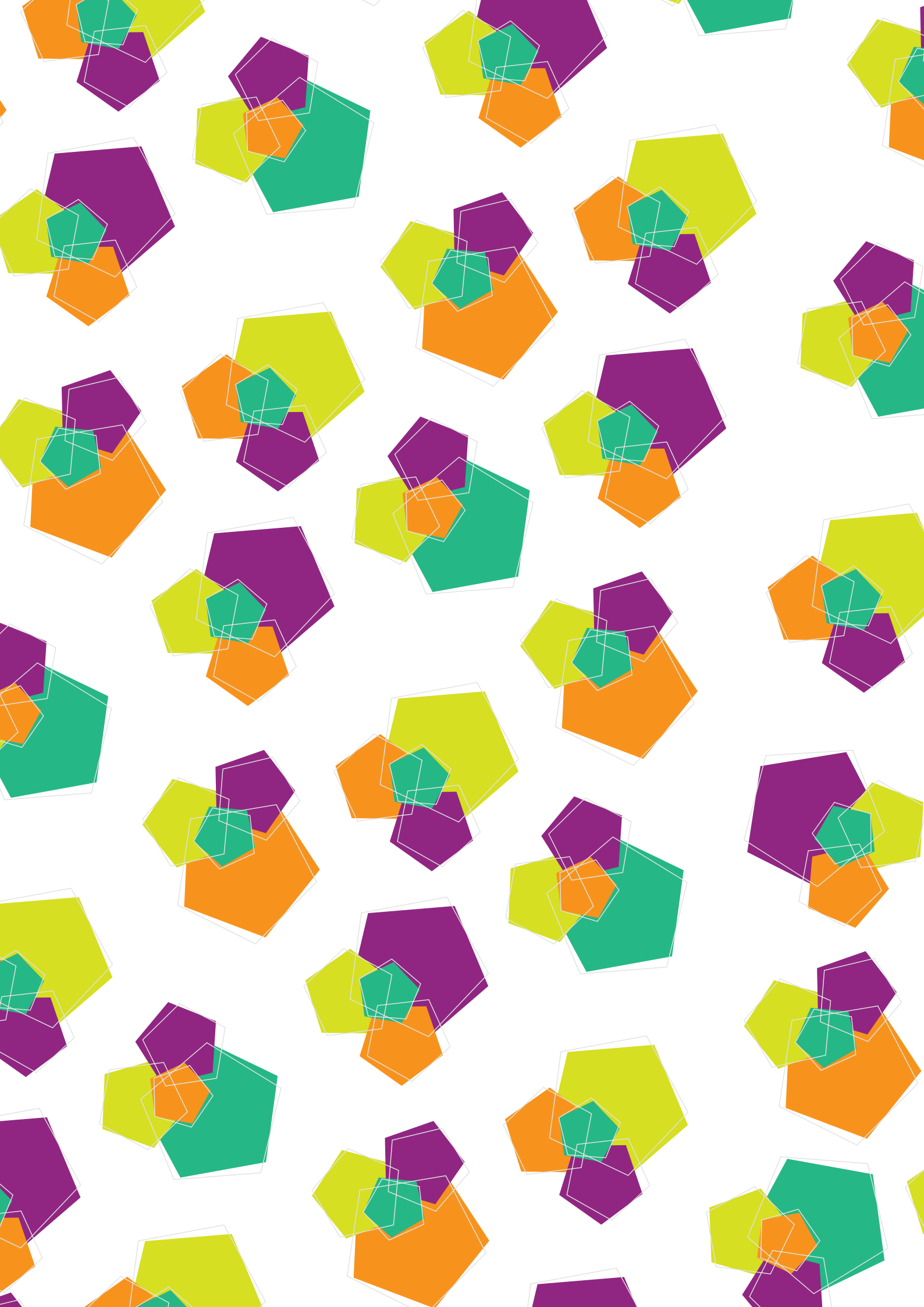
NEU Health & Safety

ASBESTOS FIBRES:
INVISIBLE BUT DEADLY...

What is the real risk from asbestos in schools?

An investigation by Dr Gill Reed

- PhD biochemistry
- MA management in education
- MA labour movement & trade union studies



Executive summary

Introduction

The asbestos industry covered up the risk from asbestos exposure when school buildings were constructed using asbestos from the 1940s until 1999, when its use was finally banned. Since then, despite the increasing evidence that staff and students were at a significant risk of developing mesothelioma cancer caused by asbestos, successive governments have failed to require a measure of the risk from long-term exposure to asbestos in school buildings.

Aim

This report aimed to find out the level of past and current risk to staff and students of developing mesothelioma* from asbestos exposure in school buildings in Great Britain.

Methods

The relationship was investigated between the UK annual import of asbestos since 1940 and the annual measure of teacher mesothelioma deaths since occupational records began in 1980. This included an investigation of the impact on staff and student mesothelioma mortality of the lifespan of school buildings, asbestos damage, mesothelioma latency period and life expectancy.

The estimation of the number of deaths of teacher and support staff (of all ages) from mesothelioma since 1980 was based on Health and Safety Executive (HSE) statistics for the disease. It was presumed that support staff and teachers had the same lifetime risk and duration of exposure.

School staff mesothelioma deaths were then compared with those in other occupations.

The number of mesothelioma deaths according to HSE statistics was compared with the Mesothelioma UK charity findings based on claims for the industrial injuries disablement benefit for mesothelioma and lung cancer in people who worked in schools (and hospitals).

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* Mesothelioma is a type of cancer that develops in the lining that covers the outer surface of some of the body's organs. It is usually linked to asbestos exposure. Mesothelioma mainly affects the lining of the lungs (pleural mesothelioma), although it can also affect the lining of the abdomen (peritoneal mesothelioma) heart or testicles.

The method used in a 1980 investigation by the United States Environmental Protection Agency (EPA) of the lifetime risk and predicted mortality of US staff and students developing mesothelioma was applied to schools in Great Britain. The EPA findings were then compared with the estimated number of GB staff and students who had died since 1980 from mesothelioma.

The effectiveness of the current asbestos regulations and cost benefit analysis process for the identification and prevention of asbestos exposure from buildings like schools was considered in the light of the report findings.

Findings

The steep rise in school staff mesothelioma deaths in the UK between 1980 and 2021 was consistent with the import of asbestos for school building construction between the 1940s and 1999, and the delay arising from the 20- to 60-year mesothelioma latency period between initial exposure and death.

See: Section D, pages 53-60.

Estimates based on the HSE occupational mesothelioma statistics indicated that 839 teachers and 561 support staff have died (with numbers still rising steeply) from mesothelioma since 1980 because they were exposed to asbestos prior to the mid-1990s.

See: Section D, pages 53-60.

According to both Mesothelioma UK and the estimate in this report, school staff mesothelioma deaths since 1980 were considerably higher than was indicated by the HSE statistics.

See: Mesothelioma UK, pages 39-42.

The HSE measure of the proportional mortality ratio (PMR) between 2011 and 2021 indicates that school staff have a significantly higher risk of developing mesothelioma than the average for all occupations. However, this method masks the real risk level. Expert asbestos hygienist Robin Howie (2017) estimated that teachers and nurses between 2002 and 2010 had about five and three times, respectively, more deaths from mesothelioma than expected in populations not exposed to asbestos.

See: PMR, page 25-26.

The United States EPA (1980) investigated the asbestos levels and lifetime risk of both staff and students developing mesothelioma in buildings like schools in 1980. They found the risk was significant and consequently developed the Asbestos Hazard Emergency Response Act (AHERA) regulations for schools. There is no evidence that the UK has carried out a similar investigation.

See: Section C, page 46-47.

This investigation applied the 1980 EPA methodology to Great Britain schools. Comparison of the staff and student mesothelioma deaths in Britain predicted by the EPA with estimates by the UK's joint union asbestos committee (JUAC) 40 years later indicated the number of deaths was far greater in GB schools than predicted by the EPA method for United States schools. Possible reasons include the higher amount of amosite (brown) asbestos in GB schools, more asbestos damage in GB schools and the failure of the EPA 1980 method to take into account the increased life expectancy of children compared to adults.

See: Section C, page 48-49.

The EPA 1980 method predicted that:

- 12,600 GB students exposed prior to the mid-1990s were likely to develop mesothelioma. Adjustment of the EPA method to take account of the known higher expected **life expectancy*** of those students, doubled the number of predicted student mesothelioma deaths to 25,200.

  See: Section D, page 58.

- **damaged asbestos** in buildings which had exceeded their expected lifespan would increase the mesothelioma mortality of staff and students six-fold.

  See: Section C, page 51-52.

The combined effect of the above findings is that hundreds of thousands of students and staff exposed to asbestos in their schools since the mid-1990s are predicted to die in future from mesothelioma.

See: Section D, page 57-59.

Unfortunately, the current asbestos regulations do not identify the level of exposure to the potentially substantial amount of disturbed hidden asbestos that can pass unseen via gaps, eg in wall and ceiling voids, into occupied areas. This has meant duty holders, who have a responsibility for asbestos management, are unaware of the level of asbestos exposure in occupied areas and so funding bids are not informed by the lifetime risk of vulnerable children and staff developing mesothelioma in their schools.

See: Section E, page 62-63.

*Robin Howie (2012) predicted that the known further increase in life expectancy of students in schools since the mid-1990s would substantially increase student and young adult mortality from mesothelioma in future.

See: Section A, page 23.

Conclusion

This report estimated that tens of thousands of school staff and students have already died from mesothelioma due to asbestos exposure before the mid-1990s and hundreds of thousands of staff and students in school buildings are predicted to die from asbestos exposure due to exposure after the mid-1990s. Most of the victims will be exposed as children in schools although their cause of death will be noted under their last occupation.

Almost all the UK population is likely to have attended a school with asbestos. This disaster is not a preventable accident. It is due to the policy of successive governments that have covered up the risk in order to cut costs and reduce disruption.

Thus, they required the development of ineffective asbestos regulations, occupational mesothelioma statistics and proportional mortality ratios, and ignored the much higher risk for children. In so doing they disregarded the findings of the United States EPA (1980), Hodgson and Darnton (2000), the UK committee on carcinogenicity (2013) and Robin Howie Associates (2012; 2022).

The Grenfell Tower inferno, the Post Office Horizon IT scandal and the contaminated blood transfusion scandal in the 1970s-80s also show governments, vested interests, industries and workplaces allowing lives to be sacrificed in order to cut costs and increase profits. Who made those decisions behind closed doors? Surely it is time for the people to have their say.

See: Conclusion, page 76.

Recommendations for government

This report recommends that:

- **The remit of the duty to manage asbestos regulations** should include a measure of the lifetime risk and premature mortality of adults and children developing mesothelioma in all buildings with friable [easy to crumble or damage] asbestos. This should be based on electron microscopy (TEM) measurement of asbestos levels in buildings like schools during normal full occupation.
- **Cost benefit analysis:** Criteria for funding asbestos removal/building replacement should ensure that an imposed mesothelioma risk of one per million per year is the limit of 'acceptable risk' for children and adults in buildings that contain friable asbestos.

See: What is a typical asbestos level and acceptable risk in school buildings? page 64.

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Abstract

The asbestos industry covered up the risk of developing mesothelioma cancer when school buildings were constructed using asbestos (1940s-1999) and successive UK governments – unlike the United States – have subsequently failed to require a measure of the risk from long-term exposure to asbestos in schools despite the increasing number of school staff mesothelioma deaths.

Consequently, evidence derived from the HSE occupational mesothelioma statistics, the United States Environmental Protection Agency (1980) and the committee on carcinogenicity 2013/Robin Howie Associates (2012) suggests that 1,400 UK school staff (of all ages) have already died from mesothelioma cancer due to asbestos exposure prior to the mid-1990s. In addition, 25,200 school students, exposed at the same time, are predicted to die from mesothelioma. However, former school student deaths are recorded under their last occupation.

Today, both the HSE proportional mortality ratios and PMR estimations from Robin Howie Associates indicate that the teaching and educational professions exposed before the mid-1990s have a higher risk of developing mesothelioma than other occupations which also have not included work with asbestos.

This report outlines how predictions based on the EPA 1980 investigation and the work of Robin Howie Associates (2021) on life expectancy indicate that mesothelioma mortality will increase significantly. This is due to exposure to asbestos after the mid-1990s because of increased asbestos damage in buildings that have exceeded their expected lifespan and because of the significant increase in life expectancy of children and young adults. Consequently, hundreds of thousands of former staff and students in schools since the mid-1990s are predicted to die from mesothelioma.

Crucially, the evidence indicates that the United Kingdom asbestos regulations are not designed to detect and measure the lifetime risk of students and staff from exposure to asbestos during everyday activities in buildings like schools. So, the risk will continue to increase until the asbestos is removed.

Recommendations for government

The remit of the duty to manage asbestos regulations should include a measure of the lifetime risk and premature mortality of adults and children developing mesothelioma in all buildings with friable [easy to crumble or damage] asbestos. This should be based on the electronic microscopy (TEM) measurement of the range of prevalent asbestos levels in buildings like schools during normal full occupation.

Cost benefit analysis: Criteria for funding asbestos removal/building replacement should ensure that an imposed mesothelioma risk of one per million per year is the limit of 'acceptable risk' for children and adults in buildings that contain friable asbestos.

See: What is a typical asbestos level and acceptable risk in school buildings? page 64.

Report author and acknowledgements

Author: Dr Gill Reed

Dr Gill Reed has acted as technical adviser to JUAC; AiS member; past National Union of Teachers (NUT) health and safety working group member; past Brent NUT health and safety adviser; represented NUT members on Brent corporate health & safety committee and Brent schools health & safety committee; past NUT representative Willesden High School; past teacher; past governor Willesden High School.

Author of:

- Continuing government failure leads to rise in mesothelioma deaths. Are pupils and staff and safer today? (2021)
- Why unsafe asbestos may still be in our schools in the 2050s (2017).

Co-author of:

- Asbestos management in Brent schools: local and national implications (2016).

Acknowledgements

Many organisations and people were involved in this report and I would particularly like to thank Hank Roberts, Peter Allmark (Mesothelioma UK), Charles Pickles and the National Education Union (NEU).

Introduction: Magic mineral, or killer?

Asbestos is a fibrous silicate mineral. During the 20th century it was widely used because of its insulation and fireproof properties in building materials, car brake pads and consumer products such as ironing boards, fire blankets and heatproof mats**.** It was promoted by the asbestos industry as the **'magic mineral'**.

However, asbestos had been known as a killer since Roman times.[1] During the widespread use of asbestos in building construction in the post-war boom from the late 1940s it became increasingly apparent that it was causing an alarming number of diseases such as asbestosis, lung cancer and mesothelioma cancer.

Dr Alan Dalton raised the alarm in his worker/community guide Asbestos, Killer Dust in 1979. His introduction warned that: "Asbestos exposure will kill more people in Britain than were killed in the armed forces during the second world war", and his book exposed the deadly asbestos industry cover-up of the real risk from asbestos, aided and abetted by corrupt doctors and scientific 'experts' during asbestos mining and building construction.

