Asbestos in Schools

The Scale of the Problem and the Implications

The Asbestos in Schools Group
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Asbestos in Schools

This paper examines the extent, type and condition of asbestos in schools and the risks to the occupants. It gives evidence that asbestos is present in most schools in the country, and in particular how there has been extensive use of the more dangerous materials in places vulnerable to damage. It gives examples of how that damage has been caused by both building and maintenance work and by normal, everyday classroom activities.

The paper shows how staff and pupils have been exposed to cumulatively significant levels of asbestos fibres. It gives the results of air sampling in schools and how background asbestos fibre levels can be raised. It gives examples of classroom activities that can frequently release significant levels of asbestos fibres. It shows that this was known almost twenty five years ago but because action was not taken, the exposures continued.

There is analysis of the results of air sampling that demonstrates that the actual levels of asbestos fibres can be significantly higher, particularly in schools, than recorded in the results.

The paper looks at the level of asbestos exposure capable of causing mesothelioma. It describes how workplace control levels are applied to the occupants of schools and the unsafe practices that have resulted from this. It then analyses the reasons staff and pupils are frequently not aware of their exposure or are advised not to enter it in their medical records. The paper examines and identifies selective use of scientific studies and data when producing policy and informing opinion. It produces referenced evidence that identifies and corrects the resulting incorrect conclusions and false impressions given.

The paper analyses the mesothelioma death statistics for school teachers and support staff and their implications. It presents the case that shows why these deaths are directly relevant when an assessment is made of the asbestos exposures and subsequent deaths of school children. The paper examines the particular vulnerability of children to asbestos.

It examines the areas where scientific knowledge of the risk to the life of school staff and children is not complete and where it is therefore essential to adopt a precautionary approach in order to prevent future deaths.

PART 1: EXTENT OF THE ASBESTOS PROBLEM IN UK SCHOOLS

The Department of Education’s best estimate is that over 75% of schools contain asbestos.\(^1\) The percentage is likely to be higher as, for example, about 90% of schools in Wales, Greater Manchester, Kent and the North East contain asbestos.\(^2\)

\(^1\) E-mail DfE 20 Jun 2011
HSE summarised the extent of the use of asbestos in schools: “Of the approximate 20,400 primary schools and 3,400 secondary schools in the UK, some 13,000 were built between 1945 and 1974, when the use of Asbestos Containing Materials (ACMS) in building was at its peak. Many other school premises would have been refurbished during or since that period, providing the potential for the introduction of ACMs e.g. lagging, ceiling panels, partition walls, sprayed coatings. This suggests that a high proportion of our present schools contain asbestos and represent the potential to release deadly fibres.”

All those schools contain chrysotile but there was also widespread use of amosite and some schools contain crocidolite. All types of asbestos can cause cancer but the “amphiboles,” amosite and crocidolite, are more dangerous. Amosite is estimated to be up to 100 times more likely to cause mesothelioma than chrysotile and crocidolite up to 500 times more likely to. There is no known threshold exposure to asbestos below which there is no risk, and all exposures, however small, are cumulative.

Mesothelioma is almost always caused by exposure to asbestos. It is a cancer of the mesothelial membranes usually of the pleura and peritoneum. It is invariably fatal.

An HSE case control study in 2009 highlighted that: “The British mesothelioma death rate is now the highest in the world.” The study concluded the likely reason is because: “Britain was the largest importer of amosite, and there is strong although indirect evidence that this was a major cause of the uniquely high mesothelioma rate.”

Everyone attends school. In 2007/2008 there were 9.7 million full-time and part-time pupils in 33,700 schools in the United Kingdom.

A Medical Research Council (MRC) report examined the extent, type and location of asbestos in schools and concluded: “It is not unreasonable to assume, therefore, that the entire school population has been exposed to asbestos in school buildings.”

Extensive use of amphiboles in schools.

After WWII a large number of schools were either built, extended or refurbished. To provide the numbers required a method of prefabricating was developed in the form of Modular construction or “System built” schools. Scape is the commercial trading company for a type of system building called CLASP, of which there are more than three thousand, most of which are schools. Scape state: “About

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1 HSE Paper Number: LAFORUM/04 Forum Asbestos management in schools. 23 Nov 2004
4 Judgement Jeffrey Burke QC Edgson v Vickers plc (QBD) Expert witness statement Dr Rudd, Dr Hugh Jones, Dr Britton p524 1994
half the school buildings in the UK are constructed using building systems. Most of the system built schools were constructed in the 60’s and 70’s.\textsuperscript{10}

Plate 1: A typical 1970’s “System Built” school. There was asbestos in the ceilings and “when the wind blew the ceilings tiles used to flap about”\textsuperscript{11}

The schools were constructed of prefabricated, standardised components normally based around a frame made of steel, concrete, wood or aluminium on which was placed external and internal cladding. The light structure used in most of the designs is vulnerable to fire damage and therefore extensive use was made of asbestos materials. Invariably there was an open void between the walls, also the ceiling voids were intentionally open spaces to allow the easy laying and access to service cables, piping and heating. The open space design allows the rapid spread of fire\textsuperscript{12} and consequently asbestos materials were commonly used in critical locations, with much of it being the amphiboles (amosite and crocidolite). MRC state:

\textit{In general extensive use was made of sprayed coatings (amphiboles), Asbestolux ceiling panels, and asbestos board and asbestos –cement partitioning in system-built buildings constructed in the 1960s. These particular buildings might thus be considered to pose a relatively “higher risk” of exposure.}\textsuperscript{13}

The extensive use of asbestos materials continued in schools until the mid 1970’s, after which its use decreased although amosite continued to be used until the early 1980’s, and chrysotile materials were used until 2000. Much\textsuperscript{14}, if not most, of the asbestos remains in place because of Government policy to manage rather than remove asbestos.

\textsuperscript{10} Scape School building overview www.scapebuild.co.uk
\textsuperscript{11} IEA ECBCS UK1 annex 36 Case study report
\textsuperscript{14} HSE Occupational, domestic and environmental mesothelioma risks in Britain, a case control study 2009 p1 Introduction. Low level exposure to asbestos .a historical perspective . Martin Stear.
All types of asbestos were used for spraying but crocidolite was the most common type until 1962, its use ceased in 1971 and all spraying ceased in 1974.\textsuperscript{15} Asbestolux was first produced in 1951 and contains amosite,\textsuperscript{16} it is a type of Asbestos insulating board (AIB) which was extensively used in schools in walls, window surrounds and ceiling tiles with more than 20\% of the ceiling area of new public buildings between 1967 and 1973 being AIB.\textsuperscript{17} All the ceilings in some schools are AIB tiles, classroom, corridor, hall, stairwell and toilet walls can be AIB, as can the window surrounds and door panels. In steel frame “system built” schools either sprayed asbestos\textsuperscript{18} or more normally AIB has been used as a cladding for the columns. AIB was also used as a general building material, it was used as wall panels and ceiling tiles in traditionally built schools and also during the refurbishment of schools. Britain imported more amosite than any other country and up to 80\% was used in the manufacture of AIB.\textsuperscript{19}

**Plate 2. AIB in a Classroom Heater** Badly damaged Asbestos insulating board lining to a classroom heater. For an indeterminate period heating fans blew air across the damaged AIB into the classroom.

There were estimated to be 100,000 temporary classrooms in 1980\textsuperscript{20}, many of these would have contained asbestos materials, with all the walls and ceilings being AIB in particular makes\textsuperscript{21}. AIB baffles lined ducted warm air heating in schools and storage heaters contained a form of insulating board called Caposil blocks, which contains amosite. Heating boilers and pipes running through wall, ceiling or under floor voids were insulated with asbestos lagging, and although chrysotile was predominantly used, amosite and crocidolite were also utilised.\textsuperscript{22}

\begin{footnotes}
\footnotetext[15]{HSE HSG 264 Asbestos; The surveyors guide 2010 p53}
\footnotetext[16]{Cape asbestos story 1953}
\footnotetext[19]{HSE Occupational, domestic and environmental mesothelioma risks in Britain, a case control study 2009 p46 para 4.7}
\footnotetext[20]{Building systems and Portable Buildings Education p1.241 1980}
\footnotetext[22]{HSE HSG 264 Asbestos; The surveyors guide 2010 p53-57}
\end{footnotes}
Material containing crocidolite was used in the construction of schools, although to a lesser extent than amosite, for instance in one make of system school building the entire lining to the roof deck above the ceiling is AIB containing crocidolite. Panelling containing crocidolite is also known to have been used in some temporary classrooms. School science laboratory tops were at times made with crocidolite.

