AIR TODAY, GONE TOMORROW: The case for improving the UK's standards of monitoring airborne asbestos fibres.

Introduction

This paper considers the existing regulation for the management of asbestos in the UK. Specifically, we examine the role of air monitoring, when and how it is done, the technology used, and the control levels adhered to. We compare this with practice in France, where health and safety standards have been reformed and significantly improved. Our contention is that the UK lags behind the regulatory practice of other countries, like France, and that this is contributing to high death rates from unnecessary exposure to airborne asbestos. We therefore conclude with recommendations for how the management of asbestos can be brought in line with international best practice.

Background

Asbestos was a prime material used in the construction of virtually all buildings throughout the 20th century. The UK had been the world's largest importer of asbestos, per capita, until its harms were fully recognised, and the UK Government eventually banned all asbestos-containing materials.[1]

Despite the UK ban, some twenty years ago, this substance remains present in most of our public estate. And because of its historical legacy the UK has the highest death rates from asbestos related diseases in the world. Asbestos is still the nation's number one occupational killer, causing more than 5,500 deaths a year including about 2,600 deaths a year from mesothelioma.[2.] Worryingly, death rates amongst occupations not traditionally linked to working with asbestos, like teachers and nurses, have been rising exponentially due to unnecessary and avoidable exposure to this substance in our schools and hospitals.

The UK's current policy in relation to this increasingly aged and deteriorating material is confined to its management in-situ; this means monitoring and controlling for the condition in which asbestos is kept and maintained over time. Removal is only undertaken when a building is scheduled for demolition or refurbishment, or where asbestos has been disturbed, and is likely to become further damaged, or cannot be protected. The decision to remove

[1] Virta, R.L., 2006, Worldwide asbestos supply and consumption trends from 1900 through 2003: U.S. Geological Survey Circular 1298, 80 p., available only online [https://pubs.usgs.gov/circ/2006/1298/c1298.pdf]
[2] Mesothelioma deaths per year [www.hse.gov.uk/statistics/tables/meso04-20.xlsx]

asbestos is based upon a qualified site assessment. However, air monitoring is not used routinely, to discriminate between "safe" and “unsafe” levels of asbestos in-situ.

Asbestos regulation in the UK

The Control of Asbestos Regulations 2012 (CAR12) is the most recent update to the UK’s asbestos regulations. This states that asbestos should be maintained rather than removed, provided it is in a ‘good condition and well protected either by its position or physical protection’.

The Health and Safety Executive (HSE) requires a duty holder to ‘identify the location and condition of asbestos in non-domestic premises’ and keep a written record of this in order to ‘manage the risk and prevent harm’. In most instances this duty holder would be the owner or leaseholder of the premises. In the case of work premises the duty holder could also be the employer.

The Health and Safety at Work Act 1974 places a duty on every employer to ensure, so far as is reasonably practicable, the health, safety, and welfare of all employees. In addition, CAR12 stipulates that it is the duty of every employer to ‘monitor the exposure to asbestos of any employees by measurement of asbestos fibres present in the air’. This is to ensure that no employee is exposed beyond a legislated control limit. However, air testing is not a routine activity and not all employees are protected from asbestos fibres in the air.

Air monitoring

Asbestos air monitoring (also known as asbestos fibre air monitoring or asbestos air testing) is used to detect the level of asbestos fibres within the atmosphere. It is a legal requirement when asbestos has been removed from a building, or when asbestos has been disturbed and needs remediation, to test that the site is safe and clear of airborne fibres. It is a mandatory part of the site clearance certification process.

The test requires a measured volume of air to be drawn through a 25mm diameter cellulose membrane filter, by means of a sampling pump. The air is pumped and filtered over a predetermined period of time (e.g. 1 hour) in proximity to where the asbestos has been removed or treated. The filter collects airborne particles which are then prepared for examination, under a microscope, by a qualified asbestos analyst. The respirable fibres collected on a measured area of the filter are counted using Phase Contrast Microscopy (PCM), and the concentration of the fibres in the air is calculated. If the concentration of fibres is less than a legislated limit, then the site is declared safe to enter and a ‘clearance certificate’ is issued.

