Zusammenfassung der Ergebnisse SEMS 7
Scanning Electron Microscopy Scheme - Round 7

| Ergebnisse CRB | | Ergebnisse Ringversuch | | | |

Sample 1 - 7SEM1 [fibres mm^{-2}]	Amphibole	Chrysotile	Other inorg. fibres	Total fibres	Total Asbestos
CRB, Lab 1640	36,8	0,0	1,4	38,2	36,8
Mean					40,0
Median					38,5
Min					18,0
Max					78,3
STDev					13,2
RICE A, lower / upper limit					21,5 - 66,7

Sample 2 - 7SEM2 [fibres mm^{-2}]	Amphibole	Chrysotile	Other Inorg. Fibres	Total Fibres	Total Asbestos
CRB, Lab 1640	0,0	19,1	0,7	19,8	19,1
Mean					19,1
Median					17,3
Min					0,0
Max					55,6
STDev					11,7
RICE A, lower / upper limit					6,7 - 37,4

Sample 3 - 7SEM3 [fibres mm^{-2}]	Amphibole	Chrysotile	Other Inorg. Fibres	Total Fibres	Total Asbestos
CRB, Lab 1640	0,0	0,0	45,8	45,8	0,0
Mean					0,0
Median					0,0
Min					0,0
Max					3,0
STDev					0,4
RICE A, lower / upper limit					0,0 - 3,8

Sample 4 - 7SEM4 [fibres mm^{-2}]	Amphibole	Chrysotile	Other Inorg. Fibres	Total Fibres	Total Asbestos
CRB, Lab 1640	5,3	0,4	1,0	6,7	5,7
Mean					5,6
Median					5,0
Min					0,0
Max					19,9
STDev					3,7
RICE A, lower / upper limit					0,4 - 17,6

Scanning Electron Microscopy Scheme

BACKGROUND

This report covers Round 7 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 52 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 350 results submitted.

The samples were as follows:

7SEM1 - Medium density (38.5 fibres mm^{-2}) - amosite fibres

7SEM2 - Medium density (17.3 fibres mm^{-2}) - chrysotile fibres

7SEM3 - Low density (0 fibres mm^{-2}) - no asbestos fibres

7SEM4 - Low density (5.0 fibres mm^{-2}) - amosite & crocidolite fibres

INFORMATION SUBMITTED BY LABORATORIES

Laboratories were asked to supply the following information:

- The number of fibres >5µm long, counted (amphibole, chrysotile and 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 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.

APPENDIX 1

Sample 1 (7SEM1) - Total asbestos fibre density (38.5fmm^{-2})

Lab Number	Total Asbestos	RICE
7	27.50	A
7	28.50	A
139	38.50	A
139	42.50	A
300	45.00	A
709	43.50	A
807	29.17	A
807	36.76	A
1181	51.14	A
1187	31.98	A
1267	39.00	A
1267	46.00	A
1277	49.50	A
1277	55.40	A
1282	77.77	B
1477	37.40	A
1477	47.93	A
1477	62.45	A
1569	55.50	A
1575	28.34	A
1575	31.99	A
1575	35.65	A
1576	59.05	A
1576	62.86	A
1582	46.50	A
1592	57.00	A
1638	52.00	A
1640	36.80	A
1649	34.10	A
1658	38.50	A
1658	39.00	A
1658	39.50	A
1666	31.00	A

APPENDIX 1

1675	41.50	A
1680	27.80	A
1680	32.00	A
1680	43.20	A
1715	69.00	B
1717	27.57	A
1720	43.00	A
1745	45.50	A
1759	18.70	B
1759	19.10	B
1759	28.70	A
1761	26.67	A
1764	39.50	A
1774	41.00	A
1813	49.60	A
1813	54.50	A
1813	59.50	A
1814	19.30	B
1829	27.00	A
1829	33.00	A
1831	26.20	A
1831	45.50	A
1836	30.18	A
1852	21.43	B
1852	37.90	A
1852	46.15	A
1860	23.30	A
1875	32.77	A
1877	38.00	A
1879	18.00	B
1879	21.00	B
1879	31.00	A
1889	37.20	A
1889	39.20	A
1903	55.80	A