Dalton was sued and bankrupted for his corruption allegations – despite every single allegation now being accepted as fact.[2]

Today estimates based on the Global Burden of Disease (GBD) study (2016) indicate that over half a million people in the UK have already died from asbestos-related diseases (ARDs).[3]

However, the HSE ARD statistics still only indicate 112,000 people have died between 1978 and 2018.[4] [5]

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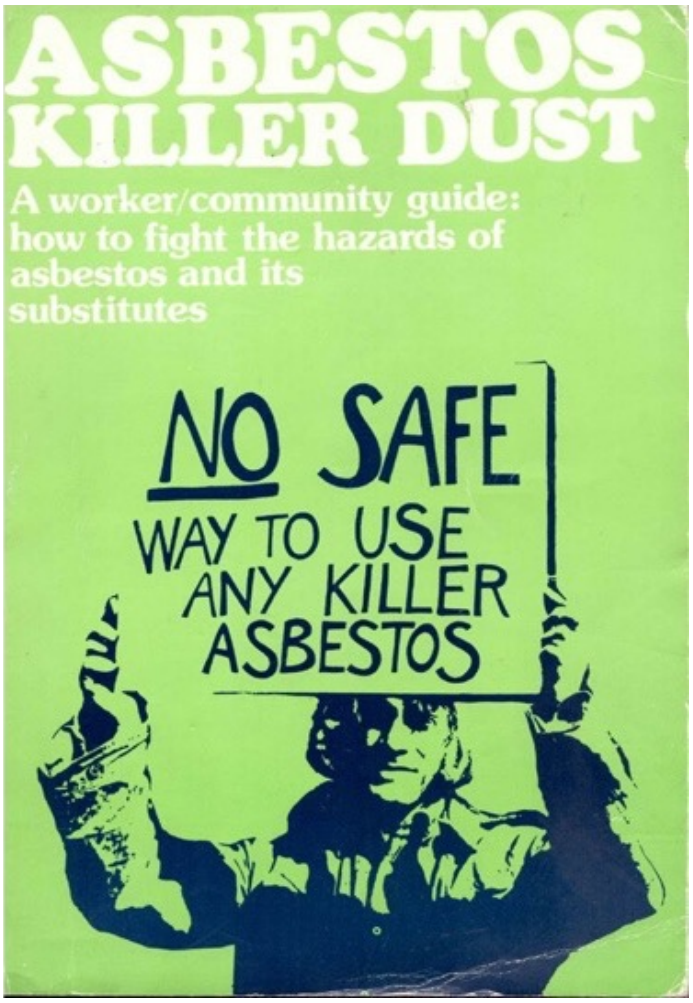
1 Note: Pliny the Elder (AD 24-79) wrote in his Natural History that those working in asbestos mines were more prone to "lung sickness". He recommended quarry slaves from asbestos mines should not be purchased because of their high incidence of early death

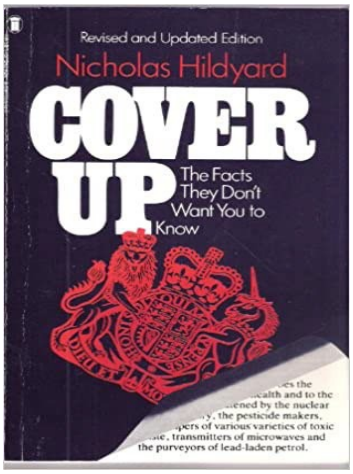
2 hazards.org/alandalton/beannoying.pdf

3 Global, regional, and national comparative risk assessment of 84 behavioural, environmental and occupational, and metabolic risks or clusters of risks, 1990–2016: a systematic analysis for the Global Burden of Disease Study 2016 – The Lancet

4 The breakdown of UK occupational asbestos-related deaths for 2016 in the GBD study was: mesothelioma 2,837; lung cancer 14,056; ovarian and larynx cancer 934; and asbestosis 209 (also, 27 deaths from non-occupational mesothelioma). This produced a total of more than 18,000 asbestos-related deaths according to the GBD study compared with around 5,000 estimated by the HSE. Global Burden of Disease Study 2016. September 16, 2017. See: Reflecting on the 20th Anniversary of Britain's Asbestos Ban, Laurie Kazan-Allen (britishasbestosnewsletter.org/ban109.pdf)

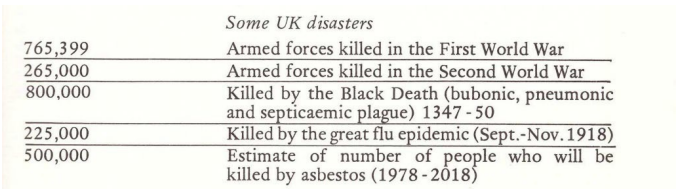
5 HSE Mesothelioma statistics for Great Britain 2022





Cover Up: The Facts They Don't Want You to Know by Nicholas Hildyard. 2nd edition published 1983.

Page 163 – "The Romans were well aware of asbestosis."



Some UK disasters

765,399	Armed forces killed in the First World War
265,000	Armed forces killed in the Second World War
800,000	Killed by the Black Death (bubonic, pneumonic and septicaemic plague) 1347 - 50
225,000	Killed by the great flu epidemic (Sept.-Nov. 1918)
500,000	Estimate of number of people who will be killed by asbestos (1978 - 2018)

Table at front of Alan Dalton's book published in 1979

This disparity between the GBD study and HSE data is because asbestos is now known to act synergistically with tobacco smoke in causing lung cancer.[6] [7] So, the HSE assumption means that they have considerably underestimated the number of ARD deaths.

The HSE occupational national statistics indicate most of the deaths initially occurred in people involved in mining, manufacturing and building construction often many decades after exposure.

We now know that the UK has the highest incidence of mesothelioma in the world and the annual death toll from ARDS still exceeds 18,000 each year. This is because asbestos use in UK buildings was increased and promoted on an industrial scale for fireproofing and insulation during the post-war building boom. In addition, countries like UK and Australia, which used vast amounts of amosite (brown) asbestos, were found to have a much higher incidence of ARDs like mesothelioma.[8] [9]

6 Asbestos, Smoking and Lung Cancer: An Update. S Klebe, J Leigh, D W Henderson, M Nurminen. Int J Environ Res Public Health 2020 Jan 17(1):258. See: ncbi.nlm.nih.gov/pmc/articles/pmc6982078/#

7 Note: The disparity between the HSE and GBD estimates arises from the difficulty in identifying most asbestos-related diseases and the impossibility of distinguishing asbestos-related lung, ovarian and larynx cancer from other types of lung, ovarian and larynx cancers. The HSE data presumes there is one asbestos-related lung cancer death for every mesothelioma death while the GBD presumes 5 asbestos-related lung deaths for every mesothelioma death

8 HSE Emma Tan, Nick Warren RR876 Mesothelioma Mortality in Great Britain 2011

9 C Rake, C Gilham, J Hatch, A Darnton, J Hodgson & J Peto, British Journal of Cancer (2009) 100, 1175-1183 & 2009. Cancer Research UK. See page 1182

Schools

Today we also know that UK school buildings constructed between the 1940s and 1980s have far more legacy amosite asbestos than other public buildings and most of these are still being used.[9] Moreover, the HSE has warned that school student activities are highly likely to disturb asbestos.[10]

The HSE occupational mesothelioma statistics show that the incidence of mesothelioma in former school teachers and staff has increased steadily since 1980, presumably due to asbestos exposure 20-60 years previously. The HSE claims that the current asbestos regulations identify unsafe asbestos and so schools are safer today.[11]

However, evidence submitted by the joint union asbestos committee (JUAC) to the government works and pensions committee inquiry shows that the regulations are unable to identify disturbed inaccessible asbestos which can pass via gaps, eg in wall and ceiling voids, into occupied areas and that they take no account of the known risk to children.[12]

In 1991, Landrigan in the United States had warned about the increased vulnerability of children to developing mesothelioma after even a low level of asbestos exposure. He predicted this would lead to a third wave of asbestos-related disease in future.[13] Moreover, Darnton has recently estimated a ratio of 8.4 and 35.8 lung cancer deaths per mesothelioma case in people who worked with crocidolite (blue asbestos) and amosite respectively.[14]On that basis, Mesothelioma UK estimated that 837 former school staff would die each year from asbestos-related disease (748 former school staff due to lung cancer plus 89 school staff deaths due to mesothelioma).[15] This failure of the asbestos regulations to identify the level of asbestos exposure in schools is therefore a serious concern.

---

10 HSE HSG227 A comprehensive guidance to managing asbestos in premises. 2002

11 Control of Asbestos at Work Regulations 2002; Control of Asbestos Regulations 2006; Control of Asbestos Regulations 2012

12 JUAC submission to work & pensions committee inquiry 2021/22. HC CWP The Health & Safety Executive's Approach to Asbestos Management HC560. committees.parliament.uk/writtenevidence/39184/html/

13 A population of children at risk of exposure to asbestos in place. Philip Landrigan. Mount Sinai Annals of New York Academy of Science 1991

14 Lucy Darnton doi.org/10.1016/j.envres.2022.114753 Quantitative assessment of mesothelioma and lung cancer risk based on phase contrast microscopy (PCM) estimates of fibre exposure: an update of 2000 asbestos cohort data. Environmental Research 230 (2023) 114753

15 Mesothelioma UK. 2024 Clearing the air: The costs and benefits of removing asbestos from UK schools and hospitals

Profit or safety?

As the death toll from ARDs gradually increased, the carcinogenic nature of asbestos become increasingly apparent but school building construction using asbestos continued from the late 1940s to 1999 when asbestos use was finally banned.

In his annual report for 1898, the Chief Inspector of Factories and Workshops wrote in detail about the "evil" effects of asbestos dust.[16]

Even in the 1960s and 1970s, the widespread use of asbestos in UK building construction was not due to ignorance about the potential risk to building occupants. Indeed, the Chief Inspector of Factories had further warned about the risk of developing mesothelioma from very low levels of asbestos exposure in 1965[17] and the Chief Medical Officer of the Factories Inspectorate warned the Department of Education and Science (DES) in 1967 of the particular risk to children and advised against the use of asbestos in school buildings.[18]

> *"How do we come to have this massive, and preventable, epidemic of asbestos-related disease?*
>
> ***One simple word: profit.***
>
> *It has been very profitable to push this deadly dust into all our lives (schools, hospitals, homes and work- places) over the past 100 years until very recently."*
>
> See: New Scientist. Killer dust, AJP Dalton letter published 8 April 1995

Unfortunately, their concerns were not acted on and the building of schools with substantial asbestos continued.

Indeed, pressure from the asbestos industry (notably companies Cape Asbestos and Turner & Newall) had even led to the watering down of DES guidance regarding the risk from asbestos exposure in school buildings.[19] [20] [21]

16 ibasecretariat.org/workshop-report-1898.pdf

17 Annual report of HM Chief Inspector of Factories on Industrial Health. 1965 p82

18 Letter: Dr Lloyd Davies, Head Medical Officer Factories Inspectorate. Ministry of Labour/Department of Education. 6 Mar 1967

19 DES Administrative Memorandum AM20/67. Inhalation of Asbestos Dust.18 Jul 1967

20 Mesothelioma Register 1967-68. Greenberg, Lloyd Davies. Department of Employment. British Journal of Industrial Medicine. 1974 31, 91-104

21 Cape Documents – Asbestos Victims Support Group Forum UK (asbestosforum.org.uk)

The Board of Trade as well as the Department of Education architects and building branch also gave support to the flawed claims of the asbestos industry.[22]

Crucially this has meant that school staff, parents and the public were not given the full facts about the increasing evidence of the potential risk in buildings they occupied.

See: Section A. Evidence for risk from cumulative asbestos exposure and increased life expectancy, pages 19–25.

Cost-cutting or safety?

Today, despite the introduction of the duty to manage into the asbestos regulations since 2002, successive UK governments have made no attempt, on grounds of cost, to require asbestos regulations that ascertain the lifetime risk of children and staff developing mesothelioma due to long-term exposure in buildings.[23] [24]

This report therefore has investigated the risk of staff and students developing mesothelioma due to asbestos exposure in their former GB schools.

In particular, this report:

- outlined the evidence of risk to school occupants from long-term cumulative asbestos exposure and increased life expectancy
- investigated how many school teachers, support staff and students have died from mesothelioma (1980-2021)
- estimated the lifetime risk (based on the United States EPA 1980 study) of developing mesothelioma in GB schools
- investigated why school mesothelioma deaths are increasing
- investigated why the current asbestos regulations are ineffective for duty holders of buildings like schools.

22 Letter: Dr R Gaze, director Cape Asbestos, J Waddell, director Turner & Newall, chairman Asbestos Information Committee/Secretary of State for Education and Science. 16 Aug 1967

23 Control of Asbestos at Work Regulations 2002; Control of Asbestos Regulations 2006; Control of Asbestos Regulations 2012

24 Secretary of State for Education and Employment written reply to Mr Michael Clapham, June 1997

A.

Evidence for risk from cumulative asbestos exposure and increased life expectancy

This section outlines the evidence regarding the risk of developing mesothelioma from:

Cumulative asbestos exposure	**Increase in life expectancy**	**Proportional mortality ratio**
Sections 1 to 6	Section 7	Section 8

Risk from cumulative asbestos exposure

The risk of developing mesothelioma increases over time because inhaled asbestos fibres accumulate in the body. This is called cumulative asbestos exposure.

The risk of developing mesothelioma from cumulative asbestos exposure:[25] Ref 28

- increases with duration of exposure
- depends on the type of asbestos fibre so risk of developing mesothelioma is in the ratio 1:100:500 for chrysotile (white asbestos), amosite and crocidolite respectively
- decreases with age so children have a much higher risk.

Crucially from 1980 there is evidence that long-term exposure to the asbestos levels found in buildings like schools significantly elevates the risk of staff and particularly children developing mesothelioma in future.

See evidence outlined briefly in sections 1 to 7 below.

1

The United States Environmental Protection Agency (1980) investigation used cumulative asbestos exposure levels to estimate the number of mesothelioma deaths for school staff and children in buildings with friable asbestos:[26]

See: Section C. The lifetime risk (based on 1980 EPA measure) of developing mesothelioma in GB schools, pages 46-52.

The agency [EPA] has determined that exposure to asbestos in school buildings poses a significant hazard to public health. This determination is based on the following considerations:

25 Cumulative asbestos exposure is measured by multiplying the average airborne asbestos level times the number of years of exposure. For example, the average level of asbestos in a building with asbestos in a good condition is: 0.0005f/ml. if a person was exposed to this level of asbestos for 30 years the cumulative asbestos exposure would be 30 years x 0.0005f/ml = 0.015f/ml.years.

26 US EPA, Asbestos-Containing Materials in Schools: Health Effects and Magnitude of Exposure. October 1980. Available at: 1.usa.gov/1AhBIQs

- the extent of use of friable asbestos-containing materials in schools
- the number of diseases which epidemiologic studies have shown to be caused by exposure to asbestos
- the evidence of elevated airborne concentrations of asbestos in schools and other buildings where friable asbestos-containing materials are present
- an estimate of the degree of risk posed by these concentrations.

2

The Medical Research Council (1997) estimated that exposure to asbestos in school contributes to a significant accumulation of asbestos in children's lungs.[27] As there are over nine million children in schools and about 80 per cent of schools contain asbestos, most of the population may have an elevated risk of developing mesothelioma in future due to asbestos exposure in their former schools.

"Children attending schools built prior to 1975 are likely to inhale around 3,000,000 respirable asbestos fibres (roughly 10% of the higher estimate of the burden from ambient lifetime exposure or 1000% of the lower estimate).

Exposure to asbestos in school may therefore constitute a significant part of total exposure."

3

The Hodgson and Darnton paper (2000)[28] **Table 11** developed "summary statements of the quantitative cancer risks from asbestos exposure at different levels of cumulative exposure for chrysotile, amosite and crocidolite". Table 11 indicated there would be a significant risk from cumulative asbestos exposure of school occupants at the levels found in system-built schools.[56] This was confirmed by the HSE watch (working group on the assessment of toxic chemicals) committee in 2011.[29]

At exposure levels seen in occupational cohorts it is concluded that the exposure specific risk of mesothelioma from the three principal commercial asbestos types is broadly in the ratio 1:100:500 for chrysotile, amosite and crocidolite respectively.

27 Fibrous materials in the Environment. MRC Institute for Environment and Health, p71

28 Hodgson and Darnton, Ann Occup Hyg, Vol. 44, No. 8, pp. 565-601, 2000. The quantitative risks of mesothelioma and lung cancer in relation to asbestos exposure.

29 Final HSE WATCH position on asbestos risk assessment: February 2011.

4

Robin Howie (2005) estimated[30] that asbestos levels found in schools with asbestos in a good condition (ie 0.0005f/ml) were unsafe for long-term exposure by children.

"

It is possible to estimate from Hodgson and Darnton the ambient asbestos exposure concentrations which, taking account of exposure durations, should not be exceeded for pre-school children in the home and for children in schools.

For crocidolite, these concentrations are 0.000001 and 0.00003 fibres/ml respectively and for amosite are 0.00004 and 0.0001fibres/ml respectively."

5

The UK government's committee on carcinogenicity (2013) confirmed that children are far more likely to develop mesothelioma after exposure to a given amount of asbestos than an adult.[31]

"

Because of differences in life expectancy, for a given dose of asbestos, the lifetime risk of developing mesothelioma is predicted to be about 3.5 times greater for a child first exposed to asbestos at age 5 compared to an adult first exposed at age 25 and about 5 times greater when compared to an adult first exposed at age 30."

