
1579	13.5	A
1579	14.0	A

1582	9.0	A
1592	23.0	A
1628	9.7	A
1628	10.0	A
1628	10.5	A
1638	15.0	A
1639	11.0	A
1640	13.4	A
1649	5.7	A
1658	7.5	A
1658	8.0	A
1680	15.4	A
1680	17.1	A
1680	21.9	A
1687	24.6	A
1715	28.0	A
1717	6.9	A
1717	8.9	A
1717	9.9	A
1720	11.0	A
1722	7.2	A
1722	7.2	A
1722	11.0	A
1727	23.7	A
1727	23.7	A
1734	22.0	A
1734	32.0	B
1734	93.0	C
1737	6.3	A
1738	3.0	B
1738	3.5	A
1738	6.5	A
1745	0.0	C
1759	17.8	A

APPENDIX 1

1759	18.7	A
1761	12.4	A
1764	13.5	A
1767	5.6	A
1767	7.6	A
1767	11.9	A
1768	1.3	B
1768	2.2	B
1768	3.1	B
1774	11.5	A
1812	6.0	A
1812	9.0	A
1814	11.5	A
1817	12.5	A
1826	7.0	A
1828	10.0	A
1828	10.0	A
1828	24.0	A
2156	26.0	A
2156	27.9	A

Mean	14.2
Median (Ref)	11.5
STDev	11.7
Min	0.0
Max	93.0

RICE A (Lower)	RICE A (Upper)	RICE B (Lower)	RICE B (Upper)	RICE C (Lower)	RICE C (Upper)
3.3	28.6	1.1	44.8	<1.1	>44.8

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. mm^{-2})

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. mm^{-2})*

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 per mm^2.