Asbestos Limits a Conversation: Webinar

A Presenters View (By Dr Garry Burdett)

Introduction

The FAAM Conference Committee was delighted with the number of people who registered (253) and participated (>150) and the number of questions (~47) and supplied answers in the chat box, in the first 1-hour webinar, "Asbestos Limits a Conversation". The recording of the webinar has since received over 350 views.

This first webinar represents a continuation of FAAMs journey to explore what are the best and most effective ways to reduce exposure to asbestos workers given the current situation and practices worldwide. The amendments to the EU Asbestos Worker Protection Directive (EU-AWPD) published late last year, presents several challenges and a relatively ambitious timeline for EU member states to introduce the proposed reductions and measurement changes to the Occupational Exposure Limit (OEL). While the science and context behind these changes also require further scrutiny, the purpose of this series of webinar was to focus on measurement strategy and compliance. Some of the other issues will be addressed at the next FAAM annual conference (8-9 October 24).

To give a more coherent set of answers to the questions raised and the individual responses made in the chat box during the webinar, one presenter has prepared a broad-brush overview response to some of the main themes raised (e.g. How low can we go, the role and use of respiratory protection equipment (RPE), real-time monitoring versus on-site and off-site microscopic analysis, the potential use of -AI and automation).

Commented [JS1]: Depending on how you define AI, some of the automated options aren't really AI as such, just a standard bit of software following rules. So automation covers all bases a bit more.

Dates, information and registration details for the FAAM conference, and the next two webinars, are available here on the BOHS Website.

Finally, the Conference Committee would like to thank all the participants in the first webinar (in particular, the nocturnal contributions from our FAMANZ colleagues during the event), and from other asbestos professionals worldwide who viewed the You Tube recording -and sent in further comments.

A Presenter's Answers

Presenters' Disclaimer

The development of an EU directive is a multi-stage process involving many actors and influencers, so their meaning is usually only possible to derive by additional legal challenges and interpretation via highly paid lawyers, which none of the presenters of the webinar were. Some directives can in part seem more of a mission statement and EU member states are required to interpret and enact the perceived requirements of the directive into their own national laws. This process is ongoing at present. It is also not unknown that EU directives set

Occupational Exposure Limits (OELs) that are aspirational, and their measurement may not be straightforward, practical, effective and have good scientific underpinning. This is acknowledged in article 22a of the amending directive, **"** *By 31 December 2028, the Commission shall assess the feasibility of a further lowering of the limit values on the basis of the Member States' reports submitted pursuant to Article 22, the availability of scientific evidence, technical developments and the relationship between new analytical methods and the numerical limit value."*

It remains to be seen how this plays out and which Member States will submit a report: it is this which will most likely determine the Commission's view.

Background to the new amending directive

The new EU amending directive makes changes to current directive EC/148/09 which itself replaced and updated previous directives on the same issue dating back to the early1980s. While the directive is focused on "asbestos workers", since the EU wide ban on asbestos in 2005, this is now a very different occupationally exposed cohort than originally perceived. Therefore, instead of the cohorts of mining and manufacturing workers in the 1980s; in the EU in 2024, most asbestos workers are engaged in the maintenance and removal of the in-place asbestos. Therefore the pattern of exposure from a previous static-site production situation with in-place controls, where shift work was predictable, has changed to a much more variable site-by-site situation, where disturbance and removal work takes place at different intensities, on different materials, for variable periods of time - from a few hours to a few weeks in most situations.

The amended EU directive is for the workplace OEL and personal sampling is required. Any other air sampling (e.g. for clearance, leak testing, respirator suitability etc.) has never been part of the EU AWPD or the new amending directive: it is left open to individual EU member states to make their own choices. Also, on matters of health, individual EU members states are free to adopt their own more stringent methods and OELs, if they so wish, some already have.

