ASBESTOS IDENTIFICATION PROGRAM (BUILDING & RELATED PRODUCTS)

SUMMARY REPORT

ROUNDS 17 and 18

REPORT NO. 1205

JULY 2020

ACKNOWLEDGMENTS

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1. FOREWORD

This report summarises the results of a proficiency testing program on the identification of asbestos, organic and synthetic mineral fibres in bulk samples (building & related products). It constitutes the seventeenth and eighteenth rounds of an ongoing series of programs.

The program was conducted during the period October 2018 to March 2020 by Proficiency Testing Australia (PTA). The aim of the program was to evaluate the competence of participating personnel in the area of bulk asbestos analysis.

The Program Coordinator was Ms C Hirst, and the Technical Advisers were Ms L Apthorpe (Hibbs & Associates Pty Ltd) and Mr G Pickford (Pickford Resources Pty Ltd). This report was authorised by Mrs K Cividin, PTA Quality Manager.

This program is accredited to ISO/IEC 17043:2010 *"Conformity assessment - General requirements for proficiency testing"* by International Accreditation New Zealand (IANZ).

2. INTRODUCTION

Aim - The aim of this program is to monitor the "accuracy" and reliability of results produced by individual identifiers from participating laboratories and thus improve the overall standard of work carried out in the area. This is considered essential given the potentially serious consequences of an incorrect analysis.

Regulation of the Program – PTA oversees the technical operation and development of the Asbestos Identification (Building & Related Products) Program. Independent experts provide technical advice.

Outline of Operation – The ongoing PTA Asbestos Identification Program commenced in 2002, with Round 1 taking place during the period October 2002 to March 2003. Since then, one round has taken place each year during the same period (i.e. October – March).

Participation in this proficiency testing program would satisfy the requirements of ISO/IEC 17025 for assuring the quality of tests results.

Every year, each participating analyst receives eight bulk samples which are selected so as to provide a good 'mix' of different types of asbestos and non-asbestos samples.

Each identifier receives a total score for each round made up of the sum of the scores for individual samples within the set (eight samples), together with an error code for each sample for which a score other than zero is obtained. A total score <4 is considered "satisfactory". The scoring system is explained in detail in Appendix 2.

Each round takes approximately six months, during which time each identifier initially receives one batch of eight bulk samples. A follow-up batch of eight bulk samples is also sent afterwards to identifiers whose performance is categorised as 'unsatisfactory' for the initial stage.

The formal assessment of identifier (and thus laboratory) performance is based on the results obtained after each cycle (i.e. two consecutive rounds). Further details relating to the participation procedure and performance criteria for Round 18 are found in Appendix 2.

3. OPERATION OF THE PROGRAM

Participants - A total of 356 different identifiers, who were each given confidential numerical codes, took part in Round 17 and/or Round 18. These identifiers were employed in 83 separate Australian laboratories, 24 New Zealand laboratories, and one facility from each of the following countries - Korea, United Arab Emirates, Malaysia and Singapore

Sample Preparation - A large pool of quality assured bulk asbestos samples is available to PTA, including samples containing no asbestos, no fibres, non-asbestos fibres, one type of asbestos fibres, multiple types of asbestos fibres and fibres that cannot be identified unequivocally as asbestos in various matrices.

Sample Reference Results - The individual fibres in each of the samples has been categorised into the fibre categories, “easy”, “medium” and “difficult”. The scoring system takes into account the difficulty level for the particular fibres within each sample, and scores heavily against false results, especially samples that contain easily identifiable fibres. The reference results for the PTA samples have been confirmed by independent experienced analysts, and continue to be confirmed due to the nature of the Program and the review of contentious sample results. If any sample is found to be questionable or contentious, it is re-analysed by an experienced analyst, formally reviewed, and the results used to confirm or modify the existing Reference Result.

3.1 Operation of each round

Initiation - One month before each round commences, a schedule is provided to each participating laboratory and each identifier within the laboratory is nominated a particular month (normally October through to March) to receive and analyse a batch of eight samples. Note, some participants receive samples outside these official months due to their own timing requirements.

Submission of Samples and Instructions - A batch of eight bulk samples, together with a set of instructions (see Appendix 1), are sent to the identifier on the dispatch day of the prescribed month via PTA’s nominated courier.

Analysis of Bulk Samples by Identifier and Submission of Results - The eight bulk samples are analysed independently by the nominated identifier according to their laboratory’s documented method. Participants are requested to record and report the presence (including trace asbestos if detected) of chrysotile, amosite and crocidolite asbestos AND the presence of synthetic mineral fibres (SMF) and organic fibres. Identifiers are requested to fully record all relevant observations, comments and conclusions on worksheets in accordance with the requirements detailed in AS 4964[1], and the NATA *Specific Accreditation Criteria Life Sciences ISO/IEC 17025 Application Document, Annex - Asbestos identification in bulk samples,* July 2018 [2]. Worksheets and test reports are retained by the analyst, and made available to PTA on request. Results are submitted to PTA on the supplied “Results Sheet” (see Appendix 1).

The Result Sheet and samples are then returned to PTA by the prescribed due date.

3.2 Assessment of identifier performance in each round

Processing Results - The results obtained by each identifier are compared with the reference results. The identifier is then assigned a score for each sample. In general, a score of 2 is allocated when an “easy” asbestos fibre is incorrectly found/not found, while 1.5 is allocated when a “medium” asbestos fibre is incorrectly found/not found, and 1 is given when a “difficult” asbestos fibre is incorrectly found/not found. The penalties applied for incorrectly reporting SMF and organic fibres are 1 for “easy” fibres, and 0.5 for “medium/difficult” fibres. A total score (for the 8 samples) of < 4 is considered satisfactory, while a score of 4 or more is considered ‘unsatisfactory’. For each sample for which the identifier received a score other than zero, an “error code” is also provided.

While it is recognised that in an occupational health perspective, organic fibres are less significant, it is still vitally important to clients that ALL fibre types within their sample can be competently analysed. This process includes analysts following the spirit and intent of the Australian Standard, and applying appropriate diagnostic criteria to all kinds of fibres in a sample, including non-asbestos fibres. To reflect the importance of the analysts ability to correctly identify the asbestos fibres, greater weighting has been applied to associated errors for these fibre types in the scoring system.

The performance criteria are based on the total score for the eight samples and are detailed in Appendix 2.

Performance Criteria and Interim Report - After an identifier has performed in two consecutive rounds, a performance category is also provided for the cycle. This is based on the scores obtained in both rounds and the criteria are detailed in Appendix 2.

After each round (and any associated follow-up) an interim report (refer Appendix 3) is produced which provides a summary of performance both for the round and cycle.