APPENDIX 1

1903	61.80	A
1922	32.40	A
1922	42.10	A
1922	45.70	A
1923	37.80	A
1923	42.60	A
1938	60.00	A
1966	25.70	A
1966	30.70	A
1992	40.70	A
1992	78.30	B
2020	27.69	A
2020	28.33	A
2020	37.23	A
2023	20.90	B
2023	22.27	A
2046	53.71	A
2051	37.50	A
2051	50.00	A
2051	56.25	A

Mean	40.0
Median	**38.5**
STDev	13.2
Min	18.0
Max	78.3

RICE A (Lower)	RICE A (Upper)	RICE B (Lower)	RICE B (Upper)	RICE C (Lower)	RICE C (Upper)
21.5	66.7	14.9	90.3	<14.9	>90.3

APPENDIX 1

Sample 2 (7SEM2) - Total asbestos fibre density (17.3fmm^{-2})

Lab Number	Total Asbestos	RICE
7	3.90	B
7	5.90	B
139	17.00	A
139	19.50	A
300	23.00	A
709	32.00	A
807	21.00	A
807	22.17	A
1181	27.31	A
1187	12.44	A
1267	18.00	A
1267	25.00	A
1277	11.70	A
1277	12.50	A
1282	55.55	B
1477	13.44	A
1477	13.44	A
1477	20.33	A
1569	11.00	A
1575	10.05	A
1575	11.88	A
1575	14.62	A
1576	42.86	B
1576	54.28	B
1582	19.50	A
1592	13.00	A
1638	21.00	A
1640	19.10	A
1649	10.80	A
1658	18.00	A
1658	22.00	A
1658	26.50	A

APPENDIX 1

1666	2.00	C
1675	10.30	A
1680	18.60	A
1680	22.10	A
1680	30.20	A
1715	32.00	A
1717	31.51	A
1720	19.00	A
1745	16.10	A
1759	7.80	A
1759	9.60	A
1759	18.30	A
1761	16.19	A
1764	20.00	A
1774	13.00	A
1813	10.40	A
1813	12.90	A
1813	15.40	A
1814	6.70	A
1829	17.40	A
1829	20.00	A
1831	15.40	A
1831	24.50	A
1836	24.10	A
1852	0.00	C
1852	9.9	A
1852	12.36	A
1860	20.77	A
1875	28.57	A
1877	15.30	A
1879	7.00	A
1879	8.00	A
1879	13.00	A
1889	36.20	A
1889	37.20	A

APPENDIX 1

1903	35.90	A
1903	49.80	B
1922	11.30	A
1922	21.60	A
1922	22.10	A
1923	19.70	A
1923	21.30	A
1938	6.00	B
1938	9.00	A
1966	6.90	A
1966	11.40	A
1992	2.00	C
1992	5.00	B
2020	5.38	B
2020	10.26	A
2020	17.34	A
2023	31.35	A
2023	51.3	B
2046	15.92	A
2051	12.50	A
2051	39.58	B
2051	39.58	B

Mean	19.1
Median	**17.3**
STDev	11.7
Min	0.0
Max	55.6

RICE A (Lower)	RICE A (Upper)	RICE B (Lower)	RICE B (Upper)	RICE C (Lower)	RICE C (Upper)
6.7	37.4	3.3	55.6	<3.3	>55.6

APPENDIX 1

Sample 3 (7SEM3) - Total asbestos fibre density (0 fmm^{-2})

Lab Number	Total Asbestos	RICE
7	0.00	A
7	0.00	A
139	0.00	A
139	0.00	A
300	0.00	A
709	0.00	A
807	0.00	A
807	0.00	A
1181	0.00	A
1187	0.00	A
1267	0.00	A
1267	0.00	A
1277	0.00	A
1277	0.00	A
1282	0.00	A
1477	0.00	A
1477	0.00	A
1477	0.00	A
1569	0.00	A
1575	0.00	A
1575	0.00	A
1575	0.00	A
1576	0.00	A
1576	0.00	A
1582	0.00	A
1592	0.00	A
1638	0.00	A
1640	0.00	A
1658	0.00	A
1658	0.00	A
1666	0.00	A
1675	0.00	A
1680	0.00	A