Sampling of asbestos exposure

In general, standard making bodies such as ISO which produces worldwide applicable standards for asbestos measurement by PCM, SEM and TEM, do so on the basis of three different environments: ambient air, indoor air and workplace air. Different sampling environments usually require different approaches and criteria but can sometimes cover two environments; for instance, ISO 10312:95 for TEM analysis of asbestos in ambient air was updated and extended for use in indoor air in 2019.

Increasing the volume of air sampled onto the filter by increasing the flow rate, or reducing the filter area, was raised multiple times during the webinar, as a way of increasing the Limit of Quantification (LOQ) of air sampling. The problem is that in the workplace environment this is likely to be dustier and samples can become too overloaded with particulates for microscopical analysis. Most current microscopy methods for fibre counting require that <10% of the filter area is covered by particulate, for the analysis to proceed.

Personal samples near the breathing zone of workers have been observed to be up to 10 times higher in fibres and particulates than nearby static samples in the same area and this is often likely to be the case when vigorous removal or disturbance of the asbestos is taking place. Therefore, the ability to sample more air per cm^2 of exposed filter area is highly dependent on the on-site conditions and is only practicable if good dust suppression is being achieved and may even require the filtering of any incoming air.

While the lowering of the OEL by an order of magnitude to 0.01 f/ml by the end of 2025 in the EU is feasible, (e.g. the UK already operates a clearance indicator limit of <0.010 f/ml, based on static sampling) it is more challenging for personal sampling during removal. The widespread availability of personal sampling pumps and batteries, which can reliably operate at the required flow rates over 8 hours, will present a challenge. Especially, if smaller pore size filters are fitted, to enable the thin fibres to be captured efficiently, so they can be viewed in the subsequent electron microscopy analysis.

Control of asbestos and use of RPE

The lower OEL value is predicated on a reduction of the release of fibres into the air through better controls, or the perceived levels of respirator performance. Several people raised the issue of the use of respiratory protection equipment (RPE) and the widely different levels of performance attributed by different EU member states, even though they are CE marked.

In the directive, RPE is allowed to be used to protect workers, when controls are insufficient to meet the OEL. In practice, RPE is widely expected to be used by current asbestos workers but compliance and effectiveness of the RPE is also a big human factors area of concern. In principle, if the respirator worn is assumed to have a x10 reduction in exposure, any measured value below the current 0.1 f/ml OEL would indicate compliance with the new EU 0.01 f/ml OEL coming into force before 21/12/2025.

However, the new language in the EU directive seeks to reduce the use of RPE and therefore requires the use of effective in-place controls: "*Where exposure cannot be reduced by other means and where compliance with the limit value makes necessary the wearing of individual respiratory protective equipment, this shall not be permanent and shall be kept to the strict minimum necessary for each worker. During periods of work which require the use of such equipment, provision shall be made for regular breaks appropriate to the physical and climatological conditions and, where relevant, in consultation with the workers and/or their representatives within the undertaking or establishment, in accordance with national law and practice.*"

Given the ranges of asbestos materials and site variables, to not use RPE and rely on control at source, would seem to require either a lot of faith in those at-source controls, or an efficient and effective real-time fibre monitoring system. Unfortunately, as such a system is not available at present, at best a rapid feedback of the airborne fibre levels from on-site sampling and analysis will be essential to avoid unnecessary exposure of the workers. While RPE should not be viewed as the first method of reducing exposure, there is a strong argument that this is precisely where the precautionary principle, which has been embedded in many EU directives over the last decade, should apply.

Need for EM method

While the x10 reduction in the PCM measured control limit is the immediate point of focus, the switch to EM methods in order to measure "thin fibres", is the "elephant in the room". It has always been stated that the OEL (and in the UK the control limit) for asbestos as measured by PCM is an "index of exposure" and measures only a relatively small percentage of the total number of all the asbestos fibres (all lengths and widths) present in the air. Any change to EM will be "A new index of exposure" and still only represent only a small percentage of all the asbestos fibres present.