6

In 2017 Robin Howie, an expert asbestos hygienist, made estimations based on HSE teacher occupational mesothelioma statistics and Hodgson and Darnton's cumulative asbestos exposure findings (2000) that suggested both teachers and nurses were likely to have been exposed to airborne asbestos fibre concentrations significantly higher than typical in buildings containing asbestos in a good condition. Howie concluded:

30 Robin Howie 2005. Asbestos in buildings: The risks. healthandsafetyatwork.com/content/asbestos-buildings-risks

31 Committee on carcinogenicity of chemicals in food, consumer products and the environment CC/13/S1: Statement on the relative vulnerability of children to asbestos compared to adults.

"From Hodgson and Darnton (2000) the likely cumulative exposures over 30 years would need to have exceeded the equivalent of about 0.15 fibres/ml.years of amosite for teachers or about 0.06 fibres/ml.years of amosite for nurses to cause the number of observed mesothelioma deaths in each profession during the period of interest. The above figures indicate that airborne asbestos fibre concentrations in both schools and hospitals need to be substantially reduced."

7

Professor Peto, Professor of Epidemiology, London School of Hygiene and Tropical Medicine, (2023) outlined the current mesothelioma risks from asbestos in British schools.[32]

"Background: Asbestos was installed in many British schools up to the late 1970s, and the mesothelioma death rate in female teachers is now 40% higher than in other women (111 deaths versus 79.5 expected overall; 19 versus 12.3 expected in teachers born since 1955).

A linear relationship between asbestos lung burden and mesothelioma risk was seen in a national case-control study and in the decline in both average asbestos lung burdens and mesothelioma risks in successive British birth cohorts born up to the 1980s.

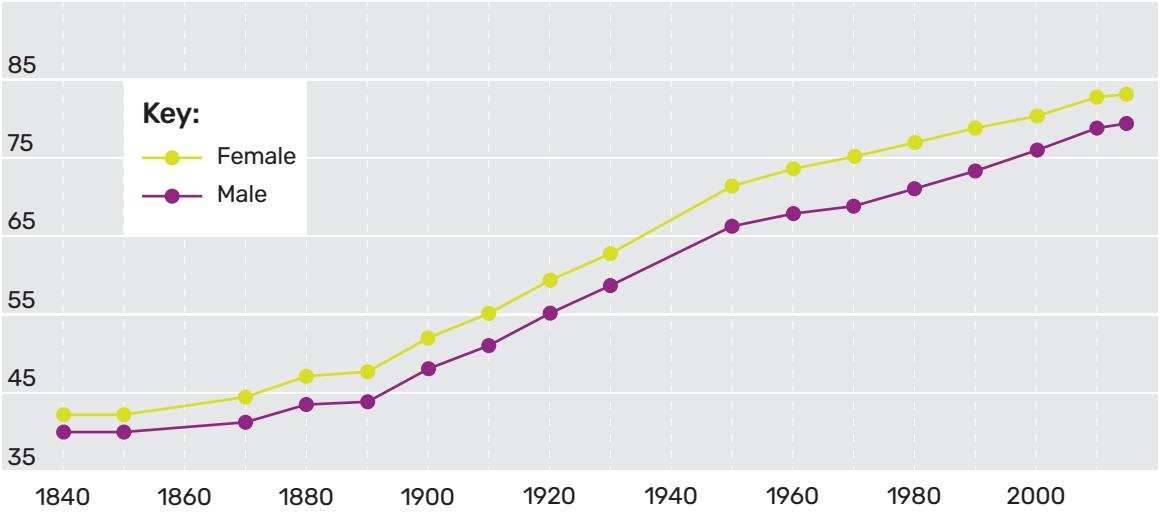
However, an increase in asbestos exposure to children since the 1980s is suggested by the recent increase in annual mesothelioma deaths in Britain below age 40 (2.7 per year 2008-2017, 6.3 per year 2018-2021). We plan to study this by collecting lung samples for asbestos fibre counting from teachers who have ever had an operation for pneumothorax (collapsed lung) and from recent mesotheliomas aged under 40."

32 Julian Peto. Departmental Seminar, Tuesday 28th Nov 2023, 12:50-13:50.

Life expectancy and mesothelioma risk

The Office for National Statistics (ONS) graph below shows the life expectancy in Great Britain from 1840 to 2016.[33]

Life expectancy in England and Wales, 1840-2016, ONS



Average life expectancy increased from 72 for women and 66 for men in 1951, up to 79 for women and 73 for men in 1991. In 2011 average life expectancy had reached 83 for women and 79 for men. Since then, life expectancy has flatlined.

Robin Howie investigated the effect of children's age and life expectation on mesothelioma risk based on Hodgson and Darnton's estimated data.[34] [35]

He estimated that pre-school and school-aged children were significantly more likely to develop mesothelioma by age 80 than equally exposed adults.

See risk in tables below:

33 Life Expectancy in Great Britain 1840-2016. National Life Tables. Office for National Statistics.

34 Robin Howie (2012). Effect of children's age and life expectation on mesothelioma risk. Submitted to committee on carcinogenicity in 2013.

35 Hodgson and Darnton. Ann Occup Hyg, Vol. 44, No. 8, pp. 565-601, 2000. The quantitative risks of mesothelioma and lung cancer in relation to asbestos exposure.

Table 1:

Adjustment factors for children and young adults likely to survive to age 80 relative to adults at age 30 who will survive to age 80

Start age	0	5	10	15	20	25	30	40	45	50
Factor	7.0	5.3	4.0	3.0	2.1	1.5	1	0.4	0.2	0.1

Table 2:

Adjustment factors for children and young adults likely to survive to age 90 relative to adults at age 30 who will survive to age 90

Start age	0	5	10	15	20	25	30
Factor	11.3	8.9	7.0	5.3	4.0	3.0	2.1

Table 3:

Adjustment factors for children and young adults likely to survive to age 100 relative to adults at age 30 who will survive to age 80

Start age	0	5	10	15	20	25	30
Factor	17.3	14.0	11.3	8.9	7.0	5.3	4.0

Howie noted that the tables above indicate that with increasing life expectancy there would be an increasing number of students and staff cohorts who would live to 90 and 100, and so have a higher risk of developing mesothelioma.[36] For example:

- A child of five who lived to 90 years would have a risk of 8.9 and a 30-year-old adult a risk of 2.1.
- A child of five who lived to 100 years would have a risk of 14.0 and a 30-year-old adult a risk of 4.0.

In consequence Robin Howie stated:

- "Increasing life expectancy therefore has a significant impact on mesothelioma risk for both children and young adults."

36 Office for National Statistics 2016. What are the chances of living to 100?

- "If a background cumulative exposure of 0.01 fibre/ml.year were deemed acceptable for today's adults, background levels would have to be reduced to 0.001, 0.0005 and 0.0003 fibres/ml for five-year-olds with life expectancies of 80, 90 and 100 years respectively, and to 0.0007, 0.0004 and 0.0002 fibres/ml respectively in residential properties where babies may be exposed to asbestos from birth."

Despite the evidence cited above, the government has not required the HSE to take the increased risk to children life expectancy into account in the duty to manage section of the asbestos regulations since 2002.

See: Duty holders have responsibility but are not aware of the risk, page 62.

The HSE has long argued that their estimated PMRs have not supported the view that former teachers and nurses are at particular risk compared to the general population. However, this was because their PMRs compared the mesothelioma deaths of different occupations with the average PMR for all occupations, including those who worked with asbestos. They were not a measure of absolute risk.

In contrast, Robin Howie compared the number of teacher and nurse deaths (2002-10) from mesothelioma with a population that had not been exposed to asbestos and found that the school staff (1960-80) and nurses who died from mesothelioma between 2002 and 2010 had about five and three times, respectively, more deaths from mesothelioma than a population not exposed to asbestos.[37] [38]

Howie (2022) noted that according to HSE local government districts (1976-99) female mesothelioma data,[39] the number of idiopathic mesothelioma deaths (not due to asbestos exposure) appears to be only 0.02 per million per year in areas with zero mesothelioma deaths. This is far lower than the one mesothelioma death per million estimated by Tan and Warren (2011) and suggests that many idiopathic deaths were due to asbestos exposure.

More recently, the HSE PMRs for the female teachers and educational workers mesothelioma category were found to be significantly higher than the average for other occupations between 2011 and 2021, and the trend (bold line) was significantly increasing. The PMR for the same female teacher and education category in 2001-10 was not elevated.[40]

37 Robin Howie, Robin Howie Associates, Edinburgh. Mesothelioma deaths in teachers and nurses in Great Britain. Environmental Health Scotland, Volume 29, No 4 2017, pages 35-37.

38 Robin Howie Associates. Written evidence (ASB0021) to work & pensions committee. HSE approach to asbestos management HC 560. committees.parliament.uk/writtenevidence/39366/html/

39 HSE (2003). Mesothelioma Occupation Statistics: male and female deaths aged 16-74 in Great Britain 1980- 2000 (excluding 1981). Health & Safety executive: Bootle.

40 SE Mesothelioma Mortality by Occupation in Great Britain. July 2023.

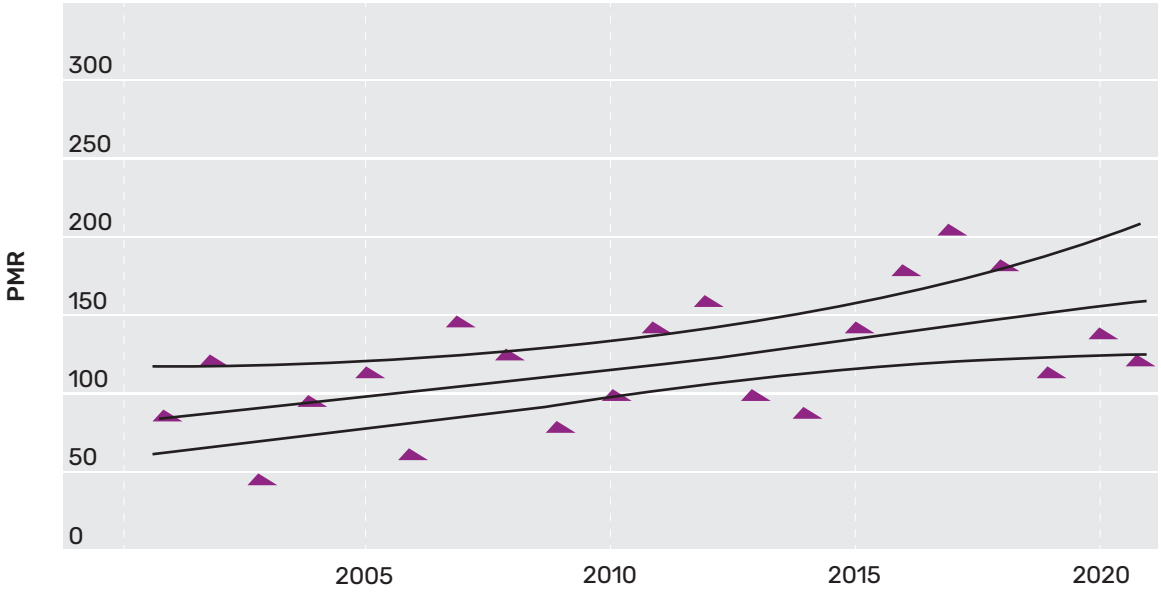
Proportional mortality ratio (2011-21) and mesothelioma risk

See graph for group 23 teaching and educational professionals below:

Group 23: Teaching and educational professionals (120 deaths, PMR=140.6, 95% CI: 116.5, 168.1). (2011-20: 113 deaths, PMR=141.9, 95% CI: 116.9, 170.6).

23 Teaching and educational professionals

2011-21: 120 deaths, PMR 140.6 (116.5, 168.1)
2001-10: 75 deaths, PMR 96.1 (75.6, 120.5)



Although schools are attended for up to 15 years by more than nine million students and for up to 30-50 years by over a million staff, there are no plans by the government to identify the schools that are placing staff and students at risk today from long-term asbestos exposure.

On the basis of his findings, Howie (2021) has proposed that "a better index of absolute risk would be to express the number of observed mesothelioma deaths in each occupation as a ratio of the All-Cause Deaths for each occupation".

See: Appendix B, page 82.

Summary

Cumulative asbestos exposure and mesothelioma risk

- The EPA (1980), Hodgson and Darnton (2000) and Robin Howie (2017) found the risk of developing mesothelioma significantly increased with duration of exposure.
- The MRC (1997), Professor Peto (2023) and Howie (2017) found that asbestos exposure in school led to a significant accumulation of asbestos in lungs.
- The committee on carcinogenicity (2013), Professor Peto's statement (2013); the EPA (1980) and Robin Howie (2005) noted that children have a higher risk of developing mesothelioma after asbestos exposure in school buildings.

ONS: Life expectancy, PMR and mesothelioma risk

- Robin Howie estimated that increasing life expectancy has a significant impact on mesothelioma risk for children and young adults
- Robin Howie estimated that teachers and nurses had about five and three times, respectively, more mesothelioma deaths than expected in populations not exposed to asbestos.
- The HSE proportional mortality ratio (2011-21) in the female teachers and educational workers mesothelioma category was found to be significantly higher than the average for other occupations.

B.

How many former school staff and students have died from mesothelioma?

This section investigates how many former school occupants have died from mesothelioma since 1980. It outlines the various assumptions that underpin all the methods used.

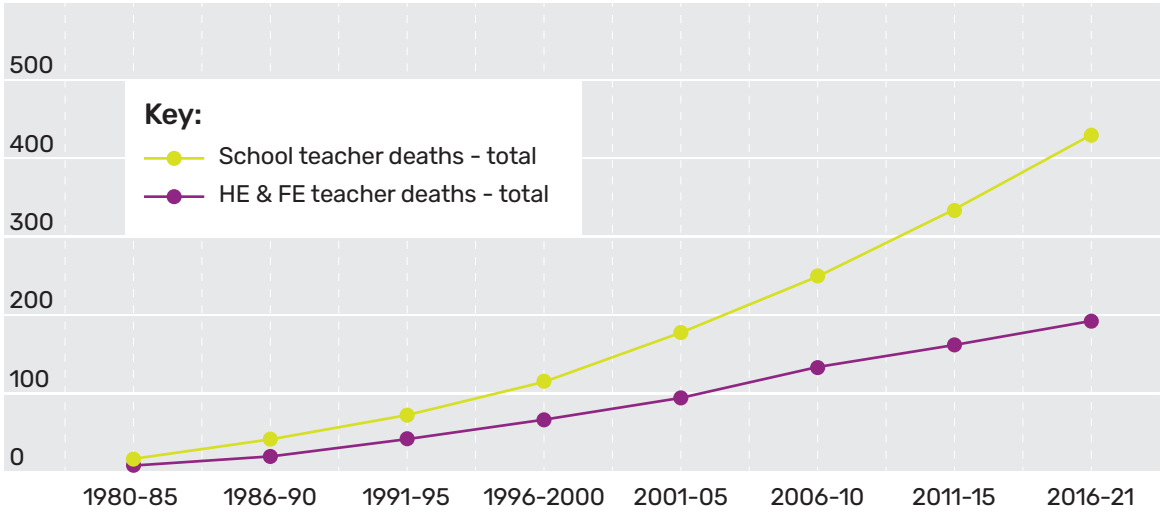
The findings are used to estimate the lifetime risk and number of premature deaths due to mesothelioma in Section C.

HSE mesothelioma deaths (aged under 75) 1980-2021

This section investigates when asbestos was imported into the United Kingdom and outlines four methods used to estimate school occupant mesothelioma deaths:

- **HSE measure of teacher mesothelioma deaths (aged under 75) 1980-2021**
- **estimated GB teacher mesothelioma deaths (all ages) 1980-2021**
- **estimated GB teacher and support staff mesothelioma deaths (all ages)**
  - **estimated number of teachers and support staff 1955-2021**
  - **estimated GB school staff mesothelioma deaths (all ages) 1955-2021**
- **Mesothelioma UK estimate of mesothelioma deaths in school and hospital workers.**

Teachers' Mesothelioma Deaths 1980-2021*



*This graph was compiled by JUAC, using HSE data occupational mesothelioma statistics provided in response to FOIs.