Classification of Identifiers – The performance category after each cycle is used to determine the classification. To demonstrate ongoing competence, the analyst must obtain a "satisfactory" grading after each cycle (i.e. must not receive unsatisfactory scores in two consecutive rounds).

If any identifier receives two unsatisfactory scores during a cycle (i.e. any two consecutive rounds), the performance category for the cycle will be classified as "unsatisfactory" and the identifier will need to obtain a score of <4 for their next two sets of 8 samples before their grading can be classified as “satisfactory”. Identifiers may request additional sets of follow-up samples prior to the next routine round to facilitate this process. These additional sets of samples are referred to as “special follow-up”.

Training - Analysts who are categorised as unsatisfactory usually require further training. This may be provided in-house as part of the internal quality control procedures. Later, performance in the next round of the PTA program will provide external quality control and monitor the identifier's performance.

4. RESULTS OBTAINED IN ROUNDS 17 AND 18

The actual scores obtained by participants (by identifier code) in both rounds are tabled in Appendix 5 together with the current performance category of each participant. A broad summary of the overall performance and identifier classification is detailed in Appendix 6.

5. TECHNICAL COMMENTS

The program is regularly reviewed to ensure it remains appropriate and suitable for analysts undertaking asbestos identification work using AS 4964. Ongoing considerations include the type and range of samples, together with the packaging and consistency in the samples. Feedback obtained from participants is also evaluated to identify any clarifications or improvements which can be made in the program.

Technical support is provided by the technical advisors throughout the program cycle, including review of participant remnant samples upon request.

It was noted that some analysts obtaining high unsatisfactory scores subsequently withdrew from the program.

For information on potential sources of error, refer to Appendix 4 of this report.

6. CONCLUSIONS

The PTA Asbestos Identification Program has fulfilled its main aim of providing participating laboratories an external means of monitoring the accuracy and reliability of results produced by individual identifiers within their laboratory.

It has assisted individual analysts by providing tangible evidence of their own performance, and when not satisfactory, has highlighted the need for additional training or remedial action.

At the conclusion of the cycle (i.e. at the end of Round 18) **92.1%** of participating identifiers were classified as satisfactory. This is an improvement on the performance in the previous cycle, at the conclusion of which 90.3% were satisfactory.

7. REFERENCES

[1] AS 4964 - 2004 *Method for the qualitative identification of asbestos in bulk samples.*

[2] NATA Specific Accreditation Criteria Life Sciences ISO/IEC 17025 Application Document *Annex - Asbestos identification in bulk samples, July 2018*

[3] *Guide to Proficiency Testing Australia (2019)*. (This document is located on the PTA website at www.pta.asn.au under Programs / Documents).

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A1.1

ASBESTOS IDENTIFICATION PROGRAM: BUILDING & RELATED PRODUCTS

Instructions to Participants

Round 18 – October 2019 to March 2020

1 Participants are requested to record and report the presence (including trace asbestos if detected) of chrysotile, amosite and crocidolite asbestos AND the presence of synthetic mineral fibres (SMF) AND organic fibres[1] (as per AS 4964), on the supplied Results Sheet.

Whilst the reporting of SMF and organic fibres is not specified in AS 4964, it is necessary to report them in this Program because of the implicit AS 4964 requirement to be able to formally distinguish SMF and organic fibres from asbestos fibres.

Some samples may contain no fibres, and other samples may contain one or more types of fibres – all of which should be reported. Some asbestos fibres may be affected by surface coatings, weathering, heat or chemicals - all of which can change the optical properties (see note below[2]).

2 All relevant observations, comments and conclusions must be fully recorded on worksheets in accordance with the requirements detailed in AS 4964, and the NATA *Specific Accreditation Criteria Life Sciences ISO/IEC 17025 Annex - Asbestos identification in bulk samples,* July 2018. These documents should be retained by the analyst.

3 Participants should treat the PTA samples as normal routine samples. They are to be analysed by the intended analyst only, and should NOT be distributed to other analysts in the laboratory for the purposes of checking or obtaining consensus results.

4 Note that some of the PTA samples may be smaller than recommended by AS4964, and may normally be rejected in accordance with your internal laboratory guidelines. All PTA samples have been deemed adequate in size for the purposes of this PTA Program, and participants are requested to analyse all eight samples provided.

5 **No part of any PTA sample is to be retained by any laboratory**.

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[1] Organic Fibres: Participants are requested to report the presence of organic fibres only where the organic fibres form PART OF the sample. Obvious contamination by a small number of organic fibres should be ignored, using professional judgement. If in doubt, submit a detailed explanation to PTA (comments section of Results Sheet), including photographs if relevant.

[2] Note, some samples may contain asbestos fibres that have been heat-degraded, and there may be mixtures of fibre types within these samples. Therefore, the fibres found may or may not exhibit Dispersion Staining (DS) colours in the range of RI oils used, and for those fibres that exhibit DS colours, the colours may not match reference colours listed in the Laboratory Method diagnostic criteria. In accordance with the requirement for "unequivocal identification of asbestos fibres" any fibre that does not match the Laboratory's diagnostic criteria, must be reported as "unidentified mineral fibres". Useful information on this and other relevant aspects for analysis can be found in PTA's 'Potential Sources of Error' document, available on request

6 Worksheets and test reports are to be retained by the analyst, and made available to PTA on request. Results are to be submitted to PTA on the supplied "Results Sheet" only.

7 **Samples and the Results Sheet** must be returned to PTA by the due date. Notification of performance will not be issued to participants until samples have been received by PTA, Brisbane.

<<Please note, as samples may contain asbestos fibres, participants are asked to strictly adhere to their routine procedures in regards to safety and handling of asbestos-containing material.>>

Please forward samples *and* the Results Sheet, **no later than xx xxxx 2020** to:

Ms Christine Hirst
Senior Scientific Officer
Proficiency Testing Australia
628 Ipswich Road, Annerley, QLD, 4103, AUSTRALIA

Phone: +61 7 3721 7373 Fax: +61 7 3217 1844

Email CHirst@pta.asn.au

A1.3

ASBESTOS IDENTIFICATION (BUILDING & RELATED PRODUCTS) PROGRAM: RESULTS SHEET

ROUND 18 - MARCH 2020

FACILITY:	**PTA Client No:**		
ANALYST'S NAME:			
CODE:		*Samples Returned*	

SAMPLE NO.	FIBRES IDENTIFIED*				
	Type(s) of asbestos present	Type(s) of trace asbestos	Synthetic mineral fibres (Yes/No)	Organic fibres (Yes/No)	Unknown mineral fibres (Yes/No)
B37602					
B37917					
B34444					
B33564					
B37866					
B35279					
B33477					
B23573					

*Record your observed and identified presence or trace presence of chrysotile, amosite and crocidolite asbestos and the presence of synthetic mineral fibres (SMF) and organic fibres. (Note: Performance grading will include SMF or organic fibres).