The debate on which fibres are responsible for which health effects (note: the new EU directive now lists seven specific asbestos related diseases) has been ongoing for decades and there is no proven or widely accepted scientific answer. Along with higher magnifications and improved resolution, the main advantage of the EM methods is that the microscope can be fitted with an energy dispersive x-ray analysis system that can make discrimination of fibre types possible. This is important for ambient and indoor air environments when many other types of fibres are present but in removal and maintenance, when working with asbestos materials the fibres in the material being disturbed usually dominates the fibre type present in the air in the immediate vicinity of the worker. As the current PCM analysis method counts all visible fibres as asbestos, it will overestimate the asbestos concentration if non-asbestos fibres are present in the material. The same will apply to fibre counting by EM and the visibility of fibres will depend on the sample preparation and the individual instruments used, as well as the magnification.

As EM's have better resolution than a PCM light microscope they can be used to count thinner fibres, but at higher magnification (e.g. 5,000 to 10,000), which means a smaller field of view and / or the additional inaccuracies of full field counting. Should discrimination of the fibres be required this will require significant additional analysis time for each fibre. There are significant differences between SEM and TEM capabilities in this respect and signal to noise ratios means that longer analysis times are required by SEM, particularly when the fibres are "thin". Therefore most SEM analysis in the EU is based on measuring PCM countable fibres.

To render all "thin fibres" (e.g. from 0.01 to 0.2 um diameter/ width) visible and analysable by EDXA (i.e. with good signal: noise ratios) will be particularly challenging by SEM and may require the use of FEG-SEMs, to carry out such analysis, if required. This means that most of the current optical and SEM equipment may need to be replaced by much more expensive TEM and FEG-SEMs.

However, the advantages of the improved analytical capabilities are somewhat wasted by the way the directive treats all asbestos types as equally potent by applying a single OEL to six different mineral types. (Note the directive also looks to add several other non-asbestos minerals to the list in the near future). The scientific report by ECHA, on which the OELs risk analysis is based, found significant differences between fibre types e.g. x470 more potency for amosite and crocidolite asbestos compared to chrysotile asbestos for mesothelioma. However, the amended directive does not require the EM to discriminate the asbestos fibre types but simply to count the thinner fibres at higher magnifications. While the use of more sophisticated and higher resolution EMs to count thinner fibres, has no overwhelming scientific justification in the ECHA science report, the differentiation of the different asbestos fibre types does.

Therefore, the EU directive appears to ignore the opportunity to have a more scientific and epidemiological basis for the control of the risk to asbestos workers.

In practice, for amosite asbestos the use of higher magnification EMs will make only a little difference to the PCM fibre count, given the precision associated with such counts. However, for chrysotile and crocidolite the EM count will give significant increases the fibre counts. The amount of the increase will depend on the type of asbestos material and the presence of other non-asbestos fibres. As it is likely that only EM fibre counting will be required to assess the OEL by EM, several of the underlying assumptions in the OEL still need to be established as applying in the EU and elsewhere (e.g. X5 increase in all thin fibres for all asbestos types, differences between direct and indirect sample preparation, the frequency of exposure of workers to different asbestos types etc.). So before we just count fibres by EM, there is also a need to do some further research, where we discriminate by fibre type, unless it is already a "fait accompli" or just another application of the "Precautionary Principle".

Next steps

Analysis of the feedback questionnaire after the webinar showed a 100% support for more webinars. Therefore the FAAM Conference Committee is pleased to announce two more webinars. The next (second) webinar will take place in September before the BOHS- FAAM Asbestos 2024 conference in Sheffield on the 8 and 9th of October. Following the conference, the third webinar will take place in November. Before this however, the FAAM Conference Committee is organising two initial workshops to give more in-depth information to PCM labs on the use of EM for asbestos analysis. This will allow participants to see and ask questions on the EM methods at first hand. There will be a North and South workshop aimed at laboratory managers and analysts, so they can be better informed on the practicalities, limitations and costs of the different types of EM instruments available. Keep watching the FAAM webpages for further information and announcements.