APPENDIX 1

1680	0.00	A
1680	0.00	A
1715	0.00	A
1717	0.00	A
1720	0.00	A
1745	0.00	A
1759	0.00	A
1759	0.00	A
1759	0.90	A
1761	0.00	A
1764	3.00	A
1774	0.00	A
1813	0.00	A
1813	0.00	A
1813	0.00	A
1814	0.00	A
1829	1.00	A
1831	0.00	A
1831	0.80	A
1836	0.00	A
1852	0.00	A
1852	0.00	A
1852	0.00	A
1875	0.00	A
1877	0.00	A
1879	0.00	A
1879	0.00	A
1879	0.00	A
1889	0.00	A
1889	0.00	A
1903	0.00	A
1922	0.00	A
1922	0.00	A
1922	0.00	A
1923	0.00	A

APPENDIX 1

1923	0.00	**A**
1938	1.00	**A**
1966	0.00	**A**
1966	0.00	**A**
1992	0.00	**A**
1992	0.00	**A**
2020	0.00	**A**
2020	0.00	**A**
2020	0.00	**A**
2023	0.00	**A**
2023	0.95	**A**
2046	0.00	**A**
2051	0.00	**A**
2051	0.00	**A**

Mean	0.1
Median (Ref)	**0.0**
STDev	0.4
Min	0.0
Max	3.0

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 4 (7SEM4) - Total asbestos fibre density (5.0 fmm^{-2})

Lab Number	Total Asbestos	RICE
7	1.00	A
7	1.50	A
139	4.50	A
139	5.00	A
300	4.00	A
709	10.50	A
807	7.58	A
807	8.75	A
1181	9.93	A
1187	5.92	A
1267	8.90	A
1267	9.30	A
1277	4.20	A
1277	5.00	A
1282	16.66	A
1477	1.45	A
1477	1.82	A
1477	5.08	A
1569	8.50	A
1575	3.66	A
1575	3.66	A
1575	3.66	A
1576	3.33	A
1576	4.76	A
1582	5.00	A
1592	6.00	A
1592	9.00	A
1638	5.00	A
1640	5.80	A
1649	1.91	A
1658	1.00	A
1658	1.00	A
1658	4.00	A

1666	0.00	B
1675	3.30	A
1680	3.70	A
1680	5.00	A
1680	5.90	A
1715	12.00	A
1717	6.89	A
1720	5.00	A
1745	3.80	A
1759	2.60	A
1759	10.40	A
1759	10.40	A
1761	5.71	A
1764	4.00	A
1774	1.00	A
1813	3.50	A
1813	4.50	A
1813	5.00	A
1814	2.20	A
1829	4.13	A
1831	4.00	A
1831	5.40	A
1836	10.63	A
1852	0.00	B
1852	1.65	A
1852	1.65	A
1860	6.61	A
1875	3.36	A
1877	3.90	A
1879	2.00	A
1879	3.00	A
1879	4.00	A
1889	6.00	A
1889	7.00	A
1903	15.90	A

APPENDIX 1

1922	2.50	A
1922	11.10	A
1922	11.80	A
1923	4.30	A
1923	4.80	A
1938	8.00	A
1938	10.00	A
1966	2.20	A
1966	5.40	A
1992	3.00	A
1992	7.00	A
2020	5.46	A
2020	5.96	A
2020	9.17	A
2023	6.6	A
2023	12.1	A
2046	19.90	B
2051	1.52	A
2051	3.23	A

Mean	5.6
Median (Ref)	**5.0**
STDev	3.7
Min	0.0
Max	19.9

RICE A (Lower)	RICE A (Upper)	RICE B (Lower)	RICE B (Upper)	RICE C (Lower)	RICE C (Upper)
0.4	17.6	0	30.6	0	>30.6

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. 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 ($R \le 63.7$ 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.