Zusammenfassung der Ergebnisse SEMS 6
Scanning Electron Microscopy Scheme - Round 6

Ergebnisse CRB	Ergebnisse Ringversuch

Sample 1 - 6SEM1 [fibres mm^{-2}]	Amphibole	Chrysotile	Other inorg. fibres	Total fibres	Total Asbestos
CRB, Lab 1640	**0,0**	**49,2**	**0,5**	**49,7**	**49,2**
Mean					32,7
Median					**32,0**
Min					0,0
Max					120,5
STDev					**20,6**
RICE A, lower / upper limit					**16,7 - 58,0**

Sample 2 - 6,SEM2 [fibres mm^{-2}]	Amphibole	Chrysotile	Other Inorg. Fibres	Total Fibres	Total Asbestos
CRB, Lab 1640	**41,0**	**0,0**	**0,7**	**41,7**	**41,0**
Mean					26,1
Median					**26,9**
Min					13,1
Max					52,6
STDev					**9,3**
RICE A, lower / upper limit					**13,1 - 51,1**

Sample 3 - SEM3 [fibres mm^{-2}]	Amphibole	Chrysotile	Other Inorg. Fibres	Total Fibres	Total Asbestos
CRB, Lab 1640	**76,2**	**0,0**	**8,8**	**85,0**	**76,2**
Mean					71,1
Median					**66,0**
Min					22,8
Max					164,1
STDev					**26,4**
RICE A, lower / upper limit					**42,9 - 102,3**

Sample 4 - 6SEM4 [fibres mm^{-2}]	Amphibole	Chrysotile	Other Inorg. Fibres	Total Fibres	Total Asbestos
CRB, Lab 1640	**0**	**0,0**	**25,2**	**25,2**	**0,0**
Mean					2,0
Median					**0,0**
Min					0,0
Max					118,0
STDev					**14,2**
RICE A, lower / upper limit					**0,0 - 3,8**

Scanning Electron Microscopy Scheme

BACKGROUND

This Interim Report covers the sixth round of the SEMS asbestos fibre counting PT scheme. The scheme is operated by HSL, in collaboration with APC, Germany and TNO, Netherlands.

Version 2 of the report has been issued as results for some laboratories have been amended.

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 44 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 285 results submitted.

The samples were as follows:

6SEM1 – Medium – high density (<50 fibres mm^{-2}) - chrysotile asbestos fibres

6SEM2 – Medium (<30 fibres mm^{-2}) - amosite asbestos fibres

6SEM3 – High density (<70 fibres mm^{-2}) – crocidolite asbestos fibres

6SEM4 – Very low density (<10 fibres mm^{-2}) – no asbestos fibres

INFORMATION SUBMITTED BY LABORATORIES

Laboratories were asked to supply:
- 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, 1000x and 15x 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 Interim 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 (6 SEM 1) - Total asbestos fibre density (fmm^{-2})

Lab Number	Total Asbestos	RICE
139	32.50	A
139	41.50	A
260	32.76	A
260	120.53	C
709	40.50	A
818	43.96	A
1187	24.52	A
1267	42.00	A
1267	64.00	B
1592	65.00	B
1628	21.14	A
1628	25.84	A
1628	30.66	A
1638	34.50	A
1639	38.50	A
1640	49.20	A
1658	23.00	A
1658	23.50	A
1680	23.80	A
1680	29.70	A
1680	35.80	A
1684	41.00	A
1687	54.60	A
1715	21.78	A
1717	26.49	A
1719	4.00	C
1720	32.00	A
1722	35.60	A
1722	36.80	A
1722	38.80	A
1745	15.20	B
1759	31.30	A
1759	34.40	A
1759	37.50	A
1761	0.00	C
1764	34.00	A
1768	18.42	A
1776	35.00	A
1812	11.00	B
1812	12.50	B
1812	13.50	B
1817	65.00	B
1826	24.46	A
1827	36.50	A

1827	37.00	A
1829	37.00	A
1831	23.00	A
1831	28.60	A
1831	29.40	A
1836	0.69	C
1836	4.12	C
1836	4.80	C
1868	13.00	B
1879	32.00	A
1879	33.00	A
1879	52.00	A
1889	12.10	B
1889	25.80	A
1903	7.50	C
1903	14.00	B
1910	12.00	B
1923	22.90	A
1923	39.90	A
1948	36.00	A
1958	27.88	A
1966	51.60	A
1966	81.53	C
1966	90.82	C
1968	34.00	A
1976	30.00	A
1976	42.00	A

Mean	32.7
Median (Ref)	**32.0**
STDev	20.6
Min	0.0
Max	120.5

RICE A (Lower)	RICE A (Upper)	RICE B (Lower)	RICE B (Upper)	RICE C (Lower)	RICE C (Upper)
16.7	58	11	80.2	<11	>80.2

APPENDIX 1

Sample 2 (6 SEM 2) - Total asbestos fibre density (fmm^{-2})

Lab Number	Total Asbestos	RICE
139	26.00	A
139	30.00	A
260	29.23	A
260	33.27	A
709	43.50	A
818	37.97	A
1187	27.19	A
1267	29.00	A
1267	36.00	A
1592	17.00	A
1628	17.23	A
1628	18.27	A
1628	22.45	A
1638	27.00	A
1639	25.50	A
1640	41.00	A
1658	19.50	A
1658	22.50	A
1680	26.90	A
1680	32.00	A
1680	39.10	A
1684	29.00	A
1687	32.20	A
1715	22.77	A
1717	21.58	A
1719	26.00	A
1720	25.00	A
1722	19.00	A
1722	19.30	A
1722	20.50	A
1745	23.80	A
1759	28.60	A
1759	29.90	A
1759	32.60	A
1761	19.16	A
1764	12.00	B
1768	14.91	A
1776	29.00	A
1812	11.00	B
1812	13.00	B
1812	14.00	A
1817	32.00	A
1826	15.64	A
1827	28.00	A
1827	30.00	A

1829	27.00	A
1831	20.60	A
1831	31.00	A
1831	31.80	A
1836	9.60	B
1836	13.70	A
1836	18.52	A
1868	20.00	A
1879	19.00	A
1879	26.00	A
1879	27.00	A
1889	29.90	A
1889	32.20	A
1903	29.40	A
1903	41.80	A
1910	23.00	A
1923	28.20	A
1923	30.30	A
1948	25.00	A
1958	20.11	A
1966	34.06	A
1966	52.63	B
1966	52.63	B
1968	23.00	A
1976	25.00	A
1976	37.00	A

Mean	26.13
Median (Ref)	**26.90**
STDev	9.27
Min	0.00
Max	52.63

RICE A (Lower)	RICE A (Upper)	RICE B (Lower)	RICE B (Upper)	RICE C (Lower)	RICE C (Upper)
13.1	51.10	8.1	72	<8.1	>72

APPENDIX 1

Sample 3 (6 SEM 3) - Total asbestos fibre density (fmm^{-2})

Lab Number	Total Asbestos	RICE
139	70.00	A
139	81.00	A
260	53.90	A
260	103.13	A
709	90.00	A
818	59.95	A
1187	64.10	A
1267	66.00	A
1267	94.00	A
1592	85.00	A
1592	108.00	B
1628	35.72	B
1628	50.27	A
1628	52.71	A
1638	58.00	A
1639	64.50	A
1640	76.20	A
1658	23.50	C
1658	28.00	C
1680	58.50	A
1680	102.00	A
1680	104.00	A
1684	102.00	A
1687	73.60	A
1715	53.47	A
1717	63.77	A
1719	42.50	B
1720	59.00	A
1722	76.10	A
1722	78.50	A
1722	84.80	A
1745	63.80	A
1759	76.80	A
1759	92.40	A
1759	128.60	B
1761	60.83	A
1764	66.00	A
1768	46.05	A
1776	58.00	A
1812	40.00	B
1812	41.00	B
1812	45.00	A
1817	93.00	A
1826	42.90	B
1827	58.50	A

1827	60.00	A
1829	74.00	A
1831	63.50	A
1831	65.10	A
1831	71.50	A
1836	75.45	A
1836	78.20	A
1836	93.96	A
1868	61.00	A
1879	82.00	A
1879	83.00	A
1879	88.00	A
1889	55.70	A
1889	59.30	A
1903	42.80	B
1903	47.80	A
1910	55.00	A
1923	85.60	A
1923	86.70	A
1948	71.50	A
1958	71.31	A
1966	114.55	B
1966	157.89	C
1966	164.09	C
1968	118.00	B
1976	60.00	A
1976	75.00	A

Mean	72.72
Median (Ref)	**68.00**
STDev	26.02
Min	23.50
Max	164.09

RICE A (Lower)	RICE A (Upper)	RICE B (Lower)	RICE B (Upper)	RICE C (Lower)	RICE C (Upper)
44.2	105.4	34	136	<34	>136

APPENDIX 1

Sample 4 (6 SEM 4) - Total asbestos fibre density (fmm^{-2})

Lab Number	Total Asbestos	RICE
139	0	A
139	0	A
260	0	A
260	0	A
709	0	A
818	0	A
1187	0	A
1267	0	A
1267	0	A
1592	0	A
1628	0	A
1628	0	A
1628	0	A
1638	0	A
1639	0	A
1640	0	A
1658	0	A
1658	0	A
1680	0	A
1680	0	A
1680	0	A
1684	0	A
1687	0	A
1715	0	A
1717	0	A
1719	0	A
1720	0	A
1722	0	A
1722	0	A
1722	0	A
1745	0	A
1759	0	A
1759	0	A
1759	0	A
1761	0	A
1764	0	A
1768	0	A
1776	0	A
1812	0	A
1812	0	A
1812	0	A
1817	0	A
1826	0	A
1827	0	A
1827	0	A

1829	0	**A**
1831	0	**A**
1831	0	**A**
1831	0	**A**
1836	0	**A**
1836	0	**A**
1836	0	**A**
1868	0	**A**
1879	1	**A**
1879	1	**A**
1879	2	**A**
1889	0	**A**
1889	0	**A**
1903	0	**A**
1903	0	**A**
1910	0	**A**
1923	0	**A**
1923	0	**A**
1948	0	**A**
1958	0	**A**
1966	0	**A**
1966	0	**A**
1966	0	**A**
1968	0	**A**
1976	0	**A**
1976	0	**A**

Mean	2.0
Median (Ref)	**0.0**
STDev	14.2
Min	0.0
Max	118.0

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 2

DATA ANALYSIS – METHOD 1

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

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

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

RICE performance bands & limits