Levels of Exposure

The UK has three levels of exposure relating to different settings and periods of exposure.

The ***Action Level*** and ***Control Level*** were applicable for controlling exposure in asbestos factories and during installation, but since the UK has now banned asbestos these measures are now outdated.

The ***Clearance / Reassurance Indicator*** is now the only level used in the UK and is applied to declare areas 'clear' of asbestos immediately following asbestos removal. The Clearance Indicator is set at 0.01 asbestos fibres per cubic centimetre of air (0.01 f/cm^3).

The ***Occupational Exposure Level*** (OEL) is an indicator which is used across the European Union. This is a measurement to ensure that no worker is exposed to an airborne concentration of asbestos in excess of 0.1 asbestos fibres per cubic centimetre of air (0.1 f/cm^3) in an eight-hour period.[3] Some European countries like Germany and the Netherlands have introduced lower OEL control levels.

Other nations, including France, also have an ***Environmental Exposure Level.*** This is the level that an average citizen can expect to be exposed to while inhabiting or working in a building containing asbestos.

An environmental level has never been introduced in the UK. Instead we have a "clearance" indicator which is used for removing asbestos, where exposures are greatest, but which is higher than general environmental exposure levels in other countries. The UK policy is to "manage asbestos in-situ". To do this effectively, a suitable control level measure is needed.

Table 1: Comparative control levels for asbestos exposure in the UK and Europe

Various Fibre Levels	Units (f/cm^3)
UK HSE "Control" Level	0.1
UK HSE "Clearance" Indicator	0.01
EU Occupational Exposure Limit	0.1
French 'Environmental Limit'	0.005
Dutch Occupational Exposure Limit	0.002
German Occupational Exposure Limit	0.001

Source: Why the UK Needs tighter Asbestos Controls, by Charles Pickles, 2018

[3] Directive 2009/148/EC - exposure to asbestos at work

Asbestos Regulation in France

Until July 2012, the French regulation governing the prevention of asbestos-related risks in the workplace was based on the distinction between the friable and non-friable nature of asbestos materials.[4] The control for the occupational exposure limit, which was set at 0.1 fibres/cm^3, was conducted using Phased Contrast Microscopy (PCM), the same method of analysis currently used in the UK.

In 2009, the French Agency for Environmental and Occupational Health and Safety published guidelines recommending firstly, that asbestos fibres be measured using Transmission Electron Microscopy (TEM), and secondly, that the Occupational Exposure Limit for asbestos be lowered to 0.01 f/cm^3 using this method of analysis.

> NOTE: Transmission Electron Microscopy (TEM) is a far more accurate method of measuring levels of airborne asbestos fibres than Phase Contrast Microscopy (PCM), which is still used in the UK.
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> Electron microscopy can measure up to 0.0005 f/cm3, while PCM can only measure up to 0.01 f/cm^3. Furthermore, electron microscopy can differentiate between the different types of asbestos fibres, as well as other non-asbestos fibres, and can count the number of thin asbestos fibres (TAF), for which carcinogenicity is proven.[5]

Following this recommendation and in order to test the feasibility of using TEM to count asbestos fibres in the work environment, the French General Directorate of Labour organised a measurement campaign from November 2009 to October 2010. The purpose of this campaign was to gather data on the size distribution of asbestos fibres released during operations on asbestos materials in the professional asbestos removal environment according to the dimensional characteristics of the three classes of fibres, defined below:

- "WHO" fibres: length (L) > 5 µm; 0.2 µm < diameter (D) < 3 µm; L/D ≥ 3;[6]
- Thin asbestos fibres (TAF): L > 5 µm; 0.01 µm < D < 0.2 µm; L/D ≥ 3;
- Short asbestos fibres (SAF): 0.5 µm < L < 5 µm; 0.01 µm < D < 3 µm; L/D ≥ 3.