ADDITIONAL COMMENTS (if required)

Signature of Analyst: _____ Date: _____

Please return Samples and Results Sheet to *Christine Hirst, Senior Scientific Officer, Proficiency Testing Australia, 628 Ipswich Road, Annerley, QLD, 4103, Australia*. Worksheets are to be retained by the analyst, and made available on request.

A2.1

Criteria for Monitoring Performance in PTA Asbestos Identification (Building & Related Products) Program

Notes:

1. Each identifier receives 8 samples every 12 months (1 round per annum), with each round usually scheduled over a 6 month period from October to March.

2. Each identifier receives a total score for each round made up of the sum of the scores for individual samples within a set. In addition, an error code is provided to indicate the broad category of error for each sample. There are three main categories of error, denoted M_x, G_x and I_x where M_x refers to "missed x fibre types (false negative) ", G_x refers to "gained x fibre types (false positive)", and I_x refers to "incorrectly identified x fibre types". The subscript "x" refers to the number of fibre types (e.g M_2 denotes "missed 2 fibre types").

3. The individual fibres in each of the samples has been categorised into the fibre categories, "easy", "medium" and "difficult". This includes chrysotile, amosite and crocidolite as well as synthetic mineral fibres and organic fibres. The scoring system takes into account the difficulty level for the particular fibres within each sample, and scores heavily against false results, especially samples that contain easily identifiable fibres. In addition, the weighting for asbestos fibres is greater than for SMF and organic fibres. In general, scores are allocated as follows:-

Condition	Score (Asbestos Fibres)	Score (SMF & Organic Fibres)
when an "easy" fibre category is not found	2.0	1.0
when a "medium" fibre category is not found	1.5	1.0
when a "difficult" fibre category is not found	1.0	0.5

If a fibre type is found when it is not present, then the appropriate score in the above table is given for each incorrect fibre type found.

4. If the total score for the 8 samples is 4 or more, (i.e. unsatisfactory), a further set of 8 "follow-up" samples will be issued before the next round of the program. If a score of 4 or more is obtained in a "follow-up" round, then the identifier's performance will be classified as unsatisfactory for the cycle. If a score of "<4" is obtained in a "follow-up" round, performance is graded as questionable, and a score <4 must be obtained in the subsequent round to achieve a satisfactory grading (see also point 5 below).
Note: SMF and organic fibres will be included in the formal performance evaluation.

5. If any identifier receives two unsatisfactory scores during a cycle (i.e. any two consecutive rounds), the performance category for the cycle will be classified as "unsatisfactory" and the identifier will need to obtain a score of "<4" for their next two sets of 8 samples before their grading can be classified as "satisfactory". Identifiers may request additional sets of "follow-up" samples prior to the next routine round to facilitate this process. These additional sets of samples are referred to as "special follow-up".

The scoring system and performance grading is best illustrated by the diagram on the reverse side of the page.

A2.2

ROUND 18

Criteria for Monitoring Performance in PTA Asbestos Identification (Building & Related Products) Program
(Based on a continuing cycle i.e. Two consecutive Rounds)

Example:

Round 17	Follow-Up	Round 18	Follow-Up	Satisfactory	Questionable	Unsatisfactory
≥4	<4	<4	-	✓	-	-
		≥4	-	-	-	✓
	≥4	any score *	-	-	-	✓
<4	-	<4	-	✓	-	-
		≥4	<4	-	✓	-
			≥4	-	-	✓

<<A total score of <4 is considered satisfactory, while a score of ≥4 is unsatisfactory>>

* The score (<4) will be examined in conjunction with the scores in the next round (normally Round 19) before the unsatisfactory category can be reviewed.

A3.1

Date

Name
Address

Dear

RE: PTA ASBESTOS IDENTIFICATION PROGRAM
(Building & Related Products) – ROUND 18
PTA Client No: Identifier Code:

Please find below a summary of your performance in Round 18 of the PTA Asbestos Identification Program. Formal evaluation of performance *includes* synthetic mineral fibre (SMF), and organic fibre identification.

Round 18 – March 2020

Including SMF, Organic & Asbestos fibres

Sample No.	Error Code	Score
B26113	I_1	2.0
B25032		0.0
B30824	G_1	1.0
B30031		0.0
B29816	M_1	0.5
B29722		0.0
B23234		0.0
B13123		0.0
	Total Score	**3.5**

Note 1: A total score of **<4** is considered **satisfactory**, while a total score of **≥4** is **unsatisfactory**.

Key to Error Codes
G_x Gained "x" fibre type(s) (i.e. false positive)
M_x Missed "x" fibre type(s) (i.e. false negative)
I_x Incorrectly identified "x" fibre type (i.e. mis-identification)
[where "x" refers to the no. of fibre types missed or gained.]

The criteria used by PTA for categorising performance, together with follow-up procedures, are detailed in the attachment. On applying these criteria to your performance for the cycle (i.e. Rounds 17 and 18) now completed, the following summary applies.

Round 17 Score	Follow-up Score	Round 18 Score	Follow-up Score	Performance Category for Cycle
2.5		3.5		Satisfactory

…/2

Finally, any comments or suggestions you wish to make on your performance or the program in general are most welcome. I look forward to your participation in Round 19 of the program (scheduled for ~March 2021).

Yours sincerely

Christine Hirst
SENIOR SCIENTIFIC OFFICER

Enc. [Criteria for Monitoring Performance]

Enc. [1934962 cri]

A4.1

PROFICIENCY TESTING AUSTRALIA

PTA ASBESTOS IDENTIFICATION PROFICIENCY TESTING PROGRAM

POTENTIAL SOURCES OF ERROR

I. INTRODUCTION

Proficiency Testing Australia (PTA) provides an asbestos identification proficiency testing program which has been designed to test the competency of identifiers using Australian Standard AS 4964 'Method for the qualitative identification of asbestos in bulk samples.'

A secondary function of this program is to provide limited feedback to assist identifiers who have not been successful in the Program, that is, those who have generated high scores.

The purpose of these Guidance Notes is to assist laboratories working in this field, and particularly for those who require additional guidance in respect to their performance in the PTA program.

II. BACKGROUND

All of the samples in the current PTA Programs have been chosen to represent most of the typical asbestos fibres and/or asbestos-containing products that are present in Australian buildings and ships and structures.

Apart from some samples that contain no fibres, most of the samples contain one or more of the various types of fibres including asbestos, synthetic mineral fibres and organic fibres.

All laboratories must analyse for the presence of synthetic mineral fibres (SMF) and organic fibres, and if found, report them as per NATA requirements.

For those samples containing asbestos, each of the fibre types (if present) have been categorised into 'easy', 'medium' and 'difficult', in terms of the ease or otherwise that the fibres can be found and can be analysed.

III. FEATURES OF THE PTA PROGRAM

A comprehensive and complex scoring scheme has been developed that penalises analysts in the event of the following:-

A. failing to find a fibre type known to be present
B. finding a fibre type known not to be present

The weighting of the score depends upon which of the three categories applies to each fibre type. For example, an error relating to a 'difficult' fibre only carries half of the 'weight' of an 'easy' fibre type.

Therefore, if an 'easy' fibre type is not found, then the score is twice as high than if a 'difficult' fibre type is not found.

All samples used in the program have been extensively validated.

In the event of disagreements between program participants and the validated results, the laboratory's worksheets are reviewed, and if necessary, the samples are re-analysed by one or more experienced analysts (as arranged by PTA).

IV. CRITICAL COMPONENTS OF SUB-SAMPLE SELECTION AND ANALYSIS

To learn what errors analysts can make, it is first best to look at various critical steps of the analytical process as follows:-

A. Laboratory Sub-Sampling and Visual Examination
   (i) using 100% of the sample received
   (ii) just examining a sub-sample which may not be representative.

B. Laboratory Sub-Sampling and Stereo Examination
   (i) using 100% of the sample received
   (ii) just examining a sub-sample which may not be representative.

C. Fibres Selection
   (i) methodical separating out of all different 'types'
   (ii) stopping when a single fibre type is sighted

D. No Fibres Sighted
   (i) submitting sample to 'trace' analysis
   (ii) no trace analysis

E. No Asbestos Fibres Sighted
   (i) submitting sample to 'trace' analysis
   (ii) no trace analysis

F. Diagnostic Criteria
   (i) using appropriate diagnostic criteria including a broad range of RIs or Dispersion Staining (DS) colours to cover atypical asbestos
   (ii) using inappropriate or inadequate diagnostic criteria, and/or a narrow range of RIs or DS colours. This can lead to false positives, or to call asbestos fibres as 'unidentified mineral fibres' (umf)

G. Others
   (i) using good worksheets, checking procedures and reporting
   (ii) using poor practices that results in errors caused by mismatching test data with laboratory diagnostic criteria or using inappropriate diagnostic criteria

In all cases above, (i) is appropriate action, and (ii) is not.

Points A and B show the need to examine all of the sample provided by PTA. Otherwise fibres can be missed.

Point C shows that an analyst should not stop when one fibre type is found, because many PTA samples have more than one type of fibre.

Points D and E show the need for trace analysis to be conducted if no fibres are sighted, even if non-asbestos fibres are present.

Point F refers to the case where a laboratory's diagnostic criteria has only one set of RIs (and DS colours) per asbestos type. Some of the PTA samples (which reflect normal types of samples received by laboratories) have some of the asbestos fibres that will NOT exhibit these DS colours (i.e. a narrow range or one 'set' of colours), and would have to be pronounced 'unknown mineral fibres' as required by AS 4964. Section VI. B. of this document provides some guidance on increasing the number of RI (DS) sets, so that a more appropriate identification can be made of 'non-classical' asbestos fibres.

Point G is obvious, but a significant number of errors are caused by first not correctly recording raw observation data, second not matching it appropriately to diagnostic criteria, and third by incorrect translation to test reports. Some laboratories have inappropriate diagnostic criteria, as well as using incorrect optical conditions when observing fibre characteristics, or recording pre-conceived and inaccurate observations.

V. BROAD TYPES OF ERRORS BY PARTICIPANTS IN THE PTA PROGRAM

As described in Section III, analysts can make one of the following major errors and accumulate points that contribute towards failure:-

A. Not finding or identifying a fibre type when it is present – false negative
B. Finding or misidentifying a fibre type that is not present – false positive
C. Finding and identifying only one fibre type when more are present

When a sample has more than one fibre type, an analyst might correctly determine the presence of one fibre type, but omit or misidentify a second or third fibre type.

In addition, an analyst may find that a fibre type is an 'unknown mineral fibre', when in fact it is easily identifiable as a common asbestos.

In accordance with AS 4964, if the presence of tremolite, actinolite or anthophyllite is unable to be confirmed by an 'independent analytical method', it must be given a classification of 'unknown mineral fibres'.

SMF and organic fibres which are part of the sample must also be reported as per NATA requirements.

VI. WHAT TO LOOK FOR WHEN YOU OBTAIN A HIGH SCORE

The fact that PTA does not provide the 'correct' answers is intentional, because it is vital that an identifier goes through the process of finding the problem and then correcting it, known as 'root cause' analysis.

This should first be self-help, but may have to be with the assistance of a colleague, but not using any PTA sample.

In some cases, the laboratory may have good internal consistency, but obtain incorrect results because of systematic errors. An expert outside the laboratory may then be required.

Here are some areas in the analysis that are sometimes not given due importance:-

A4.4

A. Naked Eye and Stereomicroscopic Examination

Before using the stereomicroscope, the sample should be examined by eye, and all visual clues should be used in conjunction with historical and sampling information, and knowledge of asbestos-containing products. It cannot be assumed that all PTA samples are homogeneous, and they should be classified by the analyst as homogeneous or non-homogeneous.

The next most vital part of the analytical process is comprehensive examination by stereomicroscope.

Low *and* high power use is as a rule essential for most samples to locate and/or differentiate fibres from non-fibrous material, but particularly for those samples with more than one fibre type present.

This enables the whole 'picture' to be seen at low power, and to assist in the gathering of clues about the nature of very small fibres and fibre bundles at high power. For example, a good stereomicroscope with adequate illumination will reveal that most organic fibres are present as single fibres, with a cellular structure. On the other hand, asbestos fibres will exhibit themselves as fibre bundles, often with very fine fibre bundles separating from the main bundles. It is impossible with stereomicroscopy, and is generally not possible for light microscopy to observe asbestos 'fibrils', which are in the order of 0.005 to 0.050 µm diameter.

Good stereo use assists in finding different fibre types at an early stage, and aids separation of all different fibrous matter from a sample for subsequent PLM examination.

The bottom line is that analysts should take the necessary steps to guard against missing fibre types.

B. Polarised Light Microscopic Examination

1. Diagnostic Criteria – General

When each fibrous sub-sample has been separated out at the stereo stage, and duly recorded, careful attention should be given to gaining sufficient information about the optical properties of the fibres.

This information should be compared to the laboratory's own diagnostic criteria, placing emphasis on the mandatory determination of refractive indices parallel and at right angles to the fibre length, and by ensuring that morphology is appropriate. Other optical properties are secondary, but can be useful in the analysis and subsequent confirmation of a fibre type.

2. Importance of Morphology

AS 4964 for asbestos identification regards morphology to be as essential as refractive indices, and has defined morphology of asbestos fibres as:-

(i) many particles with aspect ratios ranging from 20:1 to 100:1 or higher for particles >5 micrometres in length. Bundles of fibres may have lower aspect ratios.

(ii) very thin fibrils or fibre bundles generally <0.5, but always <1.0 micrometres in width, unless in thick bundles.

(iii) in addition to the mandatory fibrillar crystal growth, one or more, and preferably three of the following aspects:

- parallel fibres occurring in bundles;
- fibres displaying splayed ends;
- matted masses of individual fibres;
- fibres showing curvature.

It should be noted that some insect webs and PTFE coated materials give morphological features and dispersion staining colours almost identical to those of chrysotile asbestos fibres. This requires appropriate action such as ashing.

3. Refractive Indices – Dispersion Staining

For the chrysotile, amosite and crocidolite asbestos fibre types present in the samples, it is not sufficient to say 'unknown mineral fibres' have been found, unless they are severely degraded or otherwise modified. Such reporting demonstrates that the laboratory method has an inappropriate set of diagnostic criteria, the analyst does not have sufficient experience, or the analyst is not applying the techniques adequately.

Some fibres have adhering particles or coatings (such as bitumen), that make dispersion staining colours difficult or impossible to observe if untreated, especially if the fibres are very fine. Clean-up procedures are then necessary, or Becke lines can be used by some analysts, providing that they have the necessary experience in this technique. If an inexperienced analyst uses 'false' Becke lines that are present in every sample, this leads to incorrect results. Interpretation of Becke lines is difficult and requires considerable experience.

Many laboratories have a single set of dispersion staining (DS) colours for each of the three common asbestos types used in most asbestos products. As described in Appendix B of AS 4964, it is important to note that each specific type of asbestos has a range of RI's and therefore a range of DS colours, mainly due to location of the parent ore body, age and weathering of the asbestos. To further complicate analysis, when asbestos fibres are incorporated into the matrix of a product such as fibres-cement or block insulation, chemicals from the matrix can leach into the asbestos and cause further changes to the RI's of the fibres. Changes to RI's also occur due to coatings, heat degradation or when chemically affected or modified. Because dispersion staining 'measures' the refractive index of the outside surfaces of fibre bundles, it is also possible that moisture can cause significant problems in determining RI's.

The best guide to a complete range of DS colours plotted on a dispersion staining Chart used to be provided with the McCrone dispersion staining objective, however, this is out of print, but may be used by some Australian Laboratories. The chart gives 'families' of charted data for a number of different sources of chrysotile, amosite and crocidolite, both parallel and perpendicular to the fibre length. Observed DS colours can be read directly off the chart, or preferably from a table that each laboratory has created by using the chart.

Various tools and resources for DS microscope techniques are also available from the McCrone Group (www.mccrone.com).

Several useful papers on DS include:-

McCrone, 'Detection and Identification of Asbestos by Microscopical Dispersion Staining', Environmental Health Perspectives, Vol 9, pp 57-61, 1974, available from https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1475424/

Wilcox, 'Refractive Index Determination using the Central Focal Masking Technique with Dispersion Staining Colors', American Mineralogist, Vol 68, pp 1226-1236, 1983, available from http://www.minsocam.org/ammin/AM68/AM68_1226.pdf.

McCrone, 'The Asbestos Particle Atlas', Anne Arbor Science, 1980 or later – to be found in some technical libraries.

The McCrone publications provide some information on DS colour ranges for asbestos fibres, but not as complete as the Hartmann Chart.

The DS colours used by McCrone are not as consistent and are harder to use than those provided in the Wilcox paper. Therefore, it is best to combine the Wilcox colours with the McCrone asbestos data.

4. Standardising on Colours and Colour Names

It is critically important that analysts identify and name colours appropriately, and a colour chart reference can be used to aid this process.

There is much confusion resulting from numerous colour models, colour perceptions and common usage relating to defining and naming colours, and it is recommended that analysts settle on a consistent line of approach. The following examples illustrate this:-

Violet – actually a pure spectral colour (very strong blue), but commonly believed to contain red and blue. Therefore, best not to use this colour name.

Purple – is a general term for the range of shades of colour occurring between red and blue, and because there is disagreement over exactly which shades can be described as purple, best not to use this colour name.

Magenta – When using the classical Munsell colour system, magenta is called red-purple. In the Cyan-Magenta-Yellow (CMYK) colour model used in printing, it is one of the primary colours of ink. In the Red-Green-Blue (RGB) colour model, the colour created by mixing the red and blue primaries is called magenta, though this colour is different to the magenta colour used by printing companies. Magenta is better defined than purple, and should be used by describing magenta as an equal red and blue in the RGB colour model. Further, 'red-magenta' should be defined as magenta plus *more* red, and 'blue-magenta' as magenta plus *more* blue.

Blue – because there is so much difference between 'light' and 'dark' blue, it is best to treat them separately.

Light Blue – is also known as sky blue.

Mid Blue – is similar to navy blue and mid-blue, and has maximum content of spectral blue.

Orange – is a mixture of red and yellow.

Gold – is a mixture of orange and yellow.

Red – has the maximum content of spectral red.

Green – has the maximum content of spectral green.

Yellow - the maximum content of spectral yellow.

The following definitions apply to the different colours generally found when using central stop DS. The RGB colour model is used for this purpose; is explained on http://en.wikipedia.org/wiki/RGB_color_model; is seen in a practical demonstration on http://johncfish.com/bggallery/otherchart/index.htm; and is downloadable in various forms from http://www.colorpicker.com, as 'Visual Colour Picker.' Note that 'red', 'yellow' and 'blue' in the

table below are mainly provided because they form the base of the RGB colour model, and are not directly of relevance in terms of DS colours:-

Colour Description	***R***	***G***	***B***	***R***	***G***	***B***
	Lower Limit			***Upper Limit***		
red	255	0	0	255	70	0
yellow	240	255	0	255	220	0
green	130	255	0	0	255	110
light-blue	170	210	230	70	200	240
mid-blue	0	160	255	0	0	255
orange (red + yellow)	255	100	0	255	160	0
gold (orange + yellow)	255	170	0	255	200	0
blue-green	0	255	170	0	255	200
magenta (blue + red)	255	0	240	255	0	255
red-magenta (magenta + red)	255	0	90	255	0	160
blue-magenta (magenta + blue)	90	0	255	190	0	255

The differences in the appearance of colours amongst most modern computer screens are not significant, especially if they are reasonably well ‘calibrated’, and result in the colour chart being reproduced on screen sufficiently accurate for our purposes.

If not already done, the monitor should be calibrated prior to viewing the colours. See https://www.pcmag.com/article2/0,2817,2414252,00.asp for a typical PC monitor calibration of Windows 7 and 8, and similar for Windows XP. See http://support.apple.com/kb/HT2805?viewlocale=en_US&locale=en_US to calibrate an Apple monitor using built-in software, or download a shareware program ‘Supercal’ from http://www.bergdesign.com/supercal.

A document (in PDF form) is available from PTA on request (via email only) which provides examples of the above colours and colour ranges. This document should NOT be printed, because of various fundamental and incompatible differences of monitor colours (usually based on additive models) and printed colours (usually based on subtractive models). In practice, printed colours are significantly different to those observed on a monitor, especially blues and magentas.

When observing DS colours, the analyst must be careful to remember that the image of the fibre is not ‘true-to-life’, but rather a set of colour images resulting from refraction of white light into its component colours, superimposed onto dark field conditions which cause diffraction patterns to ‘break-up’ the refracted image of thin fibres. Hence, the colour images will generally be in bands parallel to the sides of the fibre, and if anything, the outermost colours should be chosen as the DS colours for the fibre in each of the two orientations. The periodic use of ‘standard’ asbestos fibres in relevant RI oil is important to ensure that analysts stay ‘calibrated’ to the range of colours present for ‘pure’ asbestos types.

Great care should be exercised when analysing ores because it is not uncommon for asbestos fibres in some ores exhibiting different optical properties than ‘classical’ pure asbestos fibres. Secondly, some non-fibrous bladed or acicular material can give identical DS colours to asbestos, and should be rejected because the morphology does not match the AS 4964 definition. If in doubt, ask another analyst or laboratory to analyse the sample. Be mindful of the limitations of alternative methods such and XRD and IR, as noted in Appendix A of AS 4964.

Please note: The web based links used in this document are examples only, and their accuracy or otherwise is not guaranteed. The links were active at the time of publication, but may become inactive in time.

C. SMF and Organic Fibres

All NATA accredited identifiers are accredited for SMF and organic fibres, and when they receive an asbestos-free sample with SMF and/or organic fibres, the only NATA report that they can issue within the constraints of AS 4964 reporting criteria is 'unknown mineral fibres' (UMF).

1. Synthetic Mineral Fibres:

   For the purpose of this method, all isotropic fibres are defined as Synthetic Mineral Fibres (SMF). This group includes glass fibres, glass wool, rock wool, slag wool, ceramic fibres, and 'bio-soluble' fibres of all types now being produced by most SMF manufacturers.

2. Organic Fibres:

   For the purpose of this method, organic fibres are defined as fibres which ash at approximately 400 to 450°C. These include natural organic fibres such as cellulose, hemp, cotton, flax, jute and wool; and man-made organic fibres such as polypropylene, polyester, nylon, Kevlar and acrylics.

SMF and organic materials should only be described in generic terms. This means that specific types of SMF or organic fibres such as glass fibres, ceramic fibres, cellulose fibres, wool fibres, cotton fibres and so on, are NOT to be analysed or reported.

A5.1

PTA ASBESTOS IDENTIFICATION (BUILDING & RELATED PRODUCTS) PROGRAM

SUMMARY OF RESULTS FOR ROUNDS 17 AND 18 (October 2018 – March 2020)

*	Non-participation (where an enrolled identifier was not involved in that specific round).
w/d	Withdrawn (the identifier withdrew from program during that round).
#	Special follow-up (where additional 'special' follow-up samples were issued to an identifier upon request, normally to facilitate achieving satisfactory grading).
+	Results unavailable at time of printing. In the case of the performance grading, + denotes "unclassified" due to unavailable results.
N	No results submitted (where samples were issued, but identifier failed to submit results).

Performance Categories – based on the table in Appendix 2:

S Satisfactory
U Unsatisfactory
Q Questionable

Note: Where an identifier's score was greater than 4 in Round 18 (i.e. unsatisfactory) and the follow-up was less than 4 (i.e. satisfactory), or follow-up results were outstanding at time of printing report, the performance category is shown as "Q", pending the identifier's next set of results (i.e. Round 19 or Round 18 follow-up). Where follow-up results remain outstanding, the "Q" appears in italics to denote "tentative" performance grading.

IDENTIFIER CODE	Round 17		Round 18		Performance Category at 30/06/20
	Score	Follow-up	Score	Follow-up	
1	*		+		+
2	4.5	1.0	w/d		Q
3	1.0		1.0		S
4	0.0		0.0		S
6	1.5		+		S
7	1.5		3.5		S
8	5.5	0.0	4.5	3.0	U
9	1.5		*		S
13	0.0		0.0		S
15	0.0		w/d		S
16	0.0		1.5		S
18	0.0		w/d		S
19	1.5		1.0		S
20	1.0		*		S
21	2.0		*		S
23	0.0		0.0		S
25	0.0		1.0		S

A5.2

IDENTIFIER CODE	Round 17		Round 18		Performance Category at 30/06/20
	Score	Follow-up	Score	Follow-up	
27	**1.5**		**2.0**		**S**
30	**0.0**		**0.0**		**S**
32	**0.0**		**0.0**		**S**
33	**1.0**		**1.5**		**S**
34	**1.5**		**0.0**		**S**
35	**2.0**		**2.0**		**S**
36	**3.5**		**3.5**		**S**
37	**3.5**		**w/d**		**S**
38	**0.0**		*****		**S**
39	**3.5**		*****		**S**
40	**0.0**		**w/d**		**S**
41	**0.0**		**0.0**		**S**
42	**3.0**		**w/d**		**S**
44	*****		**0.0**		**S**
49	**1.0**		**0.0**		**S**
51	**1.0**		**0.0**		**S**
54	**1.5**		**1.0**		**S**
56	**0.0**		**w/d**		**S**
57	**1.0**		**1.0**		**S**
58	**0.0**		**0.0**		**S**
59	**0.0**		**0.0**		**S**
60	**0.0**		**1.0**		**S**
61	**3.0**		*****		**S**
62	**0.0**		**0.0**		**S**
65	**1.0**		**0.0**		**S**
66	**0.0**		*****		**S**
67	**0.0**		**0.0**		**S**
68	**3.5**		**w/d**		**S**
69	**0.0**		**w/d**		**S**
70	**0.0**		**1.5**		**S**
72	**0.0**		**w/d**		**S**
74	**0.0**		**1.0**		**S**
75	**3.0**		**w/d**		**S**
76	**1.0**		**0.0**		**S**
77	**2.5**		**0.0**		**S**
79	**5.0**	**2.5**	**w/d**		**Q**
81	**0.0**		**w/d**		**S**
82	**0.0**		**0.0**		**S**
83	**3.5**		**3.0**		**S**
84	**0.0**		**0.0**		**S**
85	*****		**0.0**		**S**
86	*****		**1.5**		**S**
87	*****		**2.5**		**S**

A5.3

IDENTIFIER CODE	Round 17		Round 18		Performance Category at 30/06/20
	Score	Follow-up	Score	Follow-up	
88	1.5		1.5		S
89	0.0		0.0		S
90	1.0		w/d		S
92	1.0		w/d		S
95	6.0	1.0, 1.5#	0.0	w/d	S
96	7.0		w/d		U
97	1.0		0.0		S
98	0.0		0.0		S
100	0.0	4.0#, 1.0#	0.0	w/d	S
102	0.0		3.5		S
103	0.0		3.0		S
104	2.0		0.0		S
105	3.0		*		S
106	0.0		*		S
107	1.0		0.0		S
108	8.0	4.5	2.0	1.0#	S
112	0.0		0.0		S
114	0.0		0.0		S
116	1.0		0.0		S
118	0.0		*		S
119	1.0		0.0		S
120	0.0		0.0		S
122	0.0		0.0		S
123	1.0		1.5		S
124	2.5		w/d		S
126	0.0		1.5		S
128	1.0		w/d		S
129	0.0		w/d		S
131	2.0		2.0		S
132	0.0		0.0		S
134	0.0		w/d		S
135	0.0		0.0		S
136	2.0		0.0		S
137	0.0		2.0		S
138	3.0		0.0		S
138	3.0		*		S
142	1.0	0.0#	0.0		S
143	0.0		*		S
144	1.0		0.0		S
145	0.0		0.0		S
146	4.0	3.0	0.0		S
147	*		1.5		S
150	0.0		1.0		S

A5.4

IDENTIFIER CODE	Round 17		Round 18		Performance Category at 30/06/20
	Score	Follow-up	Score	Follow-up	
151	**1.5**		**0.0**		**S**
152	**0.0**		**w/d**		**S**
153	**0.0**		**w/d**		**S**
154	**2.5**		**5.0**	**5.5, 2.0#, 2.0#**	**S**
155	**1.5**		**0.0**		**S**
156	**0.0**		**1.0**		**S**
157	**0.0**		*****		**S**
159	**0.0**		**1.0**		**S**
160	**0.0**		**0.0**		**S**
161	**0.0**		**0.0**		**S**
162	**1.5**		*****		**S**
163	**0.0**		**1.5**		**S**
164	**1.5**		**0.0**		**S**
166	**1.0**		**w/d**		**S**
167	**0.0**		**0.0**		**S**
168	**0.0**		**0.0**		**S**
171	**2.5**		**3.0**		**S**
172	**1.0**		**0.0**		**S**
173	**0.0**		**0.0**		**S**
174	**0.0**		**0.0**		**S**
176	**2.0**		**w/d**		**S**
177	**0.0**		**w/d**		**S**
178	**1.0**		**2.5**		**S**
179	**1.5**		*****		**S**
180	**1.5**		**1.0**		**S**
181	**8.5**	**0.0**	**w/d**		**Q**
182	**1.0**		**1.0**		**S**
183	**1.0**		**1.0**		**S**
185	**2.0**		**0.0**		**S**
186	**4.0**	**0.0**	**0.0**		**S**
187	**3.5**		*****		**S**
188	**2.0**		**0.0**		**S**
189	**1.5**		**w/d**		**S**
190	**0.0**		**2.0**		**S**
191	**1.0**		**1.0**		**S**
192	**0.0**		**1.0**		**S**
193	**2.5**		**0.0**		**S**
194	**0.0**		**0.0**		**S**
195	**1.0**		**3.0**		**S**
196	**1.0**		**w/d**		**S**
199	**2.0**		**3.0**		**S**
201	**1.0**		*****		**S**
202	**1.0**		**0.0**		**S**

A5.5

IDENTIFIER CODE	Round 17		Round 18		Performance Category at 30/06/20
	Score	Follow-up	Score	Follow-up	
203	1.0		w/d		S
205	0.0		4.5		U
206	0.0		1.0		S
207	*		6.0	0.0, 0.0#	S
208	0.0		0.0		S
209	1.5		*		S
211	1.5		1.5		S
212	9.0		1.5		Q
213	1.0		w/d		S
216	0.0		+		S
217	0.0		0.0		S
218	*		0.0		S
219	2.0		*		S
221	0.0		w/d		S
223	0.0		1.0		S
225	2.0		2.0		S
226	1.5		*		S
227	*		0.0		S
228	0.0		w/d		S
230	4.5	0.0	*		Q
232	0.0		*		S
234	5.5		w/d		U
235	1.0		0.0		S
238	0.0		1.0		S
239	0.0		0.0		S
242	1.0		1.5		S
243	1.0		5.5	0.0	Q
244	2.0		1.5		S
245	0.0		*		S
246	0.0		0.0		S
247	6.5	0.0	3.5		S
248	0.0		1.5		S
249	1.0		2.0		S
250	1.0		w/d		S
251	0.0	0.0#	1.5		S
252	*		+		+
253	0.0		w/d		S
254	1.0		1.0	w/d	S
256	1.0		1.0		S
259	5.0	2.0	w/d		Q
260	N		*		+
261	1.0		*		S
262	0.0		0.5		S

A5.6

IDENTIFIER CODE	Round 17		Round 18		Performance Category at 30/06/20
	Score	Follow-up	Score	Follow-up	
263	0.0		*		S
266	1.5		w/d		S
267	0.0		*		S
268	1.5		5.5	0.0	Q
269	1.0		*		S
271	*		1.0		S
272	1.0		4.0	w/d	U
273	0.0		0.0		S
274	1.0		+		S
275	2.0		w/d		S
276	0.0		0.0		S
277	1.0		0.0		S
279	0.0		*		S
280	1.0		0.0		S
282	3.5		2.5		S
283	2.5		w/d		S
284	0.0		*		S
286	0.0		*		S
287	0.0		0.0		S
288	0.0		*		S
289	*		+		+
290	17.0		w/d		U
291	0.0		0.0		S
293	5.0	7.5	w/d		U
295	1.0		w/d		S
296	0.0		0.0		S
297	1.5		1.5	w/d	S
300	1.0		0.0		S
301	0.0		0.0		S
303	0.0		*		S
304	*		0.0		S
305	0.0		w/d		S
307	3.0		*		S
308	0.0		0.0		S
310	1.5		w/d		S
311	2.0		*		S
312	0.0		1.5		S
315	1.0		0.0		S
316	0.0		5.5		U
317	1.5		1.5		S
318	1.0		w/d		S
319	0.0		0.0		S
324	9.5		w/d		U

A5.7

IDENTIFIER CODE	Round 17		Round 18		Performance Category at 30/06/20
	Score	Follow-up	Score	Follow-up	
325	**1.0**		**3.0**		**S**
328	**1.0**		**+**		**S**
329	**3.0**		*****		**S**
330	**0.0**		**w/d**		**S**
331	**0.0**		**w/d**		**S**
333	**6.5**	**2.0**	**1.5**		**S**
334	**0.0**		**0.0**		**S**
335	**0.0**		**w/d**		**S**
336	**1.0**		**0.0**		**S**
337	**2.0**		**0.0**		**S**
339	**1.0**		*****		**S**
341	**2.0**		**0.0**		**S**
343	**0.0**		**0.0**		**S**
344	**1.0**		*****		**S**
345	**0.0**		**0.0**		**S**
346	**2.5**		**0.0**		**S**
347	**1.0**		**0.0**		**S**
348	**1.0**		*****		**S**
349	**0.0**		**0.0**		**S**
351	*****		**3.0**		**S**
352	*****		**0.0**		**S**
353	**3.0**		**1.5**		**S**
354	**1.0**		**w/d**		**S**
355	*****		**2.0**		**S**
356	*****		**7.0**	**1.0 , 0.0#**	**S**
357	*****		**0.0**		**S**
358	*****		**1.0**		**S**
359	*****		**0.0**		**S**
360	*****		**0.0**		**S**
361	*****		**0.0**		**S**
362	*****		**0.0**		**S**
363	*****		**2.0**		**S**
364	*****		**2.0**		**S**
365	**0.0**		**1.5**		**S**
366	*****		**1.0**		**S**
367	**1.0**		**1.0**		**S**
368	*****		**0.0**		**S**
369	*****		**5.0**	**2.0**	**Q**
370	*****		**2.0**		**S**
371	*****		**0.0**		**S**
372	*****		**0.0**		**S**
373	**11.0**	**0.0**	**0.0**		**S**
374	*****		**0.0**		**S**

A5.8

IDENTIFIER CODE	Round 17		Round 18		Performance Category at 30/06/20
	Score	Follow-up	Score	Follow-up	
375	*		2.0		S
376	*		0.0		S
377	0.0		1.0		S
378			0.0		S
379	0.0		w/d		S
380	*		1.0		S
381	3.0		0.0		S
382	2.0		*		S
383	*		3.0		S
384	0.0		w/d		S
385	3.0		*		S
386	*		2.5		S
387	*		1.0		S
388	*		14.5		U
389	6.0	2.5	1.0		S
390	*		0.0		S
391	*		2.0		S
392	*		1.0		S
393	*		4.5	1.5	Q
394	*		3.5		S
395	*		0.0		S
397	*		2.0		S
398	*		0.0		S
399	*		0.0		S
400	*		0.0		S
401	*		0.0		S
402	*		0.0		S
403	*		0.0		S
404	*		0.0		S
405	*		0.0		S
406	*		1.5	1.0#	S
408	*		0.0		S
409	*		0.0		S
411	*		2.0		S
412	*		5.5	1.0	Q
414	1.0		*		S
415	2.5		w/d		S
416	*		0.0		S
417	*		1.5		S
418	0.0		*		S
419	*		2.0		S
420	*		2.0		S
421	0.0		w/d		S

A5.9

IDENTIFIER CODE	Round 17		Round 18		Performance Category at 30/06/20
	Score	Follow-up	Score	Follow-up	
422	**2.0**		*		**S**
423	*		**2.0**		**S**
424	**0.0**		**0.0**		**S**
425	*		**0.0**		**S**
426	*		**0.0**		**S**
427	**0.0**		*		**S**
428	*		**0.0**		**S**
429	**1.5**		**w/d**		**S**
430	*		**0.0**		**S**
431	**0.0**		*		**S**
432	**0.0**		**0.0**		**S**
433	*		**6.5**		**U**
434	*		**0.0**		**S**
435	**0.0**		**0.0**		**S**
436	*		**0.0**		**S**
438	*		**17.5**	**1.5**	**Q**
439	*		**0.0**		**S**
440	**2.0**		**0.0**		**S**
441	*		**1.0**		**S**
442	**0.0**		*		**S**
443			**1.5**		**S**
444	*		**0.0**		**S**
445	**1.5**		**4.0**		**U**
446	*		**2.0**		**S**
447	*		**3.0**		**S**
448	*		**0.0**		**S**
449	*		**0.0**		**S**
450	**2.0**		**1.5**		**S**
456	*		**0.0**		**S**
469	*		**1.5**		**S**
470	*		**0.0**		**S**
472	*		**0.0**		**S**
476	*		**0.0**		**S**
477	*		**0.0**		**S**
487	*		**2.0**		**S**
488	*		**0.0**		**S**
492	*		**0.0**		**S**
494	*		**2.5**		**S**

APPENDIX 6.1

SUMMARY OF IDENTIFIERS' PERFORMANCE

A total of 356 different identifiers took part in either Rounds 17 and/or 18.

The total number of participations (i.e. the number of sets of eight bulk samples issued) in Rounds 17 and 18 (including follow-up) was **554**.

A total of **264** identifiers took part in Round 17 of which **20 (8%)** scored 4 or more (i.e. unsatisfactory) in the initial stage. Of these 20 identifiers, 15 took part in a follow-up exercise. In addition, 5 sets of special follow-up samples were issued to identifiers (i.e. additional follow-up at the participant's request). One participant did not return results for their routine Round 17 samples.

A total of **254** identifiers took part in Round 18 of which **16 (6%)** scored 4 or more (i.e. unsatisfactory) in the initial stage. Of these, 10 identifiers took part in a follow-up exercise, and 6 sets of special follow-up samples were issued during this round.

It should be noted that Round 18 results for 7 identifiers were not available at the time of printing this report.

At the conclusion of Round 18, 92.1% of identifiers were classified as "satisfactory", 3.4% were "questionable" and 3.4 % were "unsatisfactory". Four participants were unclassified due to the fact that their Round 18 results were still pending at the time of printing this report (and they did not participate in Round 17).

Overall, the program reported an **8 % growth** in participant numbers from the previous cycle (i.e. 356 individual identifiers in Rounds 17/18 compared to 330 in Round 15/16). There were **60** withdrawals recorded during Rounds 17 and 18. It should be noted that many of the withdrawals and new enrolments are the same individuals, as they move between organisations. Note, identifiers marked as "withdrawn" have completely withdrawn from the program for that organisation (i.e. not just opted out the most recent round).

NB: The performance category of all identifiers will be reviewed after Round 19 which will be completed by March 2021. This review will take into account the performance in the last two consecutive rounds, i.e. Rounds 18 and 19.

END OF REPORT