Table 4:

HSE teachers' mesothelioma deaths (aged under 75) 1980-2021

	1980 -1985	1986 -1990	1991 -1995	1996 -2000	2000 -2005	2006 -2010	2011 -2015	2016 -2021
School teacher deaths	15	40	71	114	177	250	335	431
HE & FE teacher deaths	6	18	40	66	93	133	161	192

The HSE data shows that 431 school teachers (aged under 75) in Great Britain died from mesothelioma (1980-2021) and the number is still increasing. More than 300 teachers have died since 2000.

The HSE acknowledges that this considerably underestimates the number of teacher mesothelioma deaths.[41] Moreover, it only shows the risk in their former schools, on average, three to five decades previously,[42] so the data cannot show the current risk.

Those former teachers who have died from mesothelioma since 1980 were likely to have been exposed to asbestos in the late 1940s to 1990s when buildings such as schools were first constructed using asbestos. This is because mesothelioma, on average, develops 20-60 years after first exposure.

See: Mesothelioma latency period, page 55.

Teachers do not work directly with asbestos, yet a significant number of teachers' inquests have been classified as 'death from industrial disease'. For instance, in December 2016, a coroner ruled that Sue Stephens, a former primary school teacher from Buckinghamshire, died from mesothelioma after being exposed to asbestos through her work.[43]

41 Mesothelioma mortality by occupation statistics in Great Britain 2021, page 2.

42 JUAC. Mesothelioma deaths among school staff 1980-2021. Teacher deaths.

43 dailymail.co.uk/news/article-4004738/Devon-teacher-died-asbestos-exposure-Buckinghamshire-schools-builders-removed- deadly-fibres-classrooms.html

Former support staff deaths from mesothelioma

HSE data for school support staff is not available from 1980 to 2002. Between 2003 and 2021, the mortality statistics also show that 11 school secretaries, 13 nursery nurses, 39 teaching assistants and 37 school midday assistants died of mesothelioma.

School caretakers, cleaners, technicians and cooks have also died from mesothelioma but their deaths are not recorded by the HSE as 'teaching and educational professionals'.

HSE occupational mesothelioma data underestimate deaths

These occupational death statistics considerably underestimate the number of teachers*/support staff that die of mesothelioma, because they do not include the deaths of anyone:

- over the age of 74*
- those former teachers/support staff whose last occupation was not in teaching.

Summary

The HSE occupational mesothelioma statistics considerably underestimate the number of teacher and support staff deaths and omit many of the support staff groups who work in school buildings.

Moreover, the long latency period for developing mesothelioma means they only provide a measure of the risk of developing mesothelioma in schools prior to the 1990s.

431 teachers (aged under75) whose last occupation was recorded as a teacher have died from mesothelioma between 1980 and 2021 according to the HSE mesothelioma occupational statistics. The HSE data does not include teachers aged over 75 or teachers whose last occupation was not as a teacher.

Estimated GB teacher mesothelioma deaths (all ages) 1980-2021

This section investigates the number of teacher mesothelioma deaths (all age groups).

The HSE GB occupational mesothelioma statistics only provide the mesothelioma deaths of GB teachers aged under 75. The GB analysis omits Scotland as last occupations are routinely recorded only on death certificates for deaths in the age range 16-74 in England and Wales. Table 5 provides an estimate of teacher mesothelioma deaths (all ages) between 1980-2021.[44] [45] The estimate presumes the ratio of teachers aged <75: teachers aged >74 is equal to the ratio of females aged <75: females aged >74 and is an update of the previous estimate for 1980-2017.[46]

The HSE occupational mesothelioma statistics indicate 431 teachers aged under 75 years died from mesothelioma between 1980 and 2020.

However, Table 5 (column 6) below indicates an estimated further 408 teachers (aged 75 and over) also died from mesothelioma in that period. Therefore, a total of 839 teachers (column 7) are estimated to have died altogether from mesothelioma between 1980 and 2021. This is far higher than the 431 teachers (under 75) provided by the HSE statistics.

This estimate of mesothelioma deaths (all ages) does not include former teachers whose last occupation was not in teaching or any school support staff and students.

Summary

- 431 former teachers (aged under 75) have died from mesothelioma.
- 408 former teachers (aged over 74) were estimated to have died from mesothelioma.
- 839 former teachers (all age groups) were estimated to have died from mesothelioma due to exposure in their former schools between the late 1940s-90s.

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44 JUAC. Mesothelioma deaths among school staff 1980-2021. Teacher deaths.

45 Table MES002 hse.gov.uk/statistics/tables/meso02.xlsx shows the number of mesothelioma deaths in each year in five-year age groups for males and Table MES003 hse.gov.uk/statistics/tables/meso03.xlsx shows the equivalent information for females.

46 JUAC Report 2021. *Continuing government failure leads to rise in school mesothelioma deaths. Are pupils and staff any safer today?* Page 8.

Table 5:

Estimation of GB former teacher mesothelioma deaths* (75 and over) and teacher mesothelioma deaths (all ages)

Year range	Great Britain (GB) female deaths (<75 years)	GB female deaths (75+ years)	Ratio GB female deaths (75+ years/ female deaths <75)	Teacher deaths (<75 years)	Estimated teacher deaths (75+ years)	Estimated total teacher deaths (all age groups)
Reference to data source	HSE mesothelioma data MESO03	HSE mesothelioma data MESO03		HSE data in response to JUAC FOI		
1980-85	428	104	0.24	15	4	19
1986-90	423	150	0.35	25	9	34
1991-95	556	208	0.37	31	11	42
1996-00	601	395	0.66	43	28	71
2001-05	800	629	0.79	63	50	113
2006-10	1007	839	0.83	73	61	134
2011-15	969	1053	1.09	85	93	178
2016-20	840	1291	1.54	83	128	211
2021-22				13	24	37
1980-2021				431	408	839

*The total number of teacher deaths does not include the former teachers whose last occupation was not in teaching so this number is likely to be a considerable underestimate.

Estimated number of former GB support staff and student mesothelioma deaths (all ages) 1980-2021

This section investigates:

- **the number of school teachers and support staff (all ages) between 1955-2021**
- **and uses that to estimate the total number of teacher, support staff and student mesothelioma deaths between 1980 and 2021.**

The US EPA 1980 study[26] presumed all school staff (teachers and support staff) were exposed to the same prevalent asbestos levels for 30 years. So, their risk of developing mesothelioma due to long-term cumulative asbestos exposure was the same. This was the basis for the estimation of the number of GB support staff who developed mesothelioma. School students were presumed to be exposed to the same prevalent levels for 15 years.

However, problematically the HSE statistics do not provide the mesothelioma deaths of all GB school support between 1980 and 2021 and, in Great Britain, the number of all school support staff is not available in a suitable form before 1997 for England and 2003 for Wales.

Estimated number of support staff and teachers (1955-2021)

The number of all school support staff has therefore been determined using a variety of school workforce statistics for Great Britain (See England[47] and Wales[48]).

47 England. Full-time equivalent FTE teachers and support staff in publicly funded schools. Years January 2000, 2005-10 and November 2010. School Workforce in England, reporting Year 2022: Teacher and support staff FTE in state-funded schools between 2010 and 2022/3.

48 Wales: FTE school teacher and support staff (PLASC).

Between 1955 and 1975 the number of staff and pupils in the UK increased, but between 1975 and 2000 the number of teachers appeared relatively stable. For that reason, it was presumed that the number of both estimated support staff and teachers in England and Wales was relatively constant during that when data was not available.[49]

Table 6 below shows how the estimated proportion of teachers in the total school staff workforce has decreased between 1955-2023.

Table 6:

Estimated proportion of teachers in school workforce 1955-2023

Year	1955-2000	2001-2005	2006-2010	2011-2015	2016-2020	2021-2022
% of teachers in school staff	64	58	52	48	48	48

Support staff were first recorded in England in 1997 but omitted the auxiliary staff, which included caretakers, cleaners and caterers, until 2011. T*he number of auxiliary staff was added to support staff in England (ie + 84,608) from 1997 to 2023.* Wales has never included auxiliary staff and so the support staff numbers were not similarly amended.

Table 7 below shows the number of full-time equivalent (FTE) school teachers and support staff in England and Wales according to the school workforce census in England, the school staff pupil level annual school census (PLASC) in Wales and historical data from 1975 to 1996.

The increase in staff numbers between the late 1940s and 1975 and between 1997 and today reflect changes in government policy regarding school staff (see table above).[50]

The number of teachers and support staff in Great Britain (England and Wales only) shown in table 7 below were used to estimate the number of support staff mesothelioma deaths in the next section. The estimation presumed that school teachers and support staff were exposed to the same prevalent asbestos levels for 30 years and have the same lifetime risk of developing mesothelioma.

49 House of Commons Library. SN/SG/4252. Paul Bolton. Education: Historical Statistics 2012 (Tables 1 and 2).

50 DCSF SFR 26/2008 school workforce in England (including local authority level figures) January 2008 (revised).

Table 7:

Number of teachers, support staff and all school staff (1955-2023) in Great Britain and United Kingdom*

Location	Wales		England		GB		UK[51]
Year	Teachers	Support staff#	Teachers	Support staff#	Total – all staff	Total – teachers	Teachers
1955	15340	5,224	232464	133,740	386768	247804	287,000
1965	18974	6,462	287543	165,428	478407	306517	355000
1975	26510	9,029	401750	231,133	668422	428260	496000
1980	26510	9,029	401750	231,133	668422	428260	485000
1990	26510	9,029	401750	231,133	668422	428260	474,000
1997-00	26510	9,029	401750	231,133	668422	428260	
2001-05	26510	12650	424200	310,828	774188	450710	
2006-10	26450	15835	441880	411,148	895313	468330	
2011-15	25055	23726	449292	477,629	975702	474347	
2016-20	24316	23634	455535	499,610	1003095	479851	
2021-22	23,941	23,779	465,527	502,552	1,225,799	489,468	

Estimates for auxiliary support staff in England (+84,608) were added prior to 2011. Wales data omits auxiliary staff so is an underestimate. HSE occupational mesothelioma for Great Britain data omitted Scotland because remit of Scotland data was not compatible with the remit for Wales and England.

* It should be noted that the HSE GB occupational mesothelioma statistics only include England and Wales because Scotland uses a different measure for recording the number of occupational mesothelioma deaths.

51 Note: The rate of increase of support staff (1955-97) in the UK was presumed equal to rate of increase of UK staff in GB. See Reference 49

Estimated number of former school staff mesothelioma deaths (all ages) in Great Britain 1980-2021

This section investigates the number of former school staff mesothelioma deaths (all age groups).

The teacher mesothelioma deaths (1980-2021) were probably due to asbestos exposure in schools constructed using asbestos between the late 1940s and the mid-1990s.

See: Annual UK import of asbestos, page 54.

The number of teachers and total number of staff exposed in schools from 1955 to the 1990s is shown in italics and grey text in Table 8 below on page 38. The mesothelioma deaths recorded after 1980 due to that exposure prior to the mid-1990s are also shown in red. The long mesothelioma latency period of 20-60 years presumably accounts for the death so many years after the initial exposure.

See: Mesothelioma latency period, page 55.

The estimated total number of mesothelioma deaths due to exposure of school teachers (all ages) prior to 1995 was 839.

As all staff are presumed exposed to the same prevalent asbestos levels and have the same lifetime risk, the total number of mesothelioma deaths for all staff is directly proportional to the total number of school teachers (1955-1990s).

Thus, the average number of staff (1955-2000) x 839/average number of teachers (1955- 2000) = 630,419 x 839/377,894 (number of mesothelioma cases 1980-2022)

= 1,400 mesothelioma deaths of school staff 1980-2021

The estimated 1,400 school staff mesothelioma deaths included 561 mesothelioma deaths of support staff (all ages) and 839 mesothelioma deaths of teachers in schools. They were exposed to asbestos prior to the mid-1990s.

Table 8:

Estimated number of school staff mesothelioma deaths (all ages) in Great britain between 1955 and 2023*

Year	Estimated number of teachers	Estimated number of teachers plus support staff	Number of mesothelioma deaths		
			Teachers*	Support staff plus teachers	Deaths per year
1955	*247,804*	386,786			
1965	*306,517*	478,407			
1975	*428,260*	668,422			
1980s	*428,260*	668,422	*53*	88	9
1990	*428,260*	668,422	*113*	189	19
1997-00	*428,260*	668,422			
2001-05	450,710	774,188	*113*	189	38
2006-10	468,330	895,313	*134*	224	45
2011-15	474,347	975,702	*178*	297	59
2016-20	479,851	1,003,095	*211*	352	70
2021-22	492,249	1,022,433	*37*	62	62
Total			***839***	**1,400**	

* The teacher mesothelioma deaths (in grey font) recorded after 1980 are assumed to be due to exposure of teachers (1955 to mid-1990s) which are also shown in grey.

Estimated former school student mesothelioma deaths (1980-2021)

Former student mesothelioma deaths were recorded by the HSE under their last occupation. The US EPA 1980 study presumed that students had the same lifetime risk as adult staff and found that for every former member of staff who died from mesothelioma there would be nine former students who died. Application of the EPA findings to GB schools indicates that 9 x 1400 = 12,600 GB school students died from mesothelioma between 1980 and 2021.

See: Estimated number of GB school staff and student mesothelioma deaths, page 48.

However, the EPA study underestimated the number of student deaths because it did not consider the known increased vulnerability of children to asbestos exposure because of their increased life expectancy.

See: Life expectancy and mesothelioma risk, page 23; Student mesothelioma risk and life expectancy, pages 57-58.

Summary

In GB between 1980-2021:

- An estimated 839 school teachers and 561 support staff (Total 1,400 died from mesothelioma due to exposure prior to the 1990s.
- According to the 1980 EPA study, which presumed United States staff and students have the same mesothelioma risk, the number of GB school student deaths would be 9x1400 = 12,600

Mesothelioma UK measure of asbestos-related diseases in former school and hospital workers

How many former school and hospital staff received industrial injures disablement benefit each year for mesothelioma and lung cancer according to Mesothelioma UK?

The recent report by Mesothelioma UK[52] included an estimation of the incidence of mesothelioma and lung cancer in staff in UK schools and hospitals. It compared the HSE number of mesothelioma cases with the number of recipients of industrial injuries disablement benefit (IIDB) for mesothelioma and lung cancer in people who have worked in schools and hospitals. The IIDB data was used as a proxy for the number of people who worked in schools and hospitals as teachers as well as other school workers, hospital workers, and university lecturers and other higher education workers in their working lives.

Mesothelioma deaths: The data from the Department for Work and Pensions (DWP), as analysed by Allmark (2023), suggest 65 cases of mesothelioma for former health professionals and 70 for teaching staff each year. After cases of mesothelioma in former school administration workers were estimated using the UK Labour Force Survey 2001, the number rose to 87 former staff and 89 former teaching staff each year. The DWP/HSE acknowledges the deaths are underestimated.[5 page 9]

52 Mesothelioma UK Clearing the Air: The costs and benefits of removing asbestos from UK schools and hospitals 2023.

Table 9:

Mesothelioma UK comparison of school and hospital mesothelioma deaths according to HSE occupational statistics, NHS Resolution and DWP data[53]

	Health				Education	
A	C	D	E	F	G	H
	FOI 3992	FOI 5989	ONS data	FOI2023/1900	ONS data	FOI2023/33335
Source	NHS Resolution		Office for National Statistics	DWP	ONS	DWP
Category	Claims received by NHS from former workers who've developed mesothelioma			IIDB claims		IIDB claims
Grouping	Former NHS workers who've developed mesothelioma		Health professional	Human health activities	Teaching and educational professionals	Primary education (SIC code 8520) or General secondary education (SIC code 8531)
Corrected total	251 over 6 years	353 over 9 years	151 over 21 years	480 over 5 years 68% ≈ 326 NHS	481 over 21 years	350 over 5 years
Annual rates	41.83 pa	39.22 pa	7.19 pa	65.28 pa [NHS]	22.90 pa	70 pa

53 Mesothelioma UK: What is the extent of mesothelioma amongst former NHS workers? Angela Tod, Mesothelioma Research Centre. Slide show for RCN.

These were considerably higher that the HSE ONS statistics for GB teaching and educational professionals which show 7.2 mesothelioma deaths per year for health professionals and 22.9 per year for teaching professionals.

Lung cancer: Mesothelioma UK notes it is not correct to ascribe all lung cancer deaths among school staff to the asbestos in their schools.

See: Introduction, Schools, pages 15-17.

However, it does note the recent research by Darnton (2023) which suggests a ratio of between 8.4 and 35.8 lung cancers per mesothelioma case for people who worked with crocidolite (blue) and amosite (brown) asbestos combined.11

Mesothelioma UK therefore used the estimate of 8.4 lung cancers per mesothelioma case to suggest that each year there are 748 cases of school workers and 731 cases of hospital workers.

Comparison of mesothelioma deaths estimated by Mesothelioma UK and JUAC

Mesothelioma UK estimated that 89 former primary and secondary school staff in the UK had died from mesothelioma each year while JUAC estimated that 70 former GB school staff died from mesothelioma each year (2016-20). Their findings indicated that staff deaths due to mesothelioma were far higher than indicated by the HSE occupational mesothelioma statistics. This is because the IIDB data and the HSE data do not include mesothelioma deaths of former staff whose last occupation was not in schools.

The disparity between the two methods is likely to be because:

- The IIDB mesothelioma claims data is for the UK whereas the GB HSE occupational statistics do not include Scotland as GB occupational mesothelioma data is restricted to deaths occurring at ages 16-74 in Wales and England.[5]
- JUAC and Mesothelioma UK made their estimates for 1997 and 2001 respectively using different population groups. It was noted that there was a six per cent decline in the proportion of teachers in the school workforce from 1997 to 2001 due to a change in government policy.

Both JUAC and Mesothelioma UK estimations of support staff mesothelioma deaths presumed, like the EPA 1980 study, that support staff and teachers had a similar risk of developing mesothelioma from exposure to prevalent asbestos levels.

However, while the EPA study (1980) was able to provide teacher and support staff numbers for all the United States schools with friable asbestos that they investigated, in the UK that data is not available so the proportion of support staff in the school workforce had to be estimated by Mesothelioma UK and JUAC for that period.

Summary

- Mesothelioma UK data estimated, using DWP IIDB mesothelioma and lung cancer data, that 87 former hospital staff and 89 former teaching staff died from mesothelioma each year and 731 former hospital workers and 748 former school workers died from lung cancer.
- The Mesothelioma UK and JUAC data shows that the HSE has considerably underestimated the number of mesothelioma deaths in school and hospital workers.

c.

The lifetime risk (based on 1980 EPA measure) of developing mesothelioma in GB schools

This section investigates the prevalent GB school asbestos levels, lifetime risk (based on the EPA 1980 measure) and the number of premature mesothelioma deaths of staff and students in Great Britain school buildings.

In the EPA 1980 study, the EPA provided three estimates of prevalent airborne asbestos levels – minimum, most reasonable and maximum – that were derived from the Sebastien et al (1978) study of asbestos levels in buildings like schools.[54] This was because airborne asbestos levels were believed to be low and variable in buildings so a range of asbestos levels was considered appropriate. However, there has been no similar study of GB school asbestos levels.

54 Sebastien P, Gaudichet A, Dufour G, Bonnaud G, Bignon J & Goni J. 1978. Metrological survey of atmospheric pollution inside buildings insulated by asbestos projection. Paris, France: Paris University Laboratory Department. [EPA translation].

What are the prevalent asbestos levels in GB schools?

In 2007 the Health, Safety and Licensing (HSL) body reviewed the level of airborne asbestos measurements using phase contrast microscopy (PCM) and transmission electron microscopy (TEM) in 20 CLASP* (see page 46) school buildings in Rhondda, Wales.[55] These schools had just been remediated to prevent asbestos passing from gaps in columns and ceiling voids into occupied areas.[56]

Table 10:

3.5 Summary of PCM data for schools (Reference 44 page 12)

Statistic	Number of samples	Mean (f/ml)	Median (f/ml)	Largest value (f/ml)	Smallest value (f/ml)
Normal occupations after remedial work	96	0.005	0.004	0.022	0.001
After remedial work with minimum activity	44	0.002	0.001	0.008	<0.001
Disturbance and clearance of testing of columns after remediation	95	0.005	0.003	0.058	<0.001
During remediation / sealing	12	0.004	0.004	0.006	0.001
During	31	0.094	0.033	0.441	0.001
Inspection of ceiling area	20	0.004	0.002	0.019	0

The levels observed after remediation were deemed by the HSL to be typical prevalent levels found in school buildings with asbestos. The asbestos levels found are summarised in HSL table above.

See above, columns 2, 3 and 4.

55 HSL Summary of fibre concentrations in CLASP construction schools containing asbestos. HSL/2007/22 page 12.

56 HSE Asbestos in system buildings, Control of Asbestos Regulations 2006. Guidance for duty holders. Updated 2008. See also the text box on page 45.

Remediation reduced asbestos levels many fold and were considered safe for long-term occupation by the HSE (see rows 2, 3 and 4) although they were similar to the range of prevalent levels found in the EPA study that the agency described as a hazard to public health.

Crucially, according to the HSL 2007 report:

"The evidence available to date shows that the HSE's initial advice to check that column casings are intact and undamaged and to seal any gaps visible in the room, appears sufficient to reduce exposures in schools to the low background levels found in other asbestos containing buildings."

Unfortunately, the level of asbestos fibres during normal school activities was measured by PCM, not TEM (as in the EPA study) so was likely to include non-asbestos fibres as well in row 2 and to a lesser extent in row 3. This could indicate that non-asbestos fibres were included in the PCM measure but the extent of potential contamination was not investigated.

The row 4 data after disturbance and clearance testing was unlikely to have contamination by non-asbestos fibres (range 0.003 to 0.058 f/ml; mean 0.005f/ml) and it is a concern that there was no further investigation of the effectiveness of column sealing and checks for other potential sources of asbestos that could account for the fact that some remediated schools still had levels above the clearance level (0.01f/ml; 10,000f/m3). See electron microscopy results section from Section 3.6 of the HSL review copied below:

3.6 ELECTRON MICROSCOPY RESULTS

Only a few electron microscopy results were available for this report. These were primarily taken to check whether the releases of the fibres from columns when disturbed were amosite fibres. These have generally confirmed that a high percentage of the fibres released when the columns were struck were amosite. The types of airborne fibres sampled in other situations have not been investigated yet. However, it is unlikely that a high percentage of the fibres sampled after remediation will be amosite and the PCM values overestimate the airborne amosite fibre concentrations.

In view of the disturbance and clearance data in column 4, it is not possible to conclude without checks that a high percentage of the fibres were not asbestos during occupation.

According to the HSE and HSL, rows 2 and 3 of the above table provide a range of prevalent PCM asbestos levels for normal occupation in schools that is similar to the estimates 1 and 2 in the EPA study.

The higher asbestos levels found after disturbance and clearance tests of remediated columns (see row 3) and tests on unremediated columns (see row 5) could indicate the impact of building/asbestos deterioration on asbestos levels in UK schools over time. That is, they could be an estimate 3 for the UK schools.

However, these airborne asbestos levels are measured during tests within enclosures and so are higher than if the disturbed asbestos was able to dissipate into the classroom. But that effect could be counteracted in practice by the potentially numerous other sources of asbestos in CLASP-type schools that would not be measured in the enclosure. It was noted that there was considerable variation between schools, indicating perhaps a number of alternative asbestos sources or a failure to completely seal asbestos within the structure.

The Rhondda CLASP* schools were investigated in 2006, 26 years after the EPA report which predicted that prevalent asbestos levels in 2010 would be six times higher than in 1980 due to asbestos deterioration. The higher level of asbestos found indicates that asbestos levels in GB buildings with damaged asbestos (before and after remediation) would be much higher than predicted by the EPA in 1980 for United States schools.

See: Impact of EPA-predicted building deterioration today on mesothelioma risk, page 51.

What is the lifetime risk from asbestos exposure in GB schools?

There has been no equivalent epidemiological study of lifetime risk in GB schools so the lifetime risk was deemed to be the same as that used by the EPA for the United States schools.

In order to measure the lifetime risk of developing mesothelioma the EPA used:

- a study by Sebastien et al (1978) which ascertained the range of prevalent asbestos levels using TEM, in buildings similar to those found in United States schools, and

* CLASP and SCOLA system buildings and others where similar construction techniques have been used, built between 1945 and 1980, normally have amosite containing AIB around the steel columns (although other types of Asbestos containing materials (ACMs) and non-asbestos materials are also found). ACMs may also have been used as column packing and may be found in blind boxes to the window frames. ACMs may also have been used in these buildings as unrecorded substitute items where there were material shortages and/or poor supervision. In addition, excess or waste ACMs may have been left hidden inside columns or panels and ceiling voids. Consequently, asbestos may be found in some unexpected locations and the presumption should be that ACMs would be present in other concealed areas.

See: HSE Asbestos in system buildings. Control of Asbestos Regulations 2006. Guidance for duty holders Updated 18 September 2008.

- a large epidemiological study[57] of insulation workers who worked with asbestos similar to that found in United States school buildings.

The EPA presumed all school staff were exposed to the prevalent asbestos levels for 30 years and school children were exposed for 15 years. They estimated the cumulative asbestos exposure[58] for staff and pupils – based on the three prevalent asbestos levels described as estimate 1 (minimum), estimate 2 (most reasonable) and estimate 3 (maximum) – and then used the epidemiological data to estimate the lifetime risk of developing mesothelioma.

The number of premature mesothelioma deaths was obtained by multiplying the lifetime risk by the number of staff/students.

The EPA findings for their 1980 study are summarised in Table 21 EPA report copied below: Reference 37, Table 21, page 91

Table 21. Quantitative Risk Estimates of Mortality from Exposure to Asbestos in Schools

Population group	Lifetime risk			Premature deaths		
	Minimum	Most reasonable	Maximum	Minimum	Most reasonable	Maximum
2,934,000 students	3.8×10^{-5}	3.2×10^{-4}	2.0×10^{-3}	111	960	5,868
208,900 teachers, administrative staff	7.5×10^{-5}	6.4×10^{-4}	3.9×10^{-3}	16	142	814
21,600 custodians, maintenance workers	7.5×10^{-5}	6.4×10^{-4}	3.9×10^{-3}	2	15	84
			Totals	129	1,117	6,766

How many GB school staff and students (1955-1990s) are exposed to friable asbestos?

The UK government has not ascertained the number of schools with friable asbestos and the GB school workforce numbers that include support staff are not readily available before 1997 for England and 2003 for Wales.

See: Estimated number of support staff and teachers (1955-2021), page 34.

The DfE's 'voluntary' asbestos management assurance process in 2019 indicated that about 80 per cent of schools contain asbestos. Unfortunately, it is not known if this asbestos was friable in the 20th century and if staff and students were potentially exposed to it. For the GB estimation it is presumed that 80 per cent of schools had friable asbestos.

57 Hammond EC, Selikoff IJ & Seidman H, 1979. Asbestos exposure, cigarette smoking and death rates. Ann NY Acad Sci 330:473-490; Selikoff IJ, Hammond EC & Seidman H. 1979a. Mortality experience of insulation workers in the United States and Canada, 1943-1976. Ann NY Acad Sci 330: 91-116.

58 Cumulative asbestos exposure = average asbestos level x number of years.

Estimated number of GB school staff and student mesothelioma deaths

The EPA investigation was carried out in about 1980, and therefore considered the prevalent asbestos levels at that time in order to determine the lifetime risk and premature mortality. The long latency period and impact of increased life expectancy means the EPA-predicted mesothelioma deaths could still occur after the 2040s.

See: Mesothelioma latency period, page 55; Life expectancy and mesothelioma risk, page 23.

Table 11 below shows the estimated average number of GB school staff and students between 1955 and the 1990s in column 1. Column 2 shows only – according to the EPA method – the estimated number of occupants who did not die prematurely from other causes in schools with friable asbestos.

In Table 11 below, the estimation of GB mesothelioma deaths presumes that the prevalent asbestos levels, cumulative asbestos exposure, lifetime risk of developing mesothelioma and epidemiological study are identical to those used in the EPA study.

Therefore, as the prevalent asbestos levels are deemed to be similar, there would be a similar, significant lifetime risk of developing mesothelioma due to asbestos exposure in the United Kingdom between 1955-1990s. See Table 8 below. The lifetime risk estimation for staff and students exposed between 1955 to the mid-1990s is shown in red font.

Thus, the estimation of lifetime risk (based on EPA measure) of GB premature student (staff) deaths due to exposure in Great Britain school buildings between 1955-1990s was not likely to be less than 259 (41), it may be as high as 2,180 (349) and, in the future, it may become as high as 13,623 (2,128) because of damage arising from asbestos deterioration due to age, maintenance, everyday activities and building deterioration (data in grey font below).

Table 11:

Estimated number (based on EPA study 1980) of former GB school staff and student deaths from mesothelioma**

Total number of school occupants in GB schools (Year)	Number of GB occupants exposed to friable asbestos (80%) less number adjusted for deaths from other causes (2.2%)	-Lifetime risk- *			-Premature deaths-		
		Minimum	Most reasonable	Maximum	Minimum	Most reasonable	Maximum
Students 9,481,196 (2021/2)	7,418,088 (15 years exposure)	3.8×10^{-5}	3.2×10^{-4}	2.0×10^{-3}	282	2,374	14,836
All staff 1,015,179 (2023)	794,276 (30 years exposure)	7.5×10^{-5}	6.4×10^{-4}	3.9×10^{-3}	60	508	3,098
Students 8,117,715 (2001-5)	6,351,300 (15 years exposure)	3.8×10^{-5}	3.2×10^{-4}	2.0×10^{-3}	203	2032	12,703
All staff 774,188 (2001-5)	605,725 (30 years exposure)	7.5×10^{-5}	6.4×10^{-4}	3.9×10^{-3}	45	388	2,362
Students 8,706,000 (1955-90s)	6,811,574 (15 years exposure)	3.8×10^{-5}	3.2×10^{-4}	2.0×10^{-3}	259	2,180	13,623
All staff 630,419 1955-90s)	493,240 (30 years exposure)	7.5×10^{-5}	6.4×10^{-4}	3.9×10^{-3}	41	349	2,128

*Number of premature deaths of staff (students) = Lifetime risk x number of staff (students)
** Occupational mesothelioma deaths are only available for England and Wales in GB so student and staff numbers were also only recorded for this research in GB.

Comparison of predicted mesothelioma deaths based on EPA study with JUAC-estimated mesothelioma deaths

Today, four decades after the US EPA 1980 study, it is possible to compare the number of former GB school staff mesothelioma deaths with the EPA estimated premature mesothelioma deaths of staff and students. See Table 12 below:

Table 12:

Comparison of predicted mesothelioma deaths based on EPA study with JUAC-estimated mesothelioma deaths

Population group exposed to friable asbestos (1980-2010) and number adjusted for deaths from other causes	Prediction of the number of GB mesothelioma deaths according to the EPA study (1980)			Estimation of GB mesothelioma deaths according to JUAC estimate based on HSE occupational mesothelioma deaths
	Estimate 1: minimum	Estimate 2: most reasonable	Estimate 3: maximum	
Students 6,811,574 (15 years exposure 1955-90s)	259	2180	13,623	12,600
School staff 493,240 (30 years exposure 1955-90s)	41	349	2,128	1,400
All school occupants	300	2,529	15,751	14,000

While the EPA indicated in their 1980 study that estimate 2 would most likely represent the premature mortality due to exposure to 1980 asbestos levels, the estimated number of GB mesothelioma deaths (14,000) over 40 years later were closer to the maximum estimate (15,751).

This suggests that the asbestos levels and lifetime risk in GB schools prior to the 1990s is far higher than predicted for the US schools with friable asbestos.

This is likely to be because:

- GB schools are known to have a substantial amount of amosite asbestos which is up to 100 times more likely to cause mesothelioma than chrysotile asbestos which was found by the EPA in the United States schools.[28]
- The EPA in 1980 presumed that children and adults have the same lifetime risk of developing mesothelioma although it is now known that children are more likely to develop mesothelioma after exposure because they have a longer life expectancy.[31 34]

However, despite the known risks, the UK government has failed to act to reduce the risk.

Impact of EPA-predicted building deterioration today on mesothelioma risk

The EPA-predicted that when buildings passed their expected lifespan of 30-40 years the level of asbestos exposure would increase six-fold due to increased asbestos damage.

The students in GB schools today are therefore predicted – according to the EPA 1980 study – to have increased asbestos exposure as their buildings have now passed their expected lifespan.

Table 13 below summarises the EPA-predicted impact of school building asbestos damage on student mesothelioma deaths in Great Britain schools.

Table 13:

EPA-predicted impact of school asbestos damage on GB number of mesothelioma deaths after the building lifespan has been exceeded

Staff (exposed before mid-1990s) See: pages 35-36	Staff (asbestos exposure increased six-fold after school lifespan passed)	Students (exposed before mid-1990s) See: pages 38-39	Students (asbestos exposure increased six-fold after school lifespan passed)
1,400	8,400	12,600	75,600

The EPA-predicted that when the buildings like those found in United States schools had passed their expected lifespan of 30-40 years, it was likely that asbestos exposure would increase six-fold.

However, the available evidence regarding system-built schools indicates that in Great Britain the level of asbestos exposure to damaged amosite (and crocidolite) asbestos may be far higher (ie 200 times higher than found in schools with asbestos in a good condition) and so the risk of developing mesothelioma may be far higher.

See: What are the prevalent asbestos levels in GB schools? pages 44-46.

Summary

The predicted number of student (staff) deaths in Great Britain from mesothelioma (based on EPA 1980 study) due to asbestos exposure in GB school buildings was not likely to be less than 259 (41), it may be as high as 2,180 (349), and in the future, it may become as high as 13,623 (2,128) because of damage arising from asbestos deterioration, maintenance, everyday activities and building deterioration.

- The EPA-predicted that exposure to airborne damaged asbestos would lead to a six-fold increase in student and staff mesothelioma deaths in schools today.

Comparison of the EPA-predicted GB deaths with the estimated HSE mesothelioma deaths showed the number of GB mesothelioma deaths (14,000) was already close to the maximum EPA estimate (15,751). This is probably because the EPA did not consider:

- the now known greater risk of children developing mesothelioma after asbestos exposure because of their increased life expectancy after asbestos exposure
- the higher risk (up to 100 times greater) from amosite asbestos that was widely used in construction of GB schools.

D.

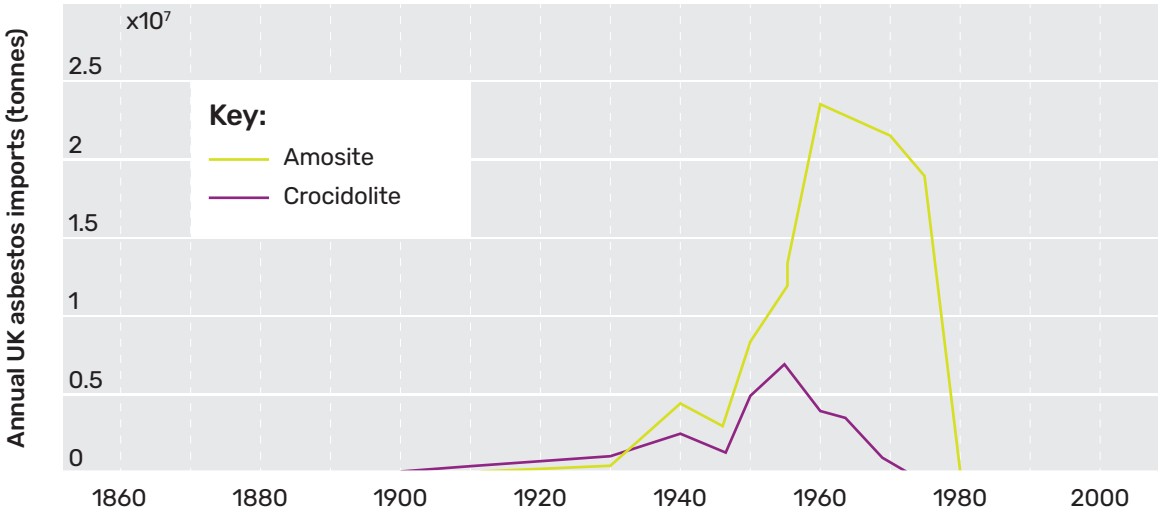
Why are former school staff and student mesothelioma deaths increasing?

This section investigates the potential impact of the UK annual import of asbestos on school building/asbestos lifespan and the number of school mesothelioma deaths.

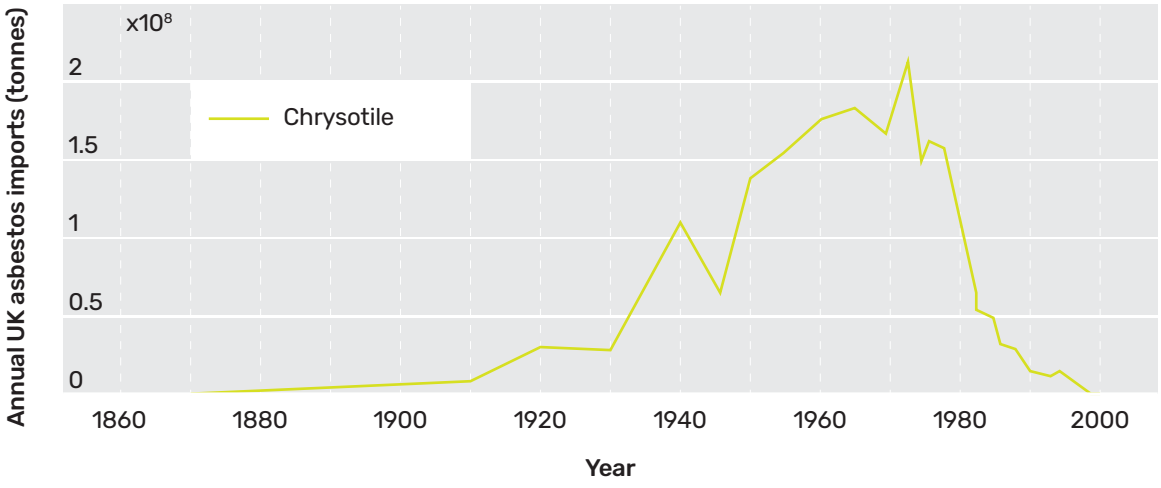
Annual UK import of asbestos

The annual imports of the three main types of asbestos[59] are shown below.

Graph showing annual import of amosite and crocidolite (tonnes x 10^7):



Graph showing annual import of chrysotile (tonnes x 10^8):



If the imported asbestos was used in school building construction shortly after being imported and it is presumed that the average latency period for developing mesothelioma is 20-60 years, then that could account for the HSE recorded teacher mesothelioma deaths from the 1980s onwards.

59 HSE. Emma Tan & Nick Warren. RR876. Mesothelioma mortality in Great Britain 2011.

Mesothelioma latency period

The average latency period for developing mesothelioma depends on whether the cancer is peritoneal or pleural. See diagram below.[60]

Latency period

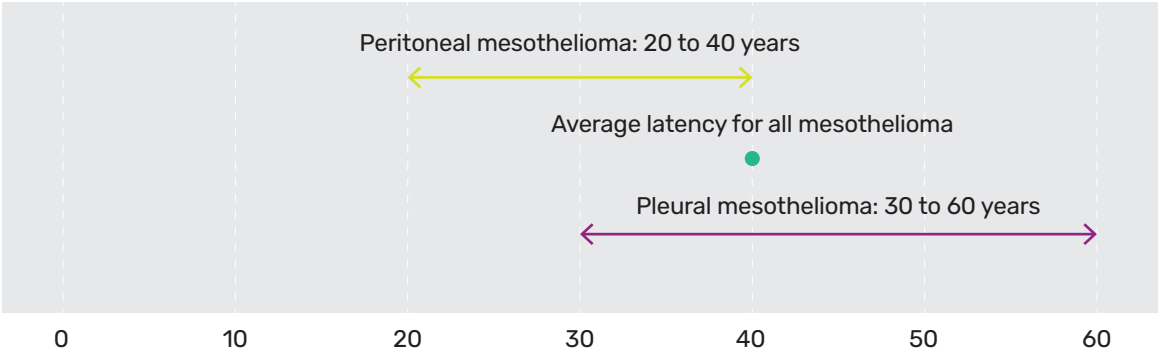


Table 14 below shows the relationship between the year of import of asbestos, expected school building lifespan and the number of school staff mesothelioma deaths.

Expected building lifespan

The expected building lifespan in column 2 of Table 14 indicates that the school buildings constructed with asbestos between:

- 1950s and 1960s had passed their expected lifespan of 30-40 years by 1990-2000
- 1970s and 1980s had passed their expected lifespan by 2010-20
- 1990s and 2010s would pass their expected lifespan by 2020-30.

Consequently, the asbestos in most schools constructed using asbestos (1950-99) is now likely to have been damaged. Damaged asbestos when disturbed causes higher airborne asbestos exposure levels, **so current occupants of these schools today are likely to be exposed to much higher asbestos levels than school occupants in the 20th century.**

See: Section C. The lifetime risk (based on 1980 EPA measure) of developing mesothelioma in GB schools, pages 43-52.

60 How long is the mesothelioma latency period? (asbestos.com)

Table 14:

Relationship between the year schools built using asbestos, expected building lifetime, mesothelioma latency period and number of school staff mesothelioma deaths

Years when school built using asbestos	Expected building life span of 30-40 years	Years when average mesothelioma latency period (20-60 years) reached	HSE teacher mesothelioma deaths < 75 years (JUAC-estimated mesothelioma deaths staff all age groups)
1950s	1980-1990	1970-2010	
1960s	1990-2000	1980-2020	
1970s	2000-2010	1990-2030	
1980s*	2010-2020	2000-2040	40 (88)
1990s	2020-2030	2010-2050	74 (189)
2000s (asbestos banned)	Increasing level of asbestos exposure from damaged asbestos in buildings passed expected lifespan ↓	Increasing number of former staff and students now at maximum risk from school asbestos exposure ↓	136 (413)
2010s (asbestos banned)			168 (649)
2020s (asbestos banned)			

Impact of latency period on school mesothelioma deaths

Column 3 in Table 14 above shows the years when the **average mesothelioma latency period** between exposure and diagnosis has been reached. Thus:

- occupants of schools in the 1950s could die from mesothelioma, on average between 1970 and 2010
- occupants of schools in the 1970s could die from mesothelioma, on average, between 1990 and 2030

- occupants of schools in the 1980s could die from mesothelioma, on average, between 2000 and 2040
- occupants of schools in the 1990s could die from mesothelioma, on average, between 2010 and 2050.

The long mesothelioma latency period indicates that mesothelioma deaths due to exposure in schools when they were first built from the 1950s-1990s onwards are still increasing and will continue to the 2050s.

In the meantime, most of the schools are still being used, asbestos remains in place due to government policy and so the risk is now far higher due to building and asbestos deterioration.

Occupancy

Occupants of school buildings include teachers, support staff and children. The number of occupants has increased by 144 per cent since 1950. There are now over a million teachers and support staff and more than nine million children.

Currently all deaths from mesothelioma were due to asbestos exposure prior to the mid- 1990s. The increased occupancy in schools today means that potentially significantly more staff and children are at risk from asbestos exposure. However, it is not known if the occupancy of schools with substantial asbestos has similarly increased.

Student mesothelioma risk and life expectancy

The EPA presumed that the lifetime risk of school students developing mesothelioma was the same as an adult and found that for every staff death there would be nine student deaths.

This ratio of students to staff depended on the relative number of staff and students and on the fact that the duration of student and staff exposure was presumed to be 15 years and 30 years respectively.

However, it is now known that the number of student mesothelioma deaths is also higher than the number of staff mesothelioma deaths because of their higher life expectancy after first asbestos exposure. The EPA in 1980 did not consider the impact of life expectancy.

See: Life expectancy and mesothelioma risk, page 23.

According to Howie and the committee on carcinogenicity,[61] the relative risk of staff and students developing mesothelioma depended on the age of first exposure. Thus, a child aged five would have a five times greater risk, a child aged ten would have a four times greater risk and a child of 15 would have a three times greater risk than an adult of 30 years.

See: Risk from cumulative asbestos exposure, page 19.

In order to estimate the increased number of school student mesothelioma deaths, this report has presumed that for a child with life expectancy of 80 years in schools for 15 years, the average adjustment factor for students (ie 5+4+3/3 = 4) is 4/2 times the staff risk/mortality because exposure of students was presumed to be for 15 years while staff were presumed to be in schools for 30 years. It also presumes that the students and staff have the same level of asbestos exposure.

Table 15 below summarises the similarly estimated impact of life expectancy to 80, 90 and 100 years on student mesothelioma risk compared to a 30-year-old adult with the same level of asbestos exposure who will survive to age 80.

Table 15:

Impact of life expectancy on student mesothelioma deaths

GB number of estimated staff mesothelioma deaths prior to 1990s	Number of estimated student deaths (x 9) according to EPA estimation	Child life expectancy of 80 years with adjustment factor of 2.0	Child life expectancy of 90 years with adjustment factor of 3.5	Child life expectancy of 100 years with adjustment factor of 5.7
1,400	12,600	2 x 12,600 = 25,200	3.5 x 12,600 = 44,100	5.7 x 12,600 = 71,820

Increase in a child's life expectancy from 80 to 90 and to 100 would clearly increase the number of mesothelioma deaths in future due to asbestos exposure of children in schools.

Thus, Robin Howie has noted that the impact of life expectancy should be considered because, from ONS figures (2011), the cohort life expectancies of babies born in 2012 are 90.5 years for boys and 94.0 years for girls. In addition, it is anticipated that about one third of the babies born in 2012 will survive to age 100, ONS (2012).[62]

61 Committee on carcinogenicity of chemicals in food, consumer products and the environment CC/13/S1: Statement on the relative vulnerability of children to asbestos compared to adults.

62 Office for National Statistics (2011). Release: Interim Life Tables, 2008-2010; Office for National Statistics (2012).

Table 16 below summarises the combined impact of both asbestos deterioration and student life expectancy on student mesothelioma deaths.

Table 16:

Impact of asbestos deterioration and life expectancy on future mesothelioma deaths of students in schools today

GB number of estimated staff mesothelioma deaths prior to mid-1990s See: pages 37-38	GB number of estimated student deaths (x 9) according to EPA estimate See: pages 46-47	GB number of EPA-estimated student mesothelioma deaths (x 9) after six-fold increase in asbestos exposure after expected school lifespan passed			
		No adjustment for child life expectancy See: Life expectancy and mesothelioma risk, page 23	Adjustment for child life expectancy of 80 years with adjustment factor of 9 x 2	Adjustment for child life expectancy of 90 years with adjustment factor of 9 x 3.5	Adjustment for child life expectancy of 100 years with adjustment factor of 9 x 5.7
1,400	1,400 x 9 = 12,600	12,600 x 6 = 75,600	2 x 75,600 = 151,200	3.5 x 75,600 = 264,600	5.7 x 75,600 = 430,920

The table shows that building deterioration with increased asbestos exposure – according to the EPA estimate – would increase staff mesothelioma deaths six-fold to 1,400 x 6 = 8,400.

However, adjustment for life expectancy of children as well as building deterioration would increase the number of mesothelioma deaths to 151,200, 264,600 and 430,920 if children lived to 80, 90 and 100 years respectively. Clearly the total number of mesothelioma deaths of children would depend on their individual life expectancy and, of course, their death would be recorded under their final occupation and not on the schools theyattended.

Young adult staff (up to age 30) would also have a higher life expectancy than older staff if they lived to 90 and 100 years as this increases their relative risk of developing mesothelioma from 1.0 at age 80 to 2.1 at age 90 and 4.0 at age 100.

See: Life expectancy and mesothelioma risk, page 23.

In 1997 the MRC[27] warned that "exposure to asbestos in school may therefore constitute a significant part of total exposure".

For staff exposed as children and as adults in school buildings with substantial asbestos (eg CLASP-type schools), the risk is potentially very high.

Summary

Asbestos imports, building lifespan, mesothelioma latency and student life expectancy

Over half of school buildings and extensions were constructed using asbestos between the late 1940s and 1999, and it is presumed that the asbestos was used soon after it was imported. The findings suggest:

- The rise in teacher deaths from mesothelioma since 1980 (when HSE records began) is consistent with exposure to asbestos used in the construction of their former schools 20 to 60 years previously.
- The delay in development of mesothelioma after exposure was probably due to the known long latency period (20-60 years) for mesothelioma.
- Most school buildings with asbestos have now passed their expected lifespan. The United States EPA (1980) found that damaged asbestos in such buildings could increase mortality due to asbestos exposure six-fold. So, GB staff mesothelioma deaths due to exposure prior to the 1990s could increase from 1,400 to 8,400, and student mesothelioma deaths from 12,600 to 75,600.
- The EPA (1980) had underestimated the number of United States student deaths in 1980 because it did not consider their higher life expectancy after first exposure.
- When life expectancy and asbestos damage was considered, the mortality of school students was predicted to increase from 12,600 for exposure prior to the mid-1990s up to several hundred thousand for exposure in schools since the mid-90s. The mortality of young adults exposed in schools was also predicted to be significantly increased.
- Consequently, so long as schools contain asbestos, the risk of developing mesothelioma from asbestos exposure will continue to rise.

E.

Why the asbestos regulations are ineffective for school duty holders

This section outlines why a measure of the lifetime risk of developing mesothelioma is crucial for duty holders.

The duty to manage in the Control of Asbestos Regulations since 2002[63] does not provide a measure of the lifetime risk of adults and children developing mesothelioma in future, due to long-term asbestos exposure in buildings like schools.

The current asbestos regulations do have 'risk' assessments but they are only designed to enable duty holders to prioritise work needed to minimise the risk of asbestos disturbance.[64] They are not a measure of lifetime risk as they depend mostly on visual inspection of accessible asbestos and sampling suspect materials. As such they facilitate the identification and removal of unsafe accessible asbestos but are unable to identify the amount of disturbed inaccessible asbestos that can pass via gaps into occupied areas.[65] [66]

Duty holders have responsibility but are not aware of the risk

Consequently, while duty holders are ultimately responsible for asbestos management, they do not know if implementing the asbestos risk reduction measures has removed the risk from inaccessible asbestos.

See: Managing asbestos in your school or college – responsibilities for managing asbestos – guidance – GOV.UK (gov.uk)

This is because the current risk reduction measures do not include measuring prevalent asbestos levels, identifying the source of airborne asbestos exposure and removing the risk of exposure to disturbed hidden and inaccessible asbestos that can pass via gaps into occupied areas.

See: Section A. Evidence of risk to school occupants from cumulative asbestos exposure, pages 18-27.

However, it appears that in the UK appropriate action was not taken to ascertain and reduce the risk to school occupants because of concerns about the consequent cost and disruption.

63 Control of Asbestos at Work Regulations 2002; Control of Asbestos Regulations 2006; Control of Asbestos Regulations 2012.

64 HSG227. pages 55-59.

65 Written evidence from joint union asbestos committee (ASB0011) committees.parliament.uk/writtenevidence/39184/html/

66 DfE. Managing asbestos in your school or college - Guidance - GOV.UK (www.gov.uk) 2020. Updated 2023.

Risk, ALARP and cost benefit analysis

Thus, a ministerial briefing document obtained in a freedom of information (FOI) request in 1997 gave the Department for Education's reasons for not assessing the risk to teachers and pupils:

> *A central government initiative to assess the risk to teachers and pupils would not only be inappropriate, given where the statutory duty lies, but would also lead to pressure for centrally funded initiatives to remove all asbestos and for other aspects of building work. That would be extremely expensive, as well as disruptive for the schools concerned."* [54]

In so doing government ignored the warnings about the particular risk to children, the precautionary principle and a third wave of mesothelioma arising from exposure of children to asbestos in buildings like schools.[13]

Significantly, the HSE 2010 report[67] has estimated that the economic cost to society of new cases of mesothelioma cancer in Great Britain, arising from past working conditions (ie before 1990s) was £3 billion. It noted that while individuals bear the vast majority of the human costs of mesothelioma (around £2.8 bn) and most of the total costs to society, there were few financial incentives for employers or indeed the government to reduce exposure to asbestos because *"employers do not bear the vast majority of the costs associated with the consequences of exposure to some of the risk factors they control".*

ALARP

The asbestos regulations require that the risk is reduced to 'as low as reasonably practical' (ALARP). The decision is supposed to be weighted in favour of health and safety because the presumption is that the duty holder should implement the risk reduction measure. Thus, the HSE states that to avoid having to pay the cost of risk reduction, the duty holder must be able to show that the sacrifice would be disproportionate.

However, in 1997 during consultation for the duty to manage in the asbestos regulations (2002), the HSE apparently accepted that the cost of developing a risk assessment which identified the lifetime risk of developing mesothelioma in school buildings was disproportionate. However, there is no evidence their decision was based on a measure of the predicted sacrifice of staff and students (then and in future) who consequently developed mesothelioma.

67 HSE. RR1074. Costs to Britain of work-related cancer Michael Zand, Clark Rushbrook, Ian Spencer, Kyran Donald & Anna Barnes.

Cost benefit analysis

The failure of the cost benefit analysis to include an effective measure of lifetime risk may also explain why the HSE 2008 guidance regarding system school buildings eventually focused only on the less effective, but cheaper short-term solution (sealing columns with bathroom sealant and checking integrity of ceiling tiles) although it had previously also recommended in 2006 a further more costly 'long-term solution'. The latter included the removal of asbestos from ceiling voids, the sealing of wall voids and the tops of columns with foam or sealant and routine air monitoring to check their effectiveness.[10] [55]

There appears to be no evidence that the HSE was ever required by the government to predict the sacrifice (ie the lifetime risk) of school staff and vulnerable students developing mesothelioma which took into account the impact of asbestos deterioration and student life expectancy. Yet, this was crucial for identifying the impact of asbestos exposure on staff and particularly students.

See: Student mesothelioma risk and life expectancy, page 57; Impact of EPA-predicted building deterioration today on mesothelioma risk, page 51.

What is a typical asbestos level and *acceptable* risk in school buildings?

An asbestos level up to 0.0005 fibres/ml (500f/m^3) was considered 'typical' inside buildings containing asbestos-containing materials in good condition[68] and the HSE (2001, 1992, 1988) has concluded that an imposed mesothelioma risk of one per million per year was the limit of 'acceptable' risk. However, Howie has noted that if a 25-year-old adult was exposed to 0.0005 fibres/ml of amosite for one year, the risk of mesothelioma to age 80 would be about four per million per year (Hodgson and Darnton, 2000). So, the risk from 'typical' asbestos levels in buildings exceeds the limit of 'acceptable' risk.

Moreover, the increased life expectancy of children means their mesothelioma risk is much greater than adults and Robin Howie[69] has estimated that:

> *Unless stringent asbestos fibre limits of less than 100 fibres per cubic metre are introduced and enforced in our schools and public buildings then our children will continue to be exposed to an unacceptable level of risk. The threat cannot be overstated."*

68 West JM (1997). Sources and uses of fibrous minerals. In: Fibrous materials in the environment. MRC Institute for Environment and Health: Leicester.

69 Robin Howie. (Expert industrial hygienist, Robin Howie Associates) *Asbestos exposure in buildings-the risks.* August 2005.

In the Willmore v Knowsley Metropolitan Borough Council case [High Court QBD Liverpool District [2009] EWHC 1831 (QB)], the court held that "a level above that commonly found in the air in buildings and the general outdoor environment" would materially increase the risk of developing mesothelioma (2009). This judgement was upheld by both the Court of Appeal and the Supreme Court. Robin Howie therefore states:

"

Without data from routine monitoring of airborne fibre concentrations in schools and hospitals built prior to about 1985; irrespective of any asbestos remediation since that date; neither school nor hospital managers will have any evidence that they have met or are meeting their duties as specified in Sections 2 and 3 of the 1974 Act.

All such monitoring MUST be undertaken while the building(s) is in full occupation, as without normal disturbance of the building structures, normal air movements due to wind effects will rapidly dilute any ongoing fibre release into the building… Unless HSE actively enforces such monitoring, it will be failing to meet its duties as specified in Section 18 of the 1974 Act." [70]

Lifetime risk and funding for asbestos removal

Today, despite the increasing evidence of risk to school occupants, and particularly children, the government has still not required the HSE to develop a measure for checking the lifetime risk that could also inform funding bids.[71]

Summary

The failure of successive governments to require a measure of the lifetime risk of staff and children developing mesothelioma in buildings like schools means that:

- duty holders, government and HSE are unaware of the real risk
- cost benefit analysis and funding bids are based on an ineffective risk measure.

70 Written evidence from Robin Howie Associates (ASB0021) committees.parliament.uk/writtenevidence/39366/html/

71 Michael Lees, JUAC AiS. 14th June 2013. Case for an environmental level for the occupants of schools; Proposal for an environmental level for asbestos exposure in schools. HSE comments. February 2015.

Discussion

Overview

This report investigated the risk of staff and students developing mesothelioma due to asbestos exposure in their former GB schools prior to the mid-1990s and in schools today. Although the HSE has described exposure to asbestos as a low risk in schools, this investigation estimated tens of thousands of students and staff have already died or are predicted to die from mesothelioma between 1980 and 2021 because they were exposed to asbestos between the late 1940s and the mid-1990s. The report further indicates that hundreds of thousands of students and staff could die from mesothelioma in the future due to school asbestos deterioration and the increased life expectancy of students and young adults since the mid-1990s.

Estimation of staff mesothelioma deaths

Impact of school construction using asbestos on staff mesothelioma deaths

A key report finding was that the rise in teacher deaths from mesothelioma since 1980 (when HSE records began) was consistent with the long latency period (20-60 years) for developing mesothelioma after exposure to the asbestos used in the construction of their former schools (between the late 1940s and 1990s).

See: Why are former school staff and student mesothelioma deaths increasing? pages 53-60.

However, the HSE has argued that current mesothelioma deaths "were based on historic exposures when the current regulatory framework was not in place… to prevent inadvertent exposure in buildings".

Nevertheless, Robin Howie in written evidence submitted to the work and pensions committee inquiry in 2021 outlined how the HSE mesothelioma statistics underestimated the level of risk due to asbestos exposure prior to the 1990s because they use proportional mortality ratios that are indices of relative risk and not indices of absolute risk.[38]

Howie (2017) has therefore proposed, using idiopathic data as the baseline for expressing the number of observed mesothelioma deaths as a ratio of 'all cause deaths' (ACD) for each occupations. Using idiopathic data, Howie estimated that teachers and nurses had about five and three times, respectively, more mesothelioma deaths than expected in populations not exposed to asbestos.

See: Risk from cumulative asbestos exposure, page 19; Use of ACD data in Appendix B, page 82.

Limitation of staff mesothelioma death estimations

The estimation of the number of staff mesothelioma deaths was also limited by incomplete data for the number of school support staff and the steep increase in the school population between the 1940s and 1990s due to changes in education policy. There were also no HSE occupational mesothelioma death statistics recorded prior to 1980.

See: How many GB school staff and students (1955-1990s) are exposed to friable asbestos? page 47.

However, the estimated number of mesothelioma teacher and support staff deaths based on HSE occupational mesothelioma statistics in this report appears broadly similar to the Mesothelioma UK estimate based on industrial injuries disablement benefit claims for the last five years, despite the different methods, year of estimation and populations used.

This similarity provided a validation of the different methods used for determining the number of mesothelioma deaths. It should be noted that both methods are underestimations as they do not include former staff whose last occupation was not in schools.

See: Mesothelioma UK measure of asbestos, page 39.

Unfortunately, the mesothelioma data in the HSE mesothelioma occupational statistics and the IIDB claims is not able to show where asbestos exposure may have occurred during each mesothelioma victim's lifetime.

Asbestos levels, cumulative asbestos exposure and lifetime risk

While statistics such as proportional mortality ratio and asbestos lung burdens are presumed to indicate the level of risk from asbestos to the whole population exposed prior to the 1990s, they provide no information about the risk of developing mesothelioma in individual schools since then.

This is because successive GB governments have not systematically estimated, like the United States EPA in 1980, typical school asbestos levels, cumulative asbestos exposure levels and lifetime risk during everyday occupation. They have ignored the available evidence that asbestos levels in schools with substantial asbestos can be far higher than found in schools with asbestos in a good condition and that the courts (See: Willmore v Knowsley MBC case, page 40) recognise that such levels will significantly elevate the risk of developing mesothelioma.

See: Appendix A, pages 80-81; What are the prevalent asbestos levels in GB schools? pages 44-46; Section C. The lifetime risk (based on 1980 EPA measure) of developing mesothelioma in GB schools, pages 43-52; Evidence for risk from cumulative asbestos exposure and increased life expectancy, page 18.

The asbestos levels in those USA schools were similar to the prevalent levels in 20 GB CLASP school buildings* investigated by HSL after remediation and were higher, on average, than found in schools with asbestos in a good condition. However, the HSE – despite the increasing amount of evidence indicating harm from cumulative asbestos exposure to those asbestos levels – deemed the remediated GB CLASP buildings were safe for students and staff to occupy.

See: Risk from cumulative asbestos exposure, pages 19-22; Risk, ALARP and cost benefit analysis, pages 63-64.

This failure of the UK government to require a realistic measure of lifetime risk from long-term asbestos exposure for staff and children in buildings like schools appears to be due to concerns regarding the higher cost and disruption potentially caused. Consequently, the asbestos regulations are apparently designed so that duty holders cannot effectively ensure the health, safety and welfare at work of all employees and members of the public.

See: Duty holders have responsibility but are not aware of the risk, page 62.

What the EPA 1980 investigation reveals about GB schools

Impact of damaged asbestos on risk

The United States EPA in 1980 investigated the lifetime risk of developing mesothelioma from asbestos exposure in buildings like schools for both staff and children. In so doing it also highlighted the increased risk from exposure to damaged asbestos in buildings that had passed their expected lifespan of 30 to 40 years. This enabled the EPA to predict that after United States school buildings had passed their predicted lifespan, the risk from damaged asbestos would have increased six-fold.

See: Impact of EPA-predicted building deterioration today on mesothelioma risk, page 51.

The failure of the GB government to carry out a similar investigation of GB schools has meant that they have no valid data on the impact of asbestos deterioration on lifetime risk of children and staff in GB schools today developing mesothelioma. Thus, despite the increasing evidence of high asbestos levels and asbestos deterioration in schools with substantial asbestos, this has been ignored.

See: What are the prevalent asbestos levels in GB schools? pages 44-46; Appendix A, pages 80-81.

EPA 1980 investigation, student life expectancy and risk

The EPA 1980 study presumed that students had the same lifetime risk of developing mesothelioma as adult staff but were exposed for 15 years whereas staff were exposed for 30 years. However, neither the EPA nor the GB government have considered the impact of the longer life expectancy of students on the predicted number of student mesothelioma deaths due to asbestos exposure.

See: Student mesothelioma risk and life expectancy, pages 57-60.

The increase in student life expectancy in the 20th century from 60 to 80 years and the further increase of cohorts to 90/100 in the 21st century indicates that students and adults under 30 in schools today potentially have a much higher risk of developing mesothelioma even if their level of asbestos exposure was the same as their counterparts in the 20th century.

This report used the work of the committee on carcinogenicity (2013) and Robin Howie Associates (2012) to estimate the impact of increased life expectancy on the number of GB student mesothelioma deaths. It estimated that for every staff death from mesothelioma there would be 2 x 9 (18) mesothelioma deaths of GB children who lived to 80; 3.5 x 9 (31.5)

mesothelioma deaths in those who lived to 90; and 5.7 x 9 (51.3) mesothelioma deaths of children who lived to 100. The predicted risk to 30-year-old adults was doubled with each ten-year increase in life expectancy.

See: Life expectancy and mesothelioma risk, pages 23-25.

Although the EPA ignored the impact of the increased life expectancy of young adults and students on mesothelioma mortality, it developed the AHERA asbestos regulations for schools after their EPA 1980 study because of the predicted high number of student and staff deaths from mesothelioma. In contrast, successive GB governments have ignored the risk to over ten million children and staff on the unproven grounds that the risk from asbestos exposure in 80 per cent of school buildings was low.

Application of the EPA 1980 study method to GB schools

The prediction of the number of GB school staff and student deaths from mesothelioma based on the EPA 1980 method provided a measure of the potential risk from the prevalent low, most likely and high school asbestos levels.

See: What is the lifetime risk from asbestos exposure in GB schools? pages 46-47.

However, comparison with the estimated number of GB staff and student deaths based on the HSE occupational mesothelioma statistics for teachers indicated that the number of GB deaths for exposure prior to the mid-1990s was closer to that predicted by the EPA (1980) method for higher asbestos levels such as found in buildings with damaged asbestos.

See: Estimated number of GB school staff and student mesothelioma deaths, page 48.

This was thought to be due in part to the widespread use of the more dangerous amosite asbestos in GB school construction and the fact that the EPA estimation of student mesothelioma deaths did not take account of their increased vulnerability due to their longer life expectancy after exposure.

See: Life expectancy and mesothelioma risk, page 23.

Furthermore, it was noted that damaged asbestos in unremediated GB CLASP schools had far higher prevalent asbestos levels than found in the EPA (1980) buildings.

See: What are the prevalent asbestos levels in GB schools? pages 44-46; Appendix A, pages 80-81.

While the United States took action to reduce the risk to staff and students from asbestos exposure in their schools and developed the AHERA regulations

a few years later, the UK government did not require a similar investigation of GB schools or develop regulations suitable for occupants of buildings like schools.

Thus, the duty to manage in the UK asbestos regulations since 2002 has taken no account of the known vulnerability of children and the risk to staff and students from long-term cumulative asbestos exposure. There is no measure of the lifetime risk from long-term asbestos exposure in buildings or of the impact of accessible and inaccessible asbestos damage on the risk of developing mesothelioma and lung cancer from asbestos exposure.[65]

The available evidence suggests that the UK government had covered up the risk in order to reduce cost and disruption.

See: Risk, ALARP and cost benefit analysis, pages 63-64.

Impact of ineffective duty to manage on school asbestos management

The duty holder has responsibility for asbestos management but the failure of the asbestos regulations to provide a measure of asbestos levels in buildings like schools means that they do not know the risk of their staff and students developing mesothelioma from prevalent asbestos exposure.

See: Duty holders have responsibility but are not aware of the risk, page 62.

Consequently, duty holders are unable to carry out an effective cost benefit analysis for their school funding bids regarding asbestos removal. Indeed, the lifetime risk from asbestos exposure is not even a criterion in funding bids for school renovation and maintenance.

Who is responsible for the remit of the asbestos regulations?

The asbestos regulations require that asbestos levels are reduced as low as reasonably practical (**ALARP**). However, the current required cost benefit analysis appears to presume that the cost of asbestos removal and building replacement is disproportionate to the benefit gained. Yet this is only because the government has not required an effective measure of lifetime risk of developing mesothelioma and premature mortality due to asbestos exposure in each school.

The HSE evidence[67] (see page 63) indicates that the cost of mesothelioma is borne by the victims and so there is no incentive for duty holders and government to bear the cost of asbestos removal.

Consequently, the ALARP policy is ineffective at reducing the risk adequately because the government holds the purse strings and has prevented the development of effective asbestos regulations and cost benefit analysis methods.

See: Risk, ALARP and cost benefit analysis, pages 63-64; Lifetime risk and funding for asbestos removal, page 65.

Further investigation is required in UK

The EPA (1980) investigation in the United States used a range of prevalent TEM-measured school asbestos levels to estimate cumulative asbestos exposure and lifetime risk.

See: Risk from cumulative asbestos exposure, page 19; What are the prevalent asbestos levels in GB schools? pages 44-46.

A suitable epidemiological study was used in the United States to estimate the lifetime risk of developing mesothelioma from cumulative asbestos exposure. As GB schools may contain chrysotile and/or amosite and/or crocidolite, a number of suitable epidemiological studies would be required in GB.

Should buildings with children be a special case?

Almost everyone goes to school and by the time they leave they may already have inhaled over three million asbestos fibres – a significant part of their total lifetime exposure. Moreover, depending on how long they live, they potentially have a five to 14 times greater chance of developing mesothelioma than an adult exposed to the same amount of asbestos.

See: Life expectancy and mesothelioma risk, page 23; Student mesothelioma risk and life expectancy, pages 57-60.

They are also more likely to be in school buildings today with more damaged asbestos so their exposure could be six times higher than those found in schools occupied by mesothelioma victims prior to the 1990s.

See: Impact of EPA-predicted building deterioration today on mesothelioma risk, pages 51-52.

However, the UK asbestos regulations have no measure of long-term asbestos exposure levels and lifetime risk to occupants in buildings like schools.[65]

See: Risk from cumulative asbestos exposure, pages 19-22; Student mesothelioma risk and life expectancy, pages 57-70.

This failure of the UK government to require a measure of asbestos levels and lifetime risk in buildings like schools means an increasing number of children will continue to die from mesothelioma as the aged asbestos in their former schools continues to deteriorate and the life expectancy of children and young people continues to rise. Their deaths, however, will be recorded (covered up) under their last occupation.

See: Recommendations, page 78.

Conclusion

"Unless stringent asbestos fibre limits of less than 100 fibres per cubic metre are introduced and enforced in our schools and public buildings then our children will continue to be exposed to an unacceptable level of risk.

The threat cannot be overstated."

Robin Howie
Expert industrial hygienist, Robin Howie Associates

Asbestos exposure in buildings – the risks
August 2005

Successive UK governments – like the asbestos industry – appear to have prioritised profit and cost reduction rather than the identification and removal of unsafe asbestos in buildings like schools. Thus, they have ignored the rising mesothelioma death toll of former school staff and students, and disregarded the research findings of the United States EPA (1980), Hodgson and Darnton (2000), the committee on carcinogenicity (2013) and Robin Howie Associates (2012) on lifetime risk, cumulative asbestos exposure, proportional mortality ratios and life expectancy.

The rising mesothelioma death toll was therefore not an accident. It was the policy of successive UK governments to cut costs rather than develop asbestos regulations which lowered the lifetime risk of staff and students developing mesothelioma in school buildings.

That government policy means that today there are no valid criteria which can inform the duty holder funding bids for unsafe asbestos removal. In addition, the government-required HSE occupational mesothelioma statistics and proportional mortality ratios appear to have been designed to underestimate the number of occupants of buildings, like schools and hospitals, who have died from mesothelioma.

While this report estimated tens of thousands of school staff and students* have already died from mesothelioma due to asbestos exposure prior to the mid-1990s, it further estimated hundreds of thousands would die from mesothelioma after the mid-1990s due to increased exposure to damaged asbestos and the increased life expectancy of children and young adults. So, duty holders, parents, staff and children should be made aware that as long as asbestos remains in buildings the risk of developing mesothelioma will continue to increase. *Those former student deaths are covered up as they are only recorded under their last occupation.

Crucially, the evidence in this report suggests that the third wave of mesothelioma deaths predicted by Landrigan (1991) in the United States is likely to be a tsunami in the UK that bears hundreds of thousands of staff and children to a painful death by suffocation. Their deaths would be the consequence of ineffective asbestos regulations and a cost-cutting culture that wrongly implies “asbestos is safe so long as it is not disturbed”. It is too late for those already exposed but prompt government action to remove asbestos from buildings could prevent further deaths in future.

Successive governments are now revealed to have historically ignored evidence of risk on grounds of cutting costs and increasing profits. The Grenfell Tower inferno, the Post Office Horizon IT scandal and the contaminated blood transfusion scandal in the 1970s- 80s all show governments, vested interests, industries and workplaces allowing lives to be sacrificed in order to cut costs and increase profits.

Who made those decisions behind closed doors? Surely it is time for the people to have their say.

Recommendations for government

- **The remit of the duty to manage asbestos regulations** should include a measure of the lifetime risk and premature mortality of adults and children developing mesothelioma in all buildings with friable asbestos. This should be based on the TEM measurement of the range of prevalent asbestos levels in buildings like schools during normal full occupation.
- **Cost benefit analysis:** Criteria for funding asbestos removal/building replacement should ensure that an imposed risk of one per million per year is the limit of 'acceptable risk' for children and adults in buildings that contain friable asbestos.

See: What is a typical asbestos level and acceptable risk in school buildings? page 64.

Appendices

Appendix A

Source of asbestos (year)	Asbestos level f/ml	Evidence source	Conditions of disturbance, if any
AIB panels surrounding door frame	0.17-0.87 (EM found majority appeared to be trace)	ILEA (1987)	Kicking AIB panels surrounding door frames (painted/ good condition)
Infant school toilet dividers (asbestos panels in good condition)	(i) All air samples > 0.015 f/ml (chrysotile, amosite and tr. Crocidolite (EM measurements)	ILEA report LSS/ AP/78 (1987)	(i) Slammed every half minute for 10 times
Stationery cupboard	0.017 f/ml to 0.04 f/ml with average of 0.027 fibres/ml EM measurements	IOM Strategic Consulting Report: 629-00224 April (2009)	Removing books from cupboard with unsealed asbestos back in good condition
Stationery cupboard	0.12 f/ml to 0.84 f/ml with an average of 0.36 fibres/ml. SEM	As above	Cleaning cupboards
Drawing pin insertion into AIB	0.05 f/ml in a 25-minute period of drawing pin activity	WATCH committee minutes 1 Feb 2006 Conclusions (para 3.36 p15)	Inserting drawing pins into AIB frequently for 25 minutes
Recirculated warm air cabinet heater baffles	"rooms served with by warm-air heaters whose ducts were lined with Asbestolux" found a level of 0.025 f/ml	Scrape CLASP asbestos handbook. Standard details. HSE (1983) Asbestos in warm air heating systems (Revised) LAAIC/C 3/5 HSE. Bootle UK	

Warm air cabinet heater +/- disturbance	0.0043 f/ml-1 with a pooled average of 0.0019 f/ml-1. TEM 1 heater.2 CLASP sch heater levels <LOQ	Ann. Occup. Hyg., 2015, 1-13 doi:10.1093 / annhyg / mev062	Vigorous disturbance of all the accessible AIB panels + heating cupboard panels
Sealed sprayed amosite and chrysotile on ceilings with some damage	<0.003 f/ml to 0.012 f/ml with an average of 0.002 f/ml	HSE Airborne asbestos concentrations buildings. Burdett and Jaffrey. Ann Occup. Hyg. Vol 30 No 2	
Column disturbance before remediation	Mean 0.049 f/ml; Range 0.441-0.001 f/ml	HSL/2007/22	Disturbance testing of enclosed columns (amosite)
Column disturbance after remediation	Mean 0.005 f/ml; Range 0.058-<0.001 f/ml	HSL/2007/14	
Unremediated column disturbance	Two classrooms: 0.0005 f/ml; 0.007 f/ml	AS/2007/14	Disturbance testing of columns (amosite) in good condition in a Rhondda school previously tested in HSL/2007/22
Column disturbance after remediation	Three areas TEM: 0.007 f/ml; 0.044 f/ml; 0.005 f/ml	AS/2007/14	
Column disturbance before remediation	One column PCM 2.53 f/ml	G&L Consultancy Ltd Report Hay Lane School Brent/2007	Disturbance testing
Lifting of ceiling tiles	0.034 f/ml in enclosure	As above 2007	Lifting ceiling tile disturbs asbestos debris on top
Lifting of ceiling tiles	0.01 f/ml	HSL RR624 2008	
Floor tiles	Atypical but unsafe fibres not counted by PCM	HEI 1991	Worn floor tiles (Chrysotile)

JUAC Report 2021. *Continuing government failure leads to rise in school mesothelioma deaths. Are pupils and staff any safer today?* See Table 12, page 58.

Appendix B

Proportional mortality ratios (PMRs): lies, damned lies or statistics?*

Robin M Howie

Occupational death data are often presented by HSE as PMRs. However, PMRs are NOT 'absolute' figures and are affected by deaths in all other occupations.

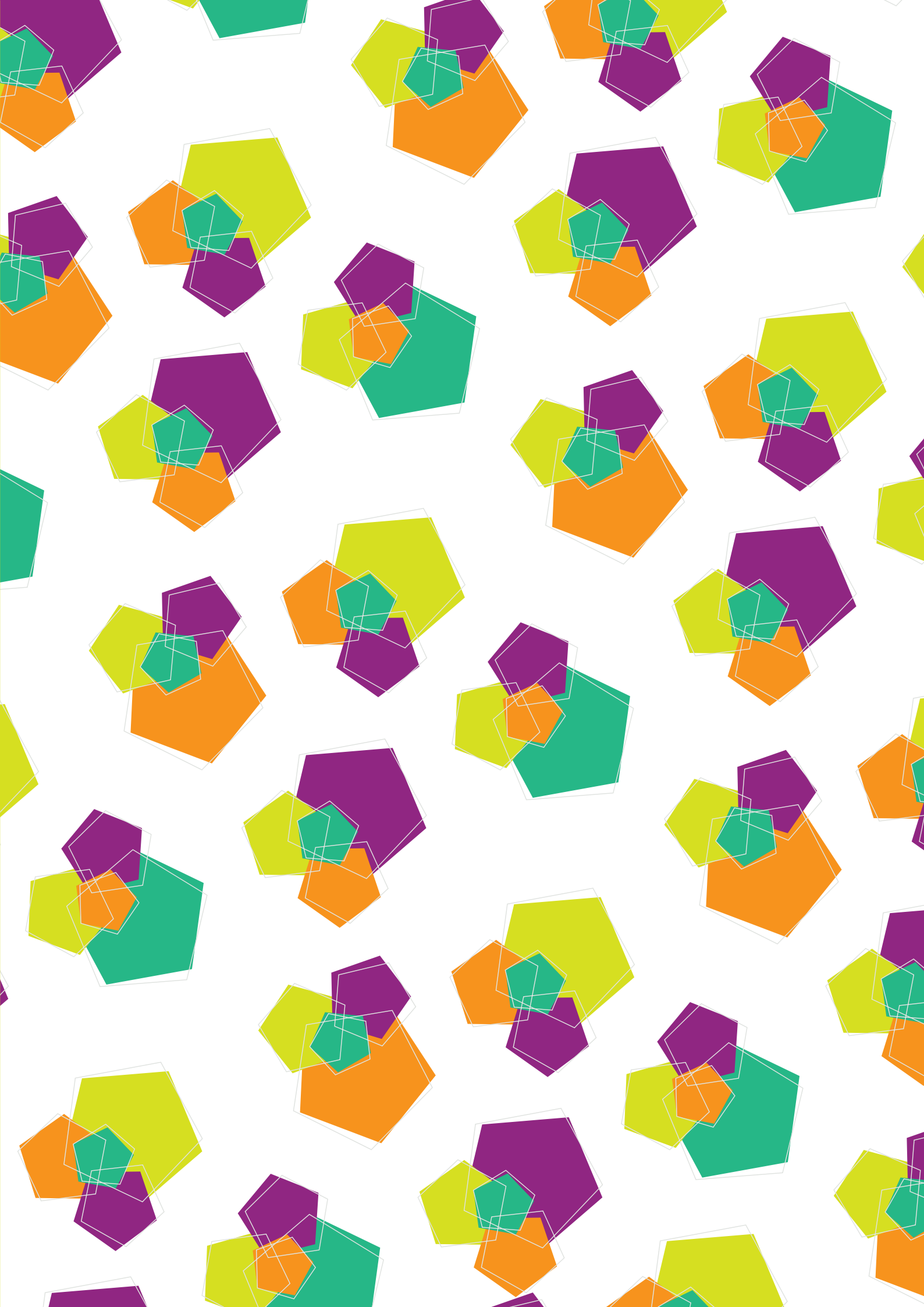
The data for mesothelioma deaths in school teachers over the period 2011-20 illustrate the critical weaknesses of PMRs.

For example, mesothelioma deaths in male secondary education teaching professionals (SOC 2314) was 56 in 9,443 all cause deaths (ACD), with a PMR of 61.4, and for female ditto there were ten mesothelioma deaths in 6,050 ACD, with a PMR of 57.4: so, although the rate per ACD was about four times higher in the males than in the females, the PMRs were similar.

If ACD for the 370 4-digit job codes are merged with the number of mesothelioma deaths in every job code this provides an 'absolute' index of risk in every occupation: unaffected by mesothelioma deaths in any other occupation(s).

As mesothelioma deaths in school teachers are elevated, this raises critical concerns: assuming teachers' mesotheliomas were caused by exposures to asbestos in schools, then their pupils would also have been exposed to asbestos and will have elevated mesothelioma risks. If each teacher over his/her career has taught, say, 500-1,000 pupils, the numbers of former pupils likely to develop mesothelioma from given cumulative exposures will be very much higher than the number of teachers developing mesothelioma, because of both their exposures earlier in life and their longer potential life expectancy.

*This paper was submitted to the British Occupational Hygiene Society (BOHS) conference in 2023.



national education union

NEU4069 10/25