There was widespread use of chrysotile in schools, in panelling, shed roofs, cloth fire curtains, window sills, guttering and extensively in floor tiles, roofing felt, and since 1903 in lagging.

Asbestos materials were also commonly used in science, domestic science, wood and metal work lessons. Asbestos wool was used for school chemistry experiments, as were AIB or Millboard Bunsen burner mats, asbestos paper and asbestos cement fume cupboard linings. Asbestos wool was known to be still in use in the 1980’s, and Bunsen burner mats and fume cupboards are still found in some schools. A recent survey identified an ironing board with an asbestos iron stand still in use. Crocidolite and chrysotile were used in asbestos cloth for fireblankets, oven mitts and welding aprons for science, domestic science, pottery and metal work classes. Asbestos mitts were known to be still in use in a ceramics class in 2007. Blackboards could be made of asbestos cement and some notice boards were AIB.

Although the use of asbestos materials for lessons has almost ceased, most of the asbestos that was used in the construction of school buildings remains in situ today because of government policies to manage asbestos rather than remove it.

**Dilapidated Schools.**

The nation’s school stock has not been well maintained so that over the years school buildings have become more dilapidated. The asbestos materials used in their construction are an integral part of the fabric of the buildings, the significance of this was emphasised by the Asbestos Consultants’ Association who stated “Over the years the school stock has not been well maintained so that as the fabric of the buildings has deteriorated then so has the asbestos.”

The fact that much of the school stock is in a poor condition, was recognised in 1999 by the Schools Minister who summed up the seriousness of the situation by stating “Our current buildings are below the standard we have a right to expect. Many are at or near the end of their expected life. Many others are in poor condition; others still are not suitable for the needs of the modern curriculum. Simply to tackle the most urgent priorities requires “a huge increase in the resources devoted to school capital.”

In 2003 an Audit Commission document highlighted a number of reports carried out by themselves and others ”warning about the maintenance time-bomb and the serious deterioration in the school building stock.”

The £55 billion project Building Schools for the Future (BSF) was launched in 2004 to refurbish or rebuild every secondary school in England, and a project for primary schools (PCP) was launched in 2005 which was considerably less well funded. BSF did not fulfil its potential and therefore only 186

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23 Hills 8-3-4. Lees private correspondence
24 Assessment of asbestos management in schools Asbestos Testing and Consultancy Association 24 Jan 2010
26 Improving school buildings Audit commission 2003 Para 12.
schools had been replaced or refurbished at its close in 2010. A similar situation exists in Scotland and Wales. A school estate survey for 2009 identified that 611 (23%) of schools in Scotland were in either a poor or bad condition. A 2010 study by the Welsh Assembly identified the likelihood of a £1 billion repair bill for their schools.

In 2011 the Schools Capital Review examined the school estate in England and concluded that “Significant parts of the school estate were and are in an unacceptable state.”

Policy of managing asbestos

The Government policy for schools is: “Asbestos which is in good condition and unlikely to be disturbed or damaged is better left in place and managed until the end of the life of the building as this presents less risk of exposure to the occupants than the process of removing it.” This policy of asbestos management has failed in the past, and unless considerably greater resources are allocated, it will continue to fail in the future. The Asbestos Consultants’ Association report stated:

The evidence is that the system of asbestos management in many schools is not of an adequate standard, in some it is ineffective, in others it is almost non-existent, and in some it is at times dangerous.... These are not minor problems that have crept in over recent years; rather they are fundamental problems that are endemic in schools in the UK... The members of the Asbestos Consultants Association, ATAC, have serious concerns over the general standards of asbestos management in schools. MPs, the teaching unions, school support staff unions and others are equally concerned that staff and pupils are being put at risk..... These flaws should have been identified
decades ago and measures taken to correct them, but because they were not, teachers support staff and children have been exposed to asbestos, when it could have been prevented."  

ATAC conclusions have been confirmed by HSE inspections that have resulted in enforcement action being taken for a failure to safely manage asbestos. A quarter of local authorities that were inspected had enforcement action taken, and a fifth of schools outside local authority control had action taken.  

Building and maintenance work, asbestos incidents and everyday classroom activities have released asbestos fibres into schools. Teachers, support staff and pupils have been exposed to asbestos, and frequently the exposures have been to amosite. Many schools are in a dilapidated state so that inevitably so are the asbestos materials they contain, there are insufficient funds to resolve the problem and so the asbestos will remain in place and be managed long into the future. It is therefore not unreasonable to assume that future generations of school staff and children will continue to be exposed to asbestos at school.

No known threshold of exposure below which there is no risk.

Dianne Willmore was exposed to asbestos while a pupil at school and subsequently died of mesothelioma. In March 2011 seven Justices of the Supreme Court unanimously confirmed the judgement that she had been negligently exposed to asbestos while a pupil at school, and that the exposure she had suffered materially increased the risk of her mesothelioma developing. The High Court, Appeal Court and Supreme Court all accepted the expert medical opinion given by Dr Rudd, an internationally recognised expert in mesothelioma, that:

“Mesothelioma can occur after low level asbestos exposure and there is no threshold dose of asbestos below which there is no risk.”  

The World Health Organisation acknowledged the absence of a known threshold and stated “No threshold has been identified for the carcinogenic risks to chrysotile.” The HSE’s Hodgson and Darnton paper on risks from asbestos exposure examined the various studies into the level of exposure that can cause mesothelioma and concluded “All these observations suggest that relatively brief exposures may carry a low, but non-zero, risk of causing mesothelioma. Taking this evidence together we do not believe there is a good case for assuming any threshold for mesothelioma.” The evidence was re-examined by the government’s advisory committee on science, WATCH, who in

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35 Assessment of asbestos management in schools Asbestos Testing and Consultancy Association 24 Jan 2010  
36 HSE Inspection Findings: Asbestos management in Local Authority school system buildings 2009/10  
38 High Court QBD Liverpool District. The Hon Mr Justice Nicol . Dianne Willmore and Knowsley Metropolitan Borough Council 24 July 2009 Para 4  
2011 confirmed that “The risk will be lower, the lower the exposure, but “safe” thresholds are not identifiable.”

Dr Rudd defined a significant exposure as one that will materially increase the risk of mesothelioma developing. He referred to the Industrial Injuries Advisory Council definition of a significant exposure as a level above the normal background level. He stated: “Significant” is defined in accordance with the definition adopted in relation to mesothelioma causation by the Industrial Injuries Advisory Council in their 1996 report (CM3467) “A level above that commonly found in the air in buildings and the general outdoor environment.”

It would be appropriate for the Court to conclude that each such exposure materially increased the risk that she would develop mesothelioma.

In an earlier case Dr Rudd and other colleagues explained how all exposures to asbestos have a cumulative effect that can lead to the development of mesothelioma. They stated as expert witnesses:

“Mesothelioma can in theory be caused by a single fibre acting to create a mutation of a cell from which a malignant tumour may develop. ...all exposures up to 10 years before the appearance of symptoms is relevant, for two reasons: first, any inhalation may cause mutation...; secondly, the inhalation of asbestos is now known to have an adverse effect on the body’s natural ability...to deal with potentially mutating or mutated cells before a malignant tumour develops....Later exposure adds to earlier exposure. All exposures, other than in the last ten years before the emergence of symptoms, is cumulative and contributes to the risk of and the development of a tumour.”

(Subsequently medical opinion has changed and it is generally accepted that all asbestos exposures are cumulative and contribute to the risk of a tumour developing up to about five years before the onset of symptoms.)

MRC “Exposure to asbestos in school may therefore constitute a significant part of total exposure.”

The Medical Research Council report assessed lifetime asbestos exposures and estimated the numbers of asbestos fibres inhaled. It based its estimate on the number of fibres inhaled by a child during their time at school on the asbestos being in good condition with a background asbestos fibre level of 0.0005f/ml. The outside background airborne asbestos fibre level is between 0.000001 f/ml and 0.0001 f/ml, and so the background level in schools with asbestos in good condition is already five to five hundred times greater than outside air. MRC stated:

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41 Final WATCH Position on asbestos risk assessment: February 2011
42 High Court QBD Liverpool District. The Hon Mr Justice Nicol . Dianne Willmore and Knowsley Metropolitan Borough Council 24 July 2009 Para 8, 57b
43 (Jeffrey Burke QC Edgson v Vickers plc (QBD) Dr Rudd, Dr Hugh Jones, Dr Britton p524 1994)
45 Supreme Court Judgment Sienkiewicz (Administratrix of the Estate of Enid Costello Deceased) (Respondent) v Greif (UK) Limited (Appellant) Knowsley Metropolitan Borough Council (Appellant) v Willmore (Respondent) Lord Phillips, President 9 March 2011 para 19v
46 Fibrous Materials in the Environment Institute for Environment and Health. P71
“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.”

In expert medical and legal opinion and that of IIAC, all exposures above the normal background level will materially increase the risk of mesothelioma developing.

Dianne Willmore’s case graphically highlights the risks from low level asbestos exposure to children at school. There are other cases where it was suspected that asbestos exposure at school could have caused the mesothelioma, one current case is a 42 year old woman who has mesothelioma and it is likely she was exposed to asbestos at school. The exposures of the pupils, teachers and support staff who are suffering or who have died of mesothelioma were not due to working in a high risk occupation where their daily work disturbed asbestos, but instead their asbestos exposures occurred in schools from occasional peak exposures or long term, low level exposures whilst engaged in normal every day classroom activities.

The next section examines typical asbestos fibre levels in schools.

**PART 2: ASBESTOS FIBRE LEVELS IN SCHOOLS**

Asbestos fibres are released when asbestos materials are disturbed. The level of fibre release depends on the type of asbestos material, the type of asbestos it contains, the condition it is in, the type of disturbance and the length of time the disturbance takes place. This section examines the levels of asbestos fibres released from common classroom activity and also from building and maintenance work.

The peak exposure from building or maintenance work or physical damage being inflicted on asbestos materials by the children can be high and add significantly to the life time burden of asbestos fibres. However the fibres released from normal classroom activities can be significantly greater than background levels, the releases can be frequent and take place over prolonged periods of time so that the cumulative burden can be considerable and these issues are examined in this section.

**Significant amosite fibre release from common classroom activities.**

The MRC calculations were based on fibre levels with asbestos in good condition (0.0005f/ml). However, even if asbestos material appears to be in good condition significant levels of asbestos fibres can be released, and tests have shown that common classroom activities can produce amosite fibre levels far higher than the background levels.

The extent, type and condition of the asbestos material are relevant as the more friable the material is the more fibres will be released. Although some materials in good condition can release asbestos fibres the more damaged the material or the more friable the material the greater the likelihood of fibre release. The greater the quantity of asbestos material present the more fibres will be released.

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47 The Times Cancer in the classroom 8 Jul 2011
and also the greater the chance there is for fibre release. It is also relevant that in similar materials it is considered that crocidolite and amosite fibres are released ten times more readily than chrysotile.\textsuperscript{48} This is particularly pertinent in schools where the use of amosite was widespread.

Many schools in the UK are in a poor condition because they are beyond their design life and there has been insufficient funding to maintain them properly. This has been exacerbated because the fabric of the buildings suffer more than they would in many other environments because they are full of children. The use of AIB in vulnerable locations in schools was widespread. Children run into walls, jostle in corridors and bump into the walls, even smash holes in walls, hide satchels above suspended ceilings and kick footballs into walls, columns and ceilings.

**Significant amosite fibre release from hitting AIB walls apparently in good condition.**

In 1987 school staff expressed concern that the pupils in a boys' secondary school in Wandsworth were kicking the AIB panels that surrounded the door frames. The AIB panels were painted and appeared to be in good condition. Air sampling was carried out that found levels from 0.17 f/ml to 0.87f/ml from kicking the panels. "Analysis of the fibres by electron microscopy has confirmed the majority of the fibres to be amosite asbestos."\textsuperscript{49} These levels are between 340 and 1740 times higher than the normal background levels in schools with asbestos in good condition.

**Plate 3: A hole punched in AIB panel.** Note: A large amount of amosite fibres and AIB debris would be produced. The damaged material is very friable so that amosite fibres will be released every time there is more disturbance.  
Photo: Oracle Solutions Ltd

The tests also took air samples when a hole was intentionally kicked in an AIB panel. The asbestos fibre levels were very high so that the air sampling filters were "obscured by particulate matter and could not be counted." Not only would the peak levels be high at the time the damage was done the AIB debris would contaminate the room to be crushed underfoot so that even more fibres would be

\textsuperscript{48} Amendment to the Control of Asbestos sat Work Regulations 1987 and ACOP para A67 p 34 2002
\textsuperscript{49} ILEA report LSS/AP/52 (1987) Investigation into fibre release from low level asbestos panels - Ernest Bevin school May 1987
emitted, which would then become airborne once again with disturbance. In two schools there is evidence that the pupils also pushed books and other articles into the holes, which would have released a considerable number of asbestos fibres. The smashing of holes in walls is by no means exceptional as it is known to have happened in other schools, and in some the occupants have developed mesothelioma.\textsuperscript{50}

**Slamming a door releases amosite fibres 660 times greater than background levels.**

It was noticed in the 1987 tests that the boys were slamming a door in a corridor, therefore further sampling was carried out and levels from 0.16f/ml to 0.33f/ml were measured from slamming the door five times. Again the majority of fibres were amosite. The levels are between 340 and 660 times greater than the normal background level. They were the average fibre level measured over the period of sampling which was between 60-90 minutes. Therefore if after each lesson the door was slammed five times these level would have been maintained throughout the day.

The report concluded that the results “suggest that even when supposedly sealed in by painting, asbestos panels are still hazardous.”\textsuperscript{51} The reason is that although the front of the AIB panel is painted, the reverse face is not, and therefore every time a door is slammed or the wall hit amosite fibres are released from the reverse face of the panel into the wall void. The following photographs illustrate what happens when AIB panels are disturbed. Plate 4 shows an AIB panel beneath a classroom window, it has been scuffed and inevitably some asbestos fibres released. The remedy was probably to paint the scuffs with a PVA paint which would seal the surface. That however might fulfil the requirements of “managing” the asbestos, but it would not prevent the release of asbestos fibres from the unpainted reverse face of the AIB. The problem is graphically illustrated in Plate 5.

**Plate 4 Scuffed interior AIB Window Infill Panel.** Note: Some infill panels are a sandwich construction with two layers of AIB. Where the skirting board abuts the floor it is unlikely to provide an effective seal to asbestos fibres in the void.


\textsuperscript{51} ILEA report L55/AP/52 (1987) Investigation into fibre release from low level asbestos panels - Ernest Bevin school May 1987
Plate 5 is taken with Tyndall beam photography that illuminates the asbestos fibres that are not normally visible to the naked eye. The photograph is of AIB panels being stacked and the large cloud is of mainly amosite fibres being released. A similar process takes place when a child runs into or kicks a wall or a column, when a door is slammed or a football is thrown against a ceiling tile.

**Plate 5: Cloud of Asbestos Fibres** Note: Tyndall beam photography shows a cloud of mainly amosite fibres from stacking AIB panels. Each time AIB is hit the unsealed reverse face releases asbestos fibres.

In 1987 further air sampling was undertaken in the infant toilets of a primary school where the toilet dividers were stud walls with asbestos panels in apparently good condition. The panels contained chrysotile, amosite and a trace of crocidolite.

The two cubicle doors were slammed every half minute with a total of 10 slams. All the air samples gave levels above the Clearance level (0.01f/ml) with a Scanning Electron microscope (SEM) analysis giving a level of 0.015f/ml of asbestos fibres, some 30 times greater than normal background levels. The results from these tests show that just the simple act of slamming an infant toilet cubicle door can release asbestos fibres. Other tests from just closing the door also released asbestos fibres although the exact levels were not recorded, just the fact that they were beneath 0.01 f/ml. Before the tests began the surfaces were brushed and SEM analysis showed asbestos contamination at levels of 0.005 f/ml, and it quite possible that this contamination had taken place over a prolonged period of time. The fibre levels in this primary school were lower than similar tests carried out in the secondary school, but add to the evidence that just normal activity that is typical in a school can release asbestos fibres into the rooms considerably greater than normal background levels.

It is not unreasonable to assume that amosite fibres were being released daily in the toilets of the primary school and were being inhaled by the very young children. Although the levels were relatively low, their risk of developing mesothelioma is significantly increased purely because of their

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52 ILEA report LSS/AP/78 (1987) Investigation into fibre release from low level asbestos panels at Roehampton Gate Primary September 1987
age. In just an hour if a child had hit a wall in the secondary school they would inhale about quarter of a million fibres. If a classroom door was slammed at the change of each lesson it would take only a matter of days to exceed the estimated number of fibres inhaled for the whole of a school career, and yet in some cases the exposures were inevitably taking place over many years so that the cumulative burden of the occupants would be high. Clearly the numbers of asbestos fibres inhaled by many thousands of teachers, support staff and children has been far greater than the 3,000,000 million estimated in the MRC report.

**Fibre releases continued. Problem rediscovered twenty years later.**

There is no evidence that any measures were taken to warn the thousands of other schools that potentially had very similar problems to those identified in Wandsworth in 1987, therefore the release of asbestos fibres continued unabated. Twenty years passed until the problem was identified once again. Measures were then taken but they are inadequate and can only be considered as a temporary expedient as they hide the problem rather than solving it.

In 2006 the problem was rediscovered. Air sampling was carried out in a System built school in Wales which found that when the doors were slammed, walls and interior columns were hit, when windows were banged shut and when people sat on window sills that high levels of asbestos fibres could be ejected out of cracks and gaps into the classrooms and also into the ceiling void. Most of the airborne asbestos fibres were amosite.

All the asbestos is old in schools throughout the country, and because of fair wear and tear, vandalism and lack of maintenance it has been gradually deteriorating over the years and releasing asbestos fibres. It was also found in the schools in Wales and elsewhere that asbestos Insulating Board (AIB) off cuts and debris had been left in the ceiling void and wall voids from when the schools had been built in the 1960’s. Botched maintenance had damaged the AIB, as had the running of cables through the column cladding and the fastening of electrical sockets and other fixtures to the cladding had further damaged the AIB. In some schools the windows had been replaced by fastening to the column cladding with screws into the AIB. As the windows flexed it is thought that the screws acted as files so releasing more fibres into the column and wall voids.53

The average level from these normal everyday activities in classrooms and corridors was 0.094 f/ml, which is almost 200 times greater than the background level with asbestos in good condition. Out of 39 slides that were analysed 31 gave levels above the Clearance Limit (0.01 f/ml). The highest levels were 0.44 f/ml, 0.42 f/ml and 2.37 f/ml.54 Although the majority of the slides were analysed by optical PCM, six slides were analysed electronically by TEM, four of which gave asbestos fibre levels above 0.01 f/ml, two of which were 0.02 f/ml and 0.24 f/ml. (480 times greater than the background level.) The airborne fibres were predominantly amosite. The HSE report stated:

“There is a significant amount of data that shows that amosite fibres can be released into the classroom air when some of the casings are struck or adjacent windows and doors are banged...After further field sampling work had confirmed the probable mechanisms for release (damaged and /or poor sealing) and that predominately amosite asbestos fibres were being released...”

53 A joint message from the HSE/LGE/DFES Asbestos—potential for exposure in "clasp" school buildings October 2006
54 HSE FOI request/Lees 2007010226 15 Jan 2007
generally confirmed that a high percentage of the fibres released when the columns were struck were amosite.\textsuperscript{55}

The levels were later replicated in a school when independent tests were carried out. When a free standing column in a classroom was hit and the window sill shaken the airborne fibre level was 0.49 f/ml.\textsuperscript{56} A level of 2.53 f/ml was obtained on the personal sampler worn by the person carrying out the disturbance.\textsuperscript{57} In the same school the central column in the gym was clad in AIB and was used as a goal post, it showed visible signs that it had been hit on many occasions. The fibre level in the ceiling void measured over the hour was 0.72f/ml. That shows that significant quantities of asbestos fibres were ejected out of the tops of the columns into the ceiling void.\textsuperscript{58} That would have happened every time the column was hit or kicked, and every time the door was slammed. The fibres would have accumulated in the ceiling void to filter down through any crack or gap into the classrooms beneath. The tiles had been lifted in that particular classroom so that Christmas decorations could be hung onto the ceiling grid\textsuperscript{59}, consequently there were gaps between the tiles and the grid and wherever air can pass asbestos fibres can pass just as readily.

Plate 6. Base of column showing a large amount of AIB debris. HSE photograph

The majority of tests confirm the high amosite fibre levels that had first been identified in 1987 and showed that there is a serious problem of asbestos fibre release from AIB panels in schools. They provide definitive evidence that normal everyday activities that one can expect in a classroom produce airborne asbestos fibre levels that are orders of magnitude greater than the normal background levels with asbestos in good condition. It is likely that similar activity has released similar levels of amosite fibres into the classrooms, halls and corridors of a large number of schools over the

\textsuperscript{55} HSL Summary of fibre concentrations in CLASP construction schools containing asbestos HSL/2007/22 Introduction p1. para 3.6 p12
\textsuperscript{56} G\&L Consultancy Ltd Report for asbestos investigation 15-16 Dec 2007. Brent para 4.8.2
\textsuperscript{57} Air sampling disturbance testing System built school London Borough of Brent 16 Dec 2007
\textsuperscript{58} G\&L Consultancy Ltd Report for asbestos investigation Brent 15-16 Dec 2007. para 4.8.2
\textsuperscript{59} Lees personal observation December 16\textsuperscript{th} 2007
\textsuperscript{60} HSL Summary of fibre concentrations in CLASP construction schools containing asbestos HSL/2007/22 Introduction fig 11 p15
course of many years. In some schools it is likely that the release of fibres has occurred since the schools were first built forty or fifty years ago.

**Plate 7. Badly damaged ceiling tiles in a school corridor**

Note: The ceiling voids are contaminated with amosite fibres in this school so that any fibres in the void would enter the corridor. In addition some of the other tiles are not firmly seated on the grid. The ceiling has been damaged by water so that it is probable asbestos fibres will have been precipitated out when the water dried.

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**Viability of Second Series of tests are questioned**

A second series of tests were then commissioned by HSL “To carry out a more sensitive analysis of the airborne asbestos fibre concentration in buildings under conditions of normal occupation. To assess the potential exposure of maintenance personnel in CLASP type buildings. To further assess the potential for release after remediation.”

Serious questions have been raised about the viability of these tests, the selection of buildings, the methodology, the practice of mathematically pooling results in these circumstances, the conclusions, recommendations and the policy made based on the results. The tests were at odds with the earlier tests, as the majority of the results were low and once pooling had been performed were an order of magnitude lower than the average previously found in UK asbestos-containing buildings.

Tests were specifically undertaken to measure the asbestos fibre levels in occupied classrooms before any remedial measures were undertaken. In one test a school was selected that had chrysotile cement cladding, despite the fact that the problem under investigation was with AIB or sprayed asbestos on the columns. Because asbestos cement is a harder material than AIB and sprayed asbestos it releases considerably fewer asbestos fibres, also chrysotile is released ten times

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61 HSL Further measurements of fibre concentrations In CLASP construction buildings AS/ 2007/14
Garry Burdett Sep 2007
62 CLASP Working Group minutes 16 Jul 2007. See Release of asbestos fibres in system built schools part 2 P31-73
http://www.asbestosexposureschools.co.uk/RELEASE%20OF%20ASBESTOS%20FIBRES%20IN%20SYSTEM%20BUILT%20SCHOOLS.%20PART
%202.%20AI%203.14%20JUN%2008.pdf
less readily than amosite, consequently just one asbestos fibre was identified. On the strength of this test it was claimed that the asbestos fibre levels were "below the previously monitored average in asbestos containing buildings." A second series of tests were undertaken before remediation in offices in an office block rather than in a school. The sampling lasted five weeks, but once again just one asbestos fibre was counted and exceptionally few other fibres. The offices were clearly not typical of a busy school. However it was claimed that "The level was an order of magnitude lower than the average background value for asbestos containing materials in buildings." Other tests were carried out to test the effectiveness of the remedial action. The first series of tests had shown that when disturbance was carried out that the sealing of the columns had not always prevented asbestos fibres being released. However the second series of tests were carried out in seven occupied schools where no asbestos fibres were collected. The HSL report lists the “limit of detection” as the “asbestos fibre concentration.” The average of the 28 tests was <0.0008 f/ml. However HSL pooled the results which mathematically reduced the figure to <0.000048f/ml and purely on the strength of that felt able to claim that the asbestos fibre levels were "Some ten times lower than the average previously found in UK asbestos containing buildings." Pooling in these circumstances is not acceptable practice and the claim cannot be justified. All that can be legitimately claimed is that the average asbestos fibre concentration was < 0.0008 f/ml. That is not lower than the previously accepted background level for schools of 0.0005f/ml. What must also be borne in mind is that extensive remedial actions had been carried out in the seven schools to specifically prevent the release of asbestos fibres, and therefore the results cannot be considered representative of all schools that contain asbestos.

The government’s advisory committee on science, WATCH, were tasked to assess the risks from low level asbestos exposure and in 2009 requested “HSE/HSL to summarise the knowledge it has on airborne levels of asbestos in buildings for the next WATCH meeting.” In response HSL presented a paper to WATCH that selectively gave these exceptionally low results, and no others, as being representative of UK schools. HSL stated “What has been published suggests that there is no increase in the average occupant exposure in normally occupied buildings and the average concentrations may be even be lower than assessed by the HEI report and the earlier UK study.” The statement given by HSL cannot be justified and their paper presented to WATCH is not an accurate summary of airborne fibre levels in UK schools, and should not be considered as such.

(See Annex D)

Release of amosite fibres from classroom cupboards.

Another example of significant asbestos fibre release from common classroom activities is illustrated by the release of amosite fibres from the simple act of removing books from a classroom stationary

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63 HSE amendment to the CAWR 1987 and ACOP Regulatory impact assessment July 2002 para A67 p 34
64 CLASP Working Group minutes 16 July 2007
66 WATCH committee minutes 10 Nov 209 para 4.38 and Actions 4.49iv
67 WATCH committee papers 23 Feb 2010 (By G.Burdett, HSL) Annex 3: Update of published asbestos concentrations in buildings under normal use and occupation. 27 Oct 2010 Annex 4: Update of published asbestos concentrations in buildings under normal use and occupation. (By G.Burdett, HSL)
cupboard. It was discovered that the back of the cupboards in eleven classrooms in a school was unpainted AIB. Air sampling was carried out to assess the likely levels of asbestos fibre release. In the cupboard where sampling was carried out there was no apparent damage to the AIB. The level of amosite fibres released by removing books and stationary from the cupboard was from 0.017f/ml to 0.04 f/ml with an average of 0.027 fibres/ml. (50 times greater than normal background) This was measured by an electronic microscope (SEM).

The shelves and the contents were visibly covered in dust. Tests were then carried out to simulate cleaning the cupboard. The levels of amosite fibres measured by SEM were from 0.12f/ml to 0.84 f/ml with an average of 0.36 fibres/ml. (700 times greater than normal background)

The cupboards were accessed daily, in some case six times a day. Some staff had taught in the classrooms for many years so that cumulatively their exposure was considerable. It was estimated that the pupils had five years of lessons in the classrooms and that their exposure was less than the teachers, but nonetheless cumulatively over five years their exposures were also significant.

The local authority commissioned the Institute of Occupational Medicine (IOM) to assess the likely exposures and the subsequent risks to the staff and pupils. They assessed that the cumulative exposures of the pupils to amosite fibres was between 4.75 f/ml.hours and the worse case of 47.5 f/ml hours total over their five years at the school, and for the teachers the likely annual exposure was between 1 f/ml.hours and 7 f/ml.hours with a worst case between 5 f/ml.hours and 31 f/ml hours every year.

(IOMs advice and use of a workplace level as a threshold for a long term risk to health is examined at Annex G)

It is not unreasonable to assume that the exposure of the occupants of the classrooms from this common activity could have taken place every day since the school was built some forty years before. Cumulatively the fibre burdens of both the staff and generations of children would have been significant. Over the course of more than forty years nobody was aware of the asbestos fibre release from the cupboards, and nothing had been done to prevent the release. Many other schools are invariably in a similar situation with exposures taking place without the occupants being aware.

The risk assessment considered the release of asbestos fibres from the cupboards in isolation, however it is possible that the occupants were exposed to amosite fibres from sources other than just this one. That is because the school is in a bad state of repair.

The school is a typical System built school constructed in the 1960’s and early 1970’s, the buildings are CLASP Mk 4, 4B and 5 and Hills. All contain asbestos with some in large amounts, much of the

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68 IOM Strategic Consulting Report: 629-00224 April 2009 An assessment of the past exposure and estimation of consequent risks to health of staff that may have arisen from asbestos-containing material in cupboards at Lees Brook Community Sports College, Derby
Alan Jones, Andy Stelling, I Levers, Hilary Cowie Strategic Consulting Report: 629-00270 May 2009 An assessment of the past exposure and estimation of consequent risks to health of pupils that may have arisen from asbestos-containing material in cupboards at Lees Brook Community Sports College, Derby Alan Jones, Andy Stelling, I Levers, Hilary Cowie


70 Derby City Council Types of school buildings Sep 04
material is AIB in walls, columns and window surrounds.  

In every report since 1990 OFSTED inspectors have mentioned the poor condition of the building with the council estimating in 2007 that following condition, structural and asbestos surveys £2m to £6m needed to be spent. The school was to be replaced under BSF, but that has been postponed, finally in July 2011 £2m is to be spent on repairs including sealing asbestos. The headteacher stated: “the repairs will help keep us open and ensure that we are safe while we wait for a new building.” The asbestos problems in this school are typical of thousands throughout the country. Finally remedial actions are being taken to seal the asbestos, but that step has only been taken after decades of asbestos exposure of the occupants.

Displaying children’s work releases significant levels of amosite fibres.

The practice of pinning children’s work to walls and ceilings is another example of a common classroom activity that can regularly release low levels of amosite fibres. It is now discouraged but it was a common practice in thousands of schools, particularly in primary and infant classrooms, for teachers to display the children’s work by pinning or stapling it to the display boards, and walls and to hang it as mobiles from the ceilings. If the walls and ceilings are AIB amosite fibres are released every time a drawing pin or staple is pushed in to the AIB or pulled out.

Plate 8. AIB debris from drawing pins. 6,000 fibres per pin. Note: The debris on the left, the right has been micro-vacuumed for counting. Photo Robin Howie Associates

The practice was particularly prevalent in classrooms containing very young children, and it is known that some teachers changed parts of the displays on a daily basis. In one school the infant teachers and their assistants had to stand on chairs to insert and remove the drawing pins when hanging mobiles from the ceiling so that their faces were close to the release of asbestos fibres. One teacher

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72 Derby Evening Telegraph 26 Mar 2007  
73 Derby Evening Telegraph 26 July 2011 Chaddesden school to undergo £2m repairs
was observed to brush AIB debris from her hair, face and clothes as she removed drawing pins from an area of the AIB ceiling panel that had been frequently used for displaying work.74

Although the release of amosite fibres is small for each pin, the cumulative exposure is significant. Four series of tests were carried out to assess the fibre release and the resultant exposure. The Government’s advisory committee on science, WATCH, considered the various tests and concluded that 6,000 fibres were released from each insertion and withdrawal of a drawing pin and that “A “realistic worst-case” prediction for exposure of an operative under conceivable real-life conditions is 0.05f/ml in a 25 minute period of drawing pin activity.”75 In the extreme event of all the fibres being inhaled then the exposure would be 1f/ml during the period of pinning. It should be noted that the estimates did not consider the contamination of the classroom, the fibres becoming airborne once again from classroom activity nor the contamination of the hair and clothing of the teachers.

A calculation was made that assessed the risk to the teachers and pupils from five years of the practice. It concluded that the risk from a cumulative exposure to the teachers over 5 years from age 25 is about 1 in 10,000. It assumed that the pupils’ exposure was a tenth of the teachers, however because of their age they would be at a greater risk and therefore the risk would be about 1 in 20,000.76 These calculations are based on the Hodgson and Darnton risk model and are therefore not definitive figures, however they do give a good idea of the scale of the risks. (See the calculations at Annex E)

Again a common classroom activity can release significant levels of asbestos fibres, that if regularly performed will cumulatively result in a significant fibre burden for the occupants of the rooms. It is also pertinent that in schools that allow this practice the standards of asbestos awareness and management are poor so that it is probable that the exposure from this practice will not be in isolation and there will be releases of asbestos fibres from other activities.

Asbestos fibre release from heating systems.

Asbestos materials have been used as insulation in heating systems for over a hundred years. Asbestos lagging has been extensively used in school boiler houses, on heating pipes running through rooms, in attics, behind walls and in under floor ducting and service riser ducts. All types of asbestos have been used and all the material is now old and much is friable. There are known cases of badly damaged crocidolite lagging in ducts under corridors, under classrooms77 and in roof spaces.78 A Victorian school had damaged amosite lagging in the attic above the classrooms which precipitated significant levels of fibres through a ceiling hatch.79 A primary school teacher died of mesothelioma and her autopsy found industrial levels of asbestos fibres in her pleura. She had
regularly hung the children’s coats in the boiler house, and there was also asbestos lagging in the attic of the school.  

The actual heaters themselves can contain asbestos materials. “Caposil” blocks contain up to 30% amosite and “Caposite” blocks containing up to 85% amosite were used in classroom storage heaters. Many heaters are fan assisted so that the fibres from damaged material will be wafted into the rooms. Either amosite or chrysotile fibres were found in 17 buildings study of 24 storage heaters sampled, although the average level for “standard” fibres was <0.001 f/ml one sample was 0.002f/ml of amosite and A German study found a statistically significant increase in mesothelioma incidence amongst those who used storage heaters. Work on the heaters is also known to have taken place while the classrooms were occupied, for example in an infant classroom two large storage heaters were dismantled by men in “space suits” while the children looked on.

AIB panels lined some classroom heaters, Plate 2 is of a classroom radiator where the AIB lining has been badly damaged. For an indeterminate period fans had blown across the damaged material inevitably blowing amosite fibres into the classroom.

A common form of heating in system built schools from the early 1950s was “forced warm air heating,” and Andrews Weatherfoil was one of the leading makes. Hot water was circulated around the building into heating cabinets in the walls, where fans sucked in air from the room, passed it over heating elements and emitted the hot air through grilles back into the room again.

The cabinets were lined with unsealed AIB and the baffles to deflect the air were AIB. A book on post war schools states: “The cabinets were bulky, the fan motors noisy, and the apparatus needed regular cleaning if it was to function properly; later on, naughty children bent the bars on the fronts of the grilles.” There are doors to gain access for cleaning and servicing and it is known that children also gained access to the cabinets. The CLASP asbestos handbook gives details of the heater baffles and casing, and states: “If damaged, fibres can be readily circulated...” This has been confirmed in a school where heating cabinets were installed there was dust containing asbestos on the pupils’ desks every morning blown from the heaters. In 2011 schools are still heated with the system of heating.

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80 Lees personal communication.
83 Lees personal communication.
85 Towards a social architecture. The role of school Building in Post War England. Andrew Saint 1987 Lyng Hall. p 86
86 Lees personal communication Feb 2011
87 Scape CLASP asbestos handbook Asbestos in CLASP standard details. P11 para 1.02
88 Lees personal correspondence Sep 11
89 Lees personal correspondence Feb 2011
Amosite fibres have been emitted into the classrooms from this form of heating. Air sampling carried out in “rooms served with by warm-air heaters whose ducts were lined with Asbestolux” found a level of 0.025 f/ml.\(^\text{90}\)

**Plate 9: Warm air ducted heating.** Note: “If damaged, fibres can be readily circulated.”

Other forms of heating in schools have conventional radiators and heaters. These were commonly mounted on an AIB plinth or backed by an AIB panel on the wall where the AIB is very vulnerable to damage. A previous section demonstrated the significant fibre release from unsealed AIB backing to classroom cupboards, the AIB backings and plinths are in a similar situation and significant levels of asbestos fibres will be released.

**Asbestos floor tiles can release significant levels of asbestos fibres. However the fibres are often not counted.**

Asbestos floor tiles are common in schools. Thermoplastic tiles can contain up to 25% asbestos and vinyl floor tiles usually about 7% chrysotile.\(^\text{91}\) Although the fibres are normally held firmly in the matrix they are released when the floors become worn or when they are damaged. The French Agency for Environmental and Occupational Health and Safety (Afsset) were concerned that large quantities of asbestos fibres can be released from worn tiles, and yet when air sampling took place the fibres were not being counted as they are shorter than the standard dimensions. This means that actual fibre counts in schools can be significantly higher than the recorded values. Afsset stated:

“Afsset suggests creating a new specific statutory threshold for short asbestos fibres, applicable in indoor environments (establishments open to the public, etc.). This threshold will concern situations

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\(^{90}\) HSE (1983) Asbestos in warm air heating systems. (Revised) LAAIC/C 3/5 Health and Safety Executive. Bootle, U.K.

\(^{91}\) HSE Asbestos the surveyors guide p57
of serious deterioration of asbestos materials (vinyl asbestos tiles used in busy corridors, etc.) that almost only generate short fibres, sometimes in large quantities. These situations are not covered by current legislation which only counts long fibres.\textsuperscript{92}

The “standard” dimensions for counting airborne asbestos fibres are a length of more than 5 microns, a breadth of less than 3 microns and a length to breadth ratio greater than 3:1.\textsuperscript{93} However fibres with dimensions other than those can also cause asbestos disease, including mesothelioma, but are not included in a standard fibre count.

In 2006 Dr Lemen, the Deputy Director of NIOSH and the former US Assistant Surgeon General, stated: “The issue of short asbestos fibers was initially resolved decades ago when the tool being used for analysis, the phase microscope, could not accurately count fibers smaller than 5 microns. Over time, this technology-driven practical solution has been transformed into holy writ which states that fibers smaller than 5 microns are not a health risk. The reality is that small fibers cause disease.”\textsuperscript{94}

Jonathan Bennett of the New York Committee on Occupational Safety and Health was concerned about the OSHA regulations: “The fact that these regulations do not apply to asbestos fibers shorter than 5 microns. This oversight means that someone from OSHA can correctly assert that there is no airborne asbestos when the air is, in fact, full of short asbestos fibers. Short fibers such as these are present in large numbers in tumors and tissues that become tumors”.\textsuperscript{95}

Their conclusions were supported by a study where samples were analysed from lung and mesothelial tissues of 168 cases of human malignant mesothelioma. The study concluded that “The majority (89.4%) of the fibers in the tissues examined were shorter than or equal to 5 microns in length, and generally (92.7%) were smaller than or equal to 0.25 microns in width.... We conclude that contrary to the Stanton hypothesis, short, thin, asbestos fibers appear to contribute to the causation of human malignant mesothelioma. Such fibers were the predominant fiber type detected in lung and mesothelial tissues from human mesothelioma.... These findings suggest that it is not prudent to take the position that short asbestos fibers convey little risk of disease.”\textsuperscript{96}

In 2001 a study by the U.S Department of Health and Human Resources showed that there are a far greater number of asbestos fibres smaller than the standard dimensions in schools than there are in other buildings. “The structures (asbestos fibres of all dimensions) found in buildings are smaller and coarser than those found in occupational settings.”\textsuperscript{97} The standard dimension fibre levels in schools were about 1.5 times higher than in other public buildings and 5 times higher than in commercial buildings. However the asbestos structures in schools were 7 times greater than in other public

\textsuperscript{92} Press release Asbestos Afsset recommends revising regulations to strengthen protection for workers and the general population 17 February 2009
\textsuperscript{93} 2003/18/EC amending to EU asbestos worker protection directive (83/477/EEC) article 7.6. (Powerpoint presentation G. Burdett HSL)
\textsuperscript{94} The 2\textsuperscript{nd} Asbestos Disease Awareness Organisation (ADAO) conference Apr 2006. Dr Lemen, the Deputy Director of National Institute for Occupational Safety and Health (NIOSH) and the former US Assistant Surgeon General. p58. Kazan – Allen American Journal of Industrial Medicine 50:52- 62 (2007)
\textsuperscript{97} Toxicological Profile for Asbestos U.S Department of Health and Human Resources. Sep 2001 chapter 6.4.1 p161, 163
buildings and 25 times greater than in commercial buildings. In schools there were 223 more asbestos structures than asbestos fibres of standard dimensions, whereas in other public buildings there were 33 more asbestos structures than standard dimension fibres and in commercial buildings 54 more.  

All asbestos floor tiles in schools are now old and in busy corridors and doorways can be particularly worn, therefore the potential for substantial asbestos fibre release is high. Although the fibres are normally chrysotile and smaller than the standard dimensions many of them will add to the cumulative lung burden and increase the likelihood of asbestos disease developing.  

In addition, although Phase Contrast Microscopes (PCM) are commonly used for sample analysis, thin asbestos fibres below 0.3 microns diameter are below their normal resolving power. Air sampling was carried out in 25 flats in the UK where 75% of the chrysotile fibres and 45% of the amosite fibres had diameters of 0.3 microns or below. Therefore when PCM analysis is carried out, a significant number of asbestos fibres cannot be counted. When TEM analysis is carried out the smaller thinner fibres can be seen, but frequently the standard dimension fibres are the only ones reported (PCM Equivalent). Therefore it has to be borne in mind that a large number of fibres can be present but are not listed in a sample analysis.

Tests were carried out by HSE in four UK schools, in one there was “sealed sprayed amosite and chrysotile on ceilings with some damage” the TEM asbestos fibre levels of standard sized fibres were from <0.003 f/ml to 0.012 f/ml with an average of 0.002 f/ml. However when all fibres, including non-standard ones, were counted there were on average about seventeen times more fibres than when just standard fibres had been counted. Of the four schools the average numbers of non-standard fibres were about twice as great as those counted in two factories, seven times greater than a shop and slightly greater than a house and two high rise flats.  

It would therefore appear that there is a particular problem in schools as there are more small, thin asbestos fibres than there are in many other buildings. But these fibres are not normally counted, and therefore the results from air sampling in schools will normally understate the actual numbers of fibres. That is a concern as many of the short, thin fibres are capable of causing mesothelioma.  

**School maintenance can release significant levels of asbestos fibres.**  
Ordinary maintenance of school buildings can release significant levels of asbestos fibres. Although over the years warnings have been issued not to disturb asbestos materials it is quite common for the warnings to be ignored, and it is only relatively recently that school caretakers and maintenance staff are becoming more aware that the most simple of activities can release asbestos fibres.
Painting an AIB ceiling or wall, cleaning a light fitting or drilling a hole to hang up a picture can release significant levels of fibres,\footnote{HSE Asbestos Essentials Strictly controlled minor work on AIB.} however they have all happened frequently in schools, and still do although to a lesser extent. Just removing an AIB ceiling tile can release significant levels of asbestos fibres. By design the services in the form of electrical, telephone and computer cables, water pipes, heating pipes and gas supplies run through the ceiling void above suspended ceilings so that they can be easily accessed by removing the tiles if there is a problem, consequently ceiling tiles have regularly been removed. Careful removing of an AIB panel with shadow vacuuming can release up to 3 f/ml, and the fibre release is significantly higher if precautions are not taken.

All schools now have computers, and the cables have either been laid through the ceilings and down the walls and column voids, or else laid in tracking screwed to walls and columns. Whiteboards are common where once again the projectors have been fixed to ceilings with the cables running through the void. All are known to have disturbed AIB, in one school numerous holes had been drilled in the AIB wall to hold the tracking in place and amosite debris remained on the floor.\footnote{Lees personal observation. Dec 2009}

Many thousands of system built and traditionally built schools have flat roofs. The roofs are renowned for being prone to leaking and this causes a whole variety of problems. As the water runs over friable and damaged asbestos materials or asbestos debris the asbestos fibres become water borne and spread into the rooms, so that when the water eventually dries the fibres are precipitated out so that they can become airborne whenever there is disturbance.\footnote{Mesothelioma: cases associated with non-occupational and low dose exposures Dr G. Hillerdal OccupEnviron Med 1999;56: p 508. HSE Field Operations Directorate K.Thompson / Director of Housing and Technical Services of South Lanarkshire Council 14 Mar 2008 see page 48 Asbestos incidents and failures in asbestos management in schools 14 Dec 2009 http://www.asbestosexposureschools.co.uk/pdfnewslinks/ASBESTOS%20INCIDENTS%20IN%20SCHOOLS%2014%20Dec%202009.pdf} Another problem is that ceilings collapse under the weight of water and any asbestos material or contamination enters the rooms. A further problem is that ceiling tiles are removed to access the roof void to assess the damage and make repairs and this in itself releases asbestos fibres if the ceiling void is contaminated or if the tiles are AIB.

The problem of worn asbestos floor tiles was considered in previous paragraphs, however the removal of the tiles can also release significant level of asbestos fibres. In one school worn asbestos tiles were removed from classrooms with hammers and cold chisels breaking the tiles and ripping them from the floor causing clouds of dust in the room and corridors while the school was occupied, although the staff were informed of their asbestos exposure parents were not told of their children’s exposure.\footnote{Personal correspondence Lees 2009.} In another case, while school staff were present, a motorised mechanical tile shovel was used to break and rip up large quantities of damaged asbestos floor tiles from corridors with no precautions being taken.\footnote{Personal correspondence Lees 2011.}

There are numerous occasions where building maintenance work has damaged asbestos materials and released high levels of asbestos fibres. System built schools frequently had wood framed windows which have deteriorated over the years and have therefore needed replacement. The window surrounds, window heads and panels beneath the windows are frequently AIB and are therefore very easily be damaged when removing the old windows and when fitting the new ones.
Work such as this should be carried out when the school is not occupied however that is not always the case.

A serious incident occurred at a school where 30 windows were replaced in a primary school with no precautions taken over the course of three weeks while the staff and pupils looked on. The window surrounds, window heads and panel beneath the windows were AIB. The windows and panels beneath them were ripped out using a power jigsaw and crowbars, the debris was then thrown in the playground while staff and pupils looked on. There was extensive damage to the AIB, widespread contamination of the school and asbestos debris remained in the classrooms. The use of a jigsaw on AIB can release 5-20 f/ml, breaking and ripping out AIB 5-20 f/ml, rough handling of insulating board and removal of pieces greater than 15f/ml, drilling the AIB window reveals 2-5 f/ml, and drilling the window heads 5-10 f/ml. HSE warn that “Very high exposures arise if the tiles are broken during removal and when the debris is cleaned up and bagged.” Once the new windows had been screwed in place in each classroom the teachers spent about an hour sweeping up with a dustpan and brush and the children then returned to their lessons. A level of 73 f/ml was obtained during a test brushing up and bagging following the breaking up of a single AIB panel. At the school more than 30 double AIB panels were ripped out and about half were broken with no precautions at all.

The exposures of the workmen was very high, the exposure of the teachers and the cleaners who cleaned up would have been high. As the work continued in the school there was considerable contamination so that the asbestos fibre levels would have been significant and therefore so would the exposures of the occupants including the pupils.

IOM, were employed by the council to carry out a risk assessment and they assessed the risks for the workmen, teachers, cleaners and pupils as minimal and negligible. They also recommended that “In particular, we do not recommend that any record be kept of this incident on people’s health or personnel records of children or school staff.”

IOM’s estimates of exposure levels, report, conclusions and recommendations were criticised by HSE and by other risk experts. HSE assessed the fibre release and risks to be significantly higher than IOM’s assessment, in the case of the teachers 130 times higher.

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108 HSE a comprehensive guide to managing asbestos in premises HSG 227 Table 15 p95 Feb 04
109 HSE EH 35 Probable asbestos concentrations at construction processes, Dec 1989 HSE EH71 Working with asbestos cement and asbestos insulating board Nov 1996
110 HSE a comprehensive guide to managing asbestos in premises HSG 227 Table 15 p95 Feb 04 HSE EH 35 Probable asbestos concentrations at construction processes, Dec 1989 HSE EH71 Working with asbestos cement and asbestos insulating board Nov 1996
113 Risks with asbestos insulating board. Howie ACADemy Autumn 2001 p11-1273 f/ml personal sampler. 15 minutes dry brushing and bagging of AIB dust and debris after breaking of single 8ft x4 ft AIB panel.
116 HSE risk to health from exposure to asbestos at Silverhill school N. Black Senior Scientific Officer (Occupational Hygiene)
incident should not be recorded in medical health records is contrary to expert medical guidance. IOM concluded that no one would die from the incident, however the HSE Senior Medical Officer for the Midlands, Wales and the South West disagreed and stated that "you cannot reassure any individual that they will not get a mesothelioma." This was a serious incident, but by no means unique. There was considerable contamination of the school and exposure of the occupants. Although £750,000 was spent on an environmental clean the remaining asbestos in the schools was not removed and asbestos debris was even left in the walls and sealed in place with duct tape. This is a system built school and more than 200 columns containing AIB required sealing. It is possible that the occupants had been exposed before this incident from normal everyday classroom activities and also because of previous building and maintenance work that had taken place. Some people will therefore have a significant asbestos fibre burden and yet, because there is still asbestos in the school, they will remain potentially at risk from further asbestos exposures.

See Annex H for more details of this incident. Further examples of failures in asbestos management and asbestos incidents that are typical in schools are at the link in the footnote.

Staff and pupils unaware of asbestos exposure.

Many asbestos incidents and releases of asbestos fibres have occurred in schools and staff and pupils have been exposed, and yet they are not necessarily aware of this. Over the course of fifty years, for instance, the staff and pupils in the thousands of system built schools had no idea that they were being regularly exposed every time someone slammed a door or a child bumped into a wall. The staff and children who were exposed from the practice of inserting drawing pins were unaware that they were being exposed and neither were the staff and pupils in schools with ducted heating and AIB backed cupboards.

Frequently teachers who are suffering from mesothelioma are unaware where their exposure occurred, and yet when a thorough investigation is carried out it transpires that they have taught for some years in schools that contain the more dangerous types of asbestos materials. It is also invariably found that the systems of asbestos management in their schools have been poor or non-existent. This means that there would have been no control on maintenance activities that can disturb asbestos, and further exposures could possibly have taken place from common classroom activities disturbing asbestos. The problem has been compounded as people have been told not to enter asbestos incidents in their medical records and there has also been a policy of not informing people that they have been exposed. Because of this, teachers, support staff and former pupils frequently find it difficult, if not impossible, to identify where the exposures occurred that caused

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117 Comments on Lees family and OC 265/48 inadvertent exposure. HSE’s position on health surveillance and the information documents relating to inadvertent exposure. Robert Hermanns HSE Medical Inspector 19 Mar 2004

118 Statement of witness HSE Senior Medical Inspector for the Midlands, Wales and the South West Dr A Scott 11 Mar 2005


123 Asbestos survey Silverhill school 8 Mar 2005

124 Silverhill Primary School Derby Sealing plan 21 Jun 2007

125 Asbestos incidents and failures in asbestos management in schools 14 Dec 2009

http://www.asbestosexposureschools.co.uk/pdfnewslinks/ASBESTOS%20INCIDENTS%20IN%20SCHOOL%5%2014%20Dec%202009.pdf
their mesothelioma. It also means that there is not an accurate data bank of information about the manner in which the occupants of schools have been exposed or the levels of exposure they have suffered.

The fact that these cases of mesothelioma had no known “history” of mesothelioma does not mean that there was no exposure, it just means that they didn’t know where their exposures had occurred. Expert medical opinion considers that “Mesothelioma is a rare tumour in people who have not been exposed to asbestos, occurring with an annual incidence of around one per million of the population.”\(^\text{122}\) Three of the most recent HSE reports estimate that genuine “spontaneous” (in the absence of asbestos exposure) mesotheliomas are about 40 to 50 per annum in total.\(^\text{123}\)

A case control study commissioned by HSE found that 62% of females in the study with mesothelioma did not know where their exposure had taken place.\(^\text{124}\) Their lack of knowledge about their exposure to asbestos is precisely what occurs in school.

### Workplace control level applied to children in schools.

Workplace Control Levels for airborne fibres are applied to staff and children in schools. This has many serious implications. HSE applies the workplace Action level to the occupants of buildings, including schools, and this has left a misleading impression that has led to bad practice. Also the Clearance level has been used as the threshold for allowing people to occupy buildings following an asbestos incident or following work on asbestos. Again this has given the wrong impression that this is a safe level of exposure and has resulted in staff and children returning to classrooms when it has not been safe to do so.

**Action Level.** Following an asbestos incident in a school DfE refer the school and local authorities to HSE guidance LAC5/19 and OC265/48 that give a guide on the level of risk from exposure to asbestos fibres. The guidance advises that “Exposure would usually have been insufficient to pose a significant long-term risk to health where Action levels were not exceeded.”\(^\text{125}\)

The Action Level was a workplace level that applied to asbestos contractors, it is a cumulative exposure to asbestos and when it was in force it was 240 times greater than the “Control Limit,” and since the Control limit was reduced in 2006 it is now 480 times greater. The HSE recognise the far lower Control Limit is not a safe level, and if it is likely to be exceeded contractors have to wear face masks and protective clothing.\(^\text{126}\) HSE state “At the moment, the control limit is 0.1 asbestos fibres per cubic centimetre of air (0.1 f/cm\(^3\)). The control limit is not a ‘safe’ level.”\(^\text{127}\)

If the Control Limit is not a safe level of exposure, then the Action Level is substantially less safe. If a person was exposed to amosite or crocidolite at 48f/ml for an hour they would inhale about

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\(^{122}\) High Court QBD Knowsley Metropolitan Borough Council v Willmore 8-9 July 2009 paragraph 3 Expert witness statement Dr Rudd


\(^{124}\) HSE Occupational, domestic and environmental mesothelioma risks in Britain, a case control study 2009 p45 para 4.4


\(^{126}\) CAWR 1987 ACOP Reg 2 para 5

\(^{127}\) HSE FAQs Asbestos what is the Control Limit 2011 [http://www.hse.gov.uk/asbestos/faq.htm](http://www.hse.gov.uk/asbestos/faq.htm)
28,000,000 fibres. That is a dangerous level of exposure for an adult. It is significantly more dangerous for a child.

An exposure of 48f/ml hours is the same as 0.025 f/ml yrs. The Hodgson and Darnton\textsuperscript{128} (H&D) risk model estimates that for a 30 year old adult an exposure at 0.025 f/ml yrs to crocidolite would cause 366 mesothelioma deaths per million people exposed, and to amosite 55 deaths.\textsuperscript{129} One of the co-authors of the risk assessment also estimated that there is a 2.7 to 5.2 times greater risk to a 5 year old child than an adult of 30.\textsuperscript{130} Based on these estimates an expert member of the Government’s advisory committee on science calculated that if a child of 5 was exposed at the Action level there would be 1940 mesothelioma deaths per million exposed to crocidolite and 291 to amosite.\textsuperscript{131} For crocidolite that is the same as 1 death for 500 children exposed, and for amosite 1 death for 3,400 exposed. That is as an unacceptable level of risk, particularly for children.\textsuperscript{132}

The HSE guidance gives timescales for work on asbestos materials that it estimates give exposures at the Action Level, and that if work is carried out for a shorter length of time the “exposures would usually have been insufficient to pose a significant long-term risk to health.” The message from the guidance, and the inference that people draw from it, is that if they work on asbestos materials for less time than those given in the table they will suffer little or no long term harm. This gives the wrong impression to anyone who manages asbestos or who might be considering disturbing asbestos materials. They are left with the incorrect impression that they can drill, cut or break up asbestos lagging for 15 minutes, AIB for 60 minutes and asbestos cement for 8 hours,\textsuperscript{133} and so long as they don’t exceed these times then it is unlikely that either they or the occupants of the rooms will come to any harm. That is contrary to expert scientific, medical and epidemiological opinion.

A previous section has shown that following the exposure of staff and children in schools the Action Level has been used, incorrectly, as a threshold of exposure insufficient to cause a long term risk to health.\textsuperscript{134} Advice has then been given not to record the exposure in their medical records. In some cases staff and parents have not even been informed at all of their or their children’s exposure.\textsuperscript{135} That is because HSE took the decision in 2004 that staff and parents need only be informed if their asbestos exposure exceeded the “Action Level.”\textsuperscript{136} The long term implication of this is that if any member of staff or a pupil is exposed to asbestos and develops mesothelioma in later life then they will be unaware where their exposure occurred, or that it happened at all. The advice is contrary to expert medical opinion which is to enter the fact that exposure has occurred in the person’s GