IOM
Research Avenue North · Riccarton · Edinburgh · EH14 4AP
Scotland · UK

ASBESTOS FIBRE REGULAR INFORMAL COUNTING ARRANGEMENT (A F R I C A)

OPERATIONAL PROCEDURES

INTRODUCTION

"A F R I C A" is an international proficiency testing scheme for laboratories which measure airborne asbestos fibre concentrations using the phase contrast optical microscopy counting method. Its aim is to allow participating laboratories to compare their counting levels with those of other laboratories and with reference counts, in order to assist them in quality control of their counting performances. The scheme began in 1983 and its operational procedures are similar to the UK Regular Interlaboratory Counting Exchanges (RICE). AFRICA is managed by the Institute of Occupational Medicine (IOM). Since 1992, the operation of the scheme has been funded by membership fees from participating laboratories.

OUTLINE OF OPERATION

Reference samples are sent twice a year to each participating laboratory for counting. Laboratory counts are compared with reference counts and each laboratory can assess its performance using for guidance the performance limits specified in the RICE scheme (Appendix 1).

LABORATORIES

Participating laboratories may be located in any part of the world. The laboratories may be run by government bodies, asbestos product manufacturers, private companies which provide hygiene services, or other types of organisation. The scheme usually operates with about 30 members, representing countries in most continents.

SAMPLES AND REFERENCE COUNTS

AFRICA uses membrane filter reference samples, permanently mounted on glass microscope slides. The samples have a fibre density (i.e. the number of fibres per square millimetre on the surface of the filter) of between zero and 700 fibres/mm^2. Most of the samples come from two distinct sources: i) chrysotile samples from the asbestos products industry, and; ii) "clearance" samples from asbestos removal operations. The "clearance" samples typically contain amphibole asbestos fibres in densities of less than 100 fibres/mm^2.

Before a sample is accepted for use in AFRICA, it is screened by an IOM microscopist. It must be of adequate quality in terms of the standard of preparation and the nature of the sample itself. Samples which are judged to have a very uneven distribution of fibres, too many dust particles or other serious faults are excluded.

A ***reference count*** is assigned to each sample. The reference count is normally the *median of at least 15 counts* from various laboratories. At the end of each round, as more counts are received from participating laboratories, the reference count is compared with an average of these counts, to ensure that it is reliable.

BATCHES OF SLIDES AND GROUPS OF LABORATORIES

Several batches, each of eight reference samples of varied types and fibre densities, are formed from the available samples. There is usually a ninth and possibly tenth sample in the batch. The extra samples are "candidate samples", for which counts are being collected to provide reference counts for future use.

The participants are formed into groups, with typically about five laboratories assigned to each group. There must be at least enough batches to provide one batch for each group.

ROUNDS

The scheme is organised in *rounds*. In a given round each group of laboratories receives one batch of samples for evaluation. With each batch are enclosed:

- instructions to the laboratories (see Appendix 2)
- a Circulation Register containing addresses of the laboratories in that group (Appendix 3)
- forms for recording results (Appendix 4)
- return labels
- postcards for informing IOM when a laboratory cannot make its counts.

The batch is sent by post to the first participant, which evaluates the samples, then sends the batch on to the next laboratory, and so on until the final laboratory in the group returns the samples to IOM. Each laboratory is allowed seven working days in which to make all its counts. If, for any reason, a laboratory is not able to count the samples when they first arrive, it must pass them on to the next participant as soon as possible, informing the IOM at the same time. In such cases the batch samples will be offered again to the laboratory after the scheduled circulation has been completed.

Participants use their routine methods for evaluating asbestos fibre concentrations (for example, the WHO all-fibre counting method). Laboratories with 1-4 microscopists are asked to submit at least one count per sample; those with 5-8 microscopists, 2 counts per sample; those with more than 12 microscopists, 3 counts per sample. Counts should be allocated evenly between the available counters. Each microscopist should count at least two samples. Laboratories may submit more than the required number of counts if they wish. An additional fee may be charged when more than three counts per sample are processed.

ANALYSIS OF RESULTS

Results (in the form of fibre densities) are sent directly from the participant to IOM as soon as the counts have been made. These results are processed and a provisional results report (Form *RES1AF(h)* – see Appendix 5) is sent back to the laboratory within a few days. This rapid feedback allows laboratories to take early remedial action is necessary. The procedure followed in analysing results is based on that developed by the RICE scheme.

The reference counts, performance bands, and numbers of evaluations within each of the performance bands are included on the result form *RES1AF(h)*. Participants are thus able to assess their own performances (for guidance, using the RICE system, which is explained in Appendix 1) and take remedial action where required and if they so wish.

At the end of each round the samples are screened again by an IOM microscopist. Counts based on samples which are rejected at this point may also be retrospectively excluded from the analysis. In such cases the *RES1AF(h)* form is updated and sent back to the laboratory.

In practice, the number of samples excluded for this reason is small; and the performance rating is rarely changed as a result of such exclusions.

Further reports, including a summary of counts obtained within each group (Appendix 6) and a general description of results are also prepared at the end of each round. Participants achieving a '1' or '2' rating are also issued with an individual laboratory certificate suitable for display.

Please note: Where slides are screened by an IOM microscopist at the start or end of the round, the WHO all-fibre counting rules are used or referred to. These rules are available from the WHO website and the implementation of these rules in U.K. guidance is described in HSG 248 "Asbestos: the analysts' guide for sampling, analysis and clearance procedures".

MEMBERSHIP APPLICATIONS

Membership of AFRICA is renewed annually, for two rounds at a time. Renewal application forms are dispatched from IOM to all current participants. Prospective members should contact IOM at the address given under "Further Information". Membership fees are payable each year. The current amount is shown on the application forms, and is available on request to IOM.

CONDITIONS OF MEMBERSHIP

Laboratories are accepted as members of the AFRICA scheme on the following conditions:

- that they pay the appropriate membership fees to IOM promptly;
- that they abide by the rules of the scheme (as defined in this document);
- that they do not act unreasonably in any other way which is damaging to the operation or reputation of the scheme.

BENEFITS OF MEMBERSHIP

The membership fee for the AFRICA Scheme provides the participant with:

- Regular, twice-yearly batches of test samples to analyse. These batches include a range of asbestos sample types, including those familiar to participants, but also less familiar types
- A Provisional Results Report comparing the participant's results to reference counts, sent directly to the participant following submission of counts
- Where required, an Updated Results Report following screening of samples at the end of the round
- A Group Summary Report at the end of each round outlining the counts obtained within each group, allowing the participant to compare their results to those of other laboratories in their group
- An End of Round Report that provides a general overview of performance during the round, allowing laboratories to compare their performance to that of participants as a whole
- For laboratories receiving a '1' or '2' rating, an individual Laboratory Certificate at the end of each round, which can be displayed and shown to others (authorities, clients etc.)

- Feedback to comments made by participants on slides in their batch, following screening by an internal microscopist
- The option of additional feedback for participants who receive a '3' rating

No additional fees with be levied for costs associated with the replacement of damaged/broken slides or administrative duties (e.g. modification or cancellation of membership subscriptions, re-prints of results etc.).
Additional benefits of membership include:

- For experienced asbestos laboratories, comparison with similar organisations in other countries
- For less experienced laboratories, performance improvement through comparison with international asbestos fibre counting standards
- A link between proficiency testing schemes in different countries
- Contribution to participants' internal quality assurance programmes
- Opportunities to exchange news, advice and opinions on asbestos monitoring matters

FURTHER INFORMATION

Enquiries about AFRICA should be referred to Emma Carnaghan, AFRICA Scheme Coordinator, Institute of Occupational Medicine, Research Avenue North, Riccarton, Edinburgh, EH14 4AP, UK (telephone +44 (0)131 449 8096, fax +44 (0)131 449 8084, e-mail AFRICA@iom-world.org).

APPENDIX 1. Explanatory note on "RICE" performance assessment

The RICE performance limits are the means by which laboratory counts may be compared with the sample reference counts. Each count is placed in a target band A, B or C, depending on how close it lies to the reference count. If the reference count is denoted by *R*, the following formulae give the performance limits which define the target bands.

(a) High density samples ($R \geq 63.7$ fibres.mm^{-2})

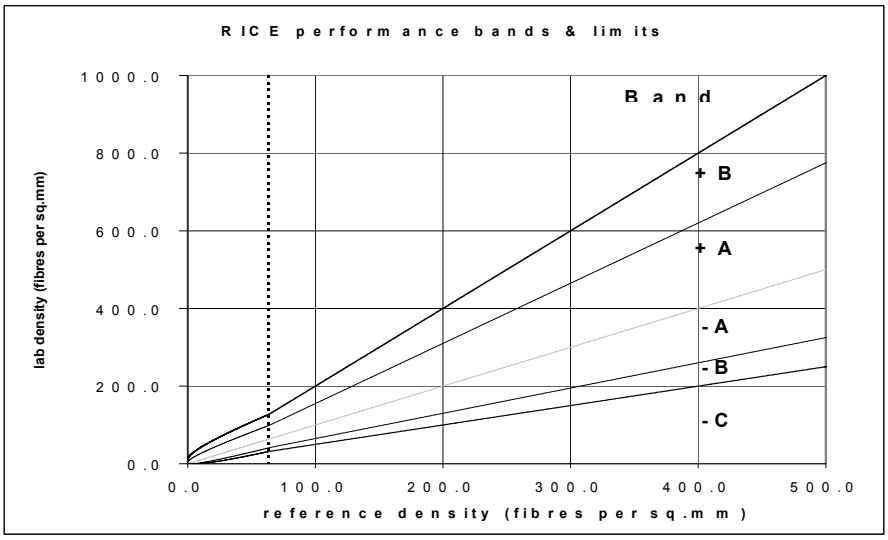
Target band A: **$0.65R$ to $1.55R$**
Target band B: **$0.50R$ to $0.65R$** [band -B] and **$1.55R$ to $2.00R$** [band +B]
Target band C: **less than $0.50R$** [band -C] and **greater than $2.00R$** [band +C]

(b) Low density samples ($R \leq 63.7$ fibres.mm^{-2})*

Target band A: **$(\sqrt{R}-1.57)^2$ to $(\sqrt{R}+1.96)^2$**
Target band B: **$(\sqrt{R}-2.34)^2$ to $(\sqrt{R}-1.57)^2$** [band -B] and **$(\sqrt{R}+1.96)^2$ to $(\sqrt{R}+3.30)^2$** [band +B]
Target band C: **less than $(\sqrt{R}-2.34)^2$** [band -C] and **greater than $(\sqrt{R}+3.30)^2$** [band +C]

The plot shows the positions of the performance limits in relation to the reference counts, up to reference density 500 fibres per mm^2. Most AFRICA reference counts lie within this range.

* For samples < 63.7 fibres.mm^{-2} the lower limit is set to zero if the component within the brackets ($\sqrt{R}$-n) is less than zero.



When the counts on all 8 reference samples in that round have been assigned to target bands, the percentage of counts within each band is calculated:

- **A laboratory achieving ≥ 75% of its results within Band A receives a *rating 1* ("good" performance) for that round.**

- **If the laboratory has < 75% in Band A, but ≥ 75% within Bands A and B combined, it receives a *rating 2* ("acceptable" performance).**

- **If the laboratory has < 75% of its results in Band A or Band B, it receives a *rating 3* ("unsatisfactory" performance).**

APPENDIX 2. Instructions sent with samples during circulation

ROUND No.:	**34**	BATCH No.:	**99**	GROUP No.:	**88**

COUNTING INSTRUCTIONS

Time limit. Please evaluate the enclosed slides and dispatch them to the next laboratory on the list WITHIN SEVEN WORKING DAYS.

Counting method. Please use your routine counting method, for example the European Reference Method.

Distribution of slides for evaluation. Distribute the slides as evenly as possible amongst your available microscopists. If you have 1-4 available microscopists, your laboratory should enter ONE result for each slide on the form (a total of 9 counts). If you have 5-8 microscopists, TWO results should be entered for each slide (a total of 18 counts). If there are 9 or more microscopists, THREE results should be entered for each slide (a total of 27 counts). If possible, each microscopist in your laboratory should make at least two evaluations in the exchange, each evaluation being on a different slide. You may enter more than these recommended numbers of counts; however, an additional fee may be charged if more than three counts per slide are processed.

Completion of results form. Each individual evaluation must be recorded in the electronic Excel worksheet *Form/1/AF* which will be emailed to you from IOM prior to the start of the round. At the top of the form, please enter (i) your laboratory name, (ii) the date or dates the slides were counted, and (iii) the fibre counting rules you use. Enter the date of dispatch of the samples at the bottom of the form. PLEASE NOTE: Electronic recording and submission of results is the preferred method. However, if electronic recording is not possible, results can be recorded on the appropriate paper results form attached. The correct form is identified by the laboratory abbreviation printed at the top, which should match the abbreviation assigned to your laboratory on the circulation register on the following page. There is a space for a representative (*e.g*. Quality Manager) to sign the form if this is your laboratory's normal practice.

Dispatch of samples. Enter the dates of receipt and dispatch and 'counted' in the appropriate columns on the circulation register. Leave the other results forms (and these instructions) with the slides and dispatch the slides either to the next laboratory on the list, or, if yours is the last laboratory, to the Scheme Coordinator, Emma Carnaghan, at the IOM, Research Avenue North, Riccarton, Edinburgh EH14 4AP, UK (phone +44 131 449 8096; fax +44 131 449 8084). Use Air Mail or an express courier service. Take care to check whether the circulation register has been extended by previous laboratories adding their names (see *Skipping your turn*, below). The full addresses of the laboratories in your group are attached and address labels are provided. Please ensure the slides are carefully packed to avoid breakages.

Dispatch of results. Return your completed Excel results form by email to the Scheme Administrator at AFRICA@iom-world.org. Alternatively, paper results forms can be returned to the Scheme Administrator by post using one of the IOM labels provided. If the results form cannot be returned immediately on counting the slides, you should still notify the Scheme Administrator of the dispatch of the slides. In any case, the results form should be dispatched to the IOM within two weeks of the counts being completed.

Skipping your turn. If you think that you will not be able to obtain the counts within the permitted seven days, send the slides IMMEDIATELY to the next laboratory on the register (or to the Scheme Administrator if no laboratories remain). Enter the dates of receipt and dispatch and 'uncounted' in the appropriate columns on the circulation register. Sign the register where indicated. Notify the Scheme Administrator on one of the post cards provided, or by fax or phone. (If you wish, the Scheme Administrator will return the slides to your laboratory later, after the other members of your group have counted.) If yours is the last laboratory in your group to count, and you require additional time, contact the Scheme Administrator for authorisation or advice.

Note: Always contact the Scheme Administrator if you are unclear about any of the above requirements, or if you are seeking advice about the slide circulation.

PLEASE KEEP THIS PAGE WITH THE SAMPLES

APPENDIX 3. Example of a Circulation Register, sent with slides during the circulation (the actual addresses have been omitted)

ROUND No.:	**34**	BATCH No.:	**99**	GROUP No.:	**88**

CIRCULATION REGISTER

Order	Laboratory abbreviation	Date received	Date dispatched	Counted/ Uncounted	Signed
1	Lab A				
2	Lab B				
3	Lab C				
4	Lab D				
5					
6					

When no more laboratories remain on the circulation register, the slides should be returned to Emma Carnaghan at IOM, Research Avenue North, Riccarton, Edinburgh, EH14 4AP, UK.

LABORATORIES IN GROUP 1

ABBREVIATION	LABORATORY CONTACT ADDRESS
Lab A	Name of contact person, laboratory/organisation name, laboratory address, telephone number, fax number, e-mail address.
Lab B	Name of contact person, laboratory/organisation name, laboratory address, telephone number, fax number, e-mail address.
Lab C	Name of contact person, laboratory/organisation name, laboratory address, telephone number, fax number, e-mail address.
Lab D	Name of contact person, laboratory/organisation name, laboratory address, telephone number, fax number, e-mail address.

Samples should be dispatched by Air Mail or express courier.

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APPENDIX 4. Example of form for recording results, sent with slides during circulation

IOM USE ONLY	LAB NO.:	GROUP NO.: 88	Laboratory Abbreviation:
	ROUND NO.: 34		
	BATCH NO.: 99	POSITION: 1	Lab A

ENTER THE FULL NAME OF YOUR LABORATORY: *Laboratory A*
ENTER THE DATE(S) OF EVALUATION : *18th – 25th June 2003*

Slide no.	Micro-scopist	Number of fibres	Number of fields	Single field area (mm^2)	Fibre density (f/mm^2)	Comments	IOM USE ONLY
99.01	AB	101	64	0.00785	201.0		
99.04	CD	47.5	200	0.00785	30.3		
99.09	AB	101.5	200	0.00785	64.6		
99.10	CD	100	113	0.00785	112.7		
99.12	AB	0.5	200	0.00785	0.3		
99.15	CD	102	44	0.00785	295.3		
99.20	AB	14	200	0.00785	8.9		
99.26	CD	100	43	0.00785	296.3		
99.30	AB	89	200	0.00785	56.7		

Microscopist - Initials No. of fields - Whole number Fibre density - 1 decimal place
No. of fibres - 1 decimal place Single field area - 5 decimal places (eg. 0.00785)

Date of dispatch of slides to next laboratory/IOM *25/6/03*
Recorded Delivery No. (slides) *XX 123456 22*

Signed (laboratory representative) *(name of contact)* Date of signature *25/6/03* **When this form has been completed, return to Emma Carnaghan at IOM, Research Avenue North, Riccarton, Edinburgh EH14 4AP, U.K.**

APPENDIX 5. Example of results form *RES1AF(h)*: rapid feedback of results to participants

RES1AF(H)/34/999

A F R I C A

ASBESTOS FIBRE REGULAR INFORMAL COUNTING ARRANGEMENT

PROVISIONAL ONE-ROUND REPORT
ROUND 34

Name of Contact Person
Laboratory/organisation name
Laboratory address

Report issued by:
Institute of Occupational Medicine,
Research Park North, Riccarton,
Edinburgh, U.K.
27 April, 2017

Laboratory Number	999
Group	88
Batch	99
Evaluation Date	25/06/2003

This is a provisional report on your laboratory's AFRICA results and is for guidance only. The details of each count are given, together with the reference count for that slide and the performance band (A, B or C) awarded. Formal performance classification is carried out at the end of each round. Details of the performance assessment procedures are given in the ***AFRICA Operational Procedures, available from IOM****.*

Slide	Micro-scopist	Number of Fibres	Number of Fields	Graticule area (mm²)	Density (fibres/mm²) Labor-atory	Density (fibres/mm²) Reference	Performance range
							Low -C	Low -B	Mid A	High +B	High +C
99.01	AB	101.0	64	0.00785	201.0	430.0	C				
99.04	CD	47.5	200	0.00785	30.3	28.7			A		
99.09	AB	101.5	200	0.00785	64.6	36.9			A		
99.10	CD	100.0	113	0.00785	112.7	89.4			A		
99.12	AB	.5	200	0.00785	.3	3.5			A		
99.15	CD	102.0	44	0.00785	295.3	310.7			A		
99.20	AB	8.9	99	0.00782	8.9	7.6			A		
99.26	CD	100.0	43	0.00785	296.3	155.9				B	
99.30	AB	89.0	200	0.00785	56.7	NR	-No reference count-				
						Totals:	-C: 1	-B: 0	A: 6	+B: 1	+C: 0

Number of valid results	8	(100%)
Results within Band A	6	(75%)
Results Within Band A & B	7	(87%)

APPENDIX 6. Example of a summary of the results from laboratories in the same circulation group (one of the reports provided at the end of the round)

A F R I C A

ASBESTOS FIBRE REGULAR INFORMAL COUNTING ARRANGEMENT

GROUP SUMMARY OF RESULTS

Laboratory: Laboratory Name and Address	**Round:** 34
	Group: 88
	Batch: 99
	Evaluation date: 25/06/2003

Fibre densities (fibres per mm^2)

Slide number	**99.01**	**99.04**	**99.09**	**99.10**	**99.12**	**99.15**	**99.20**	**99.26**	**99.30**	
Your laboratory	201.0	30.3	64.6	112.7	0.3	295.3	8.9	296.3	56.7	
Other laboratories in your group†	579.2	27.9	44.8	120.0	0.3	411.2	12.4	196.1	77.0	
	244.5	23.6	30.1	64.7	5.1	216.7	3.3	122.9	48.3	
	375.3	35.2	29.0	94.8	2.7	346.4	7.3	163.0	60.3	
	484.9	18.8	33.3	80.6	0.0	188.4	5.1	132.5	51.3	
Reference count	430.0	28.7	36.9	89.4	3.5	310.7	7.6	155.9	*	

† Each laboratory produces between one and three results per slide, depending on the number of active microscopists in the laboratory.

* An asterisk in the last row indicates a "candidate" slide or a slide excluded because of failure to meet post-screening criteria.

Institute of Occupational Medicine, Research Avenue North, Riccarton, Edinburgh EH14 4AP, Scotland, U.K.	*Form GS1AF*	3 June 2003