[4] The term 'friable' and 'non-friable' relates to the likelihood of asbestos fibres being released into the air as a consequence of how they are bound (e.g. with cement or other materials) and how easily these materials can be disturbed.
[5] Boulanger G., Andujar P., Pairon J.C. et al. — Quantification of short and long asbestos fibres to assess asbestos exposure: a review of fibre size toxicity. Environmental Health, 2014, Vol. 13, p. 59.
[6] Fibre length and dimensions recommended by the World Health Organisation

The campaign used TEM to determine the concentrations of asbestos fibres in individual samples taken from a professional setting, involving the removal or encapsulation (e.g. covering with paint) of asbestos-containing materials, or any other type of intervention on asbestos-related materials, in both indoor and outdoor environments. Based on concrete scientific and technical evidence, the results of this campaign enabled public authorities to develop regulations on the prevention of asbestos-related risks, notably concerning:

- The methodology of sampling and counting asbestos fibres in the professional environment using TEM
- The conditions for monitoring compliance with the Occupational Exposure Level
- The harmonisation of asbestos risk prevention, by eliminating the notions of friable and non-friable asbestos
- The rules governing the choice of collective protection and personal protective equipment (PPE) according to the dust levels resulting from the implementation of the work processes ("material — technique" pairing).

Campaign Findings

The campaign demonstrated the technical feasibility of controlling asbestos in the workplace using Transmission Electron Microscopy (TEM), regardless of the level of dust. It has shown that TEM can be used to assess the exposure to asbestos fibres more accurately, in order to improve the protection of workers.

The 265 measurement results carried out on worksites, during the campaign, revealed that certain materials and techniques can generate significant quantities of dust beyond which Phase Contrast Microscopy (PCM) can capture and analyse. Furthermore, they confirm that there is no correlation between the results of the PCM counting method and those obtained by TEM.

Direct comparison between the PCM and TEM methods confirmed that, in the majority of cases, PCM underestimates the dust levels when compared to TEM, with this observation being reinforced as dust levels rose. This underestimation of exposure could result in the minimisation of risk and danger, and as a consequence, insufficient health and safety prevention being implemented.

As a result, the French government has removed the definition of friable and non-friable asbestos from the regulations governing the protection of workers against asbestos-related risks. The TEM measurement using individual sampling has been adopted, in order to evaluate the levels of dust resulting from the implementation processes. These assessments are used

to verify compliance with the new Occupational (0.01 f/cm^3) and Environmental (0.005 f/cm^3) Exposure Limits.

To date, France is the only country in the world to assess the exposure of workers to asbestos fibres using TEM.

Discussion

The UK uses a measurement (Clearance Indicator 0.01 f/cm^3) and a method of analysis (PCM – which cannot measure beyond 0.01 f/cm^3) to declare areas safe following asbestos removal or remediation. What we have, therefore, is an air monitoring regime that is used to pass off "clearance" and "reassurance" air monitoring certificates, but which is known to be unsafe as a permanent environmental level.

The clearance indicator is not a 'safe' level for everyday use in buildings. It is what the HSE consider a 'transient indication of site cleanliness' – whereby the concentrations of airborne asbestos fibres are considered as low as 'reasonably practicable', before allowing people to re-enter decontaminated premises. The Clearance Indicator is categorically not 'an acceptable, permanent environmental level'.[7] Unlike other countries the UK does not have a legislated limit for the amount of asbestos fibres that can be permitted in a building as a safe level for everyday use.

The UK's current regime allows a 'clearance level' of airborne asbestos (0.01 f/cm^3) which is five times greater than the 'environmental limit' allowed in France (0.005 f/cm^3) and ten times greater than the acceptable 'Occupational Exposure Limit' in Germany (0.001 f/cm^3).

Not only do the UK's standards for air monitoring lag other countries but research about safe levels of asbestos fibre, which should not be exceeded, are patently ignored. According to research conducted by Hodgson and Darnton[8] asbestos fibre levels for children in schools should not exceed 0.0001 f/cm^3.

These observations raise serious questions about what the UK considers safe compared to other developed European nations. The UK must urgently reform its air monitoring standards. Current practices need to be stopped, since they are both misleading and dangerous.

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[7] Health and Safety Executive (HSE), 2013. 'Managing and working with asbestos: Control of Asbestos Regulations 2012'. [online]. Available at: Accessed: 15 October 2019. The HSE definition work 'licensable work' is explained on P. 85

[8] Hodgson JT and Darnton A (2000), Quantitative Risks of Mesothelioma and Lung Cancer in Relation to Asbestos Exposure, Annals of Occupational Hygiene, 44: 565-602

The HSE is duty bound to adopt best practice, under the Health and Safety at Work Act 1974, but have refused to acknowledge that the French method is an improvement because they do not accept that we may have an ongoing problem with exposure to unsafe levels of asbestos.

There is a lack of awareness, or interest in the scientific evidence for other microscopy regimes, in the UK. There are proven microscopy alternatives to PCM, which is both dated and inadequate. The HSE are obliged to write into Guidance that we should use the "best practicable technique", but they have not done so regarding microscopy for asbestos.

It is now reasonably practicable to measure asbestos fibres far below the UK's existing control level. Consequently, the control level should be reduced.

Conclusion and recommendations

The UK's health and safety regime starts with the presumption that the management of asbestos in-situ is safe, with minimum disturbance, and a remote risk of exposure. This is not plausible, given that we have an estimated 6 million tonnes of asbestos across 1.5 million properties in the UK. Other nations with 'National Asbestos Plans', enhanced testing, and phased removal targets, accept that asbestos in-situ is deteriorating and will release fibres. So why does the UK assume that all asbestos in-situ is safe? This begs the question, 'how much exposure is there?'. The answer is, we do not know.

Regulation of asbestos in the UK cannot ensure that employees, or any other persons using buildings where asbestos is present, are not exposed beyond a controlled level. There is simply no legislated limit for a safe environmental level, while existing occupational levels only apply to the asbestos removal industry to provide a measure of site cleanliness.

Other European nations have introduced higher standards for asbestos air monitoring. Yet the UK remains blind to this best practice and blind to what fibres it can see in the atmosphere.

1. **Government must change the UK's Management of Asbestos In-Situ:**
   - From the current cycle of: Assumption of no risk, backed up by inadequate testing regime, resulting in an absence of evidence to prove there is a risk.
   - To a proposed cycle of: Assumption of risk, supported by sensitive testing to prove / assure public of safety or identify areas of asbestos for removal.

2. **The HSE should accept the findings of the French campaign and adopt the reforms to improve air monitoring of asbestos. Failing this the HSE should undertake a similar program of research to test the feasibility of these methods.**

3. **This should result in an improved air testing regime which can claim to be best practice. The components of such a regime should involve:**

   - The use of Transmission Electron Microscopy
   - Measurement of airborne asbestos fibres to the lowest level technically feasible (0.0005 f/cm^3)
   - A legislated environmental control limit, which at a minimum should be in line with international best practice (0.005 f/cm^3)
   - A routine practice of Detection + Mandatory Periodic Monitoring + Confinement or Removal
   - Mandatory removal of asbestos, where significant deterioration is identified.

4. **The HSE should be properly resourced to undertake these reforms and effectively manage asbestos. The Executive's budget has been cut by £100 million in the past decade, from £231 million in 2009/10 to £129m in 2019/20. The Government has allocated the HSE an extra £14 million to ensure safe workplaces during the Covid19 pandemic, but safety in the workplace is not a temporary measure.**

   The implementation of much needed reforms would constitute the proper management of asbestos in-situ. This would better protect professional asbestos workers, those most at risk of exposure (e.g. workers in building trades such as plumbers-heating engineers, electricians, etc), as well as those who work in and use buildings containing asbestos, including nurses, teachers, and pupils.

   Ultimately these measures will lead to fewer deaths from asbestos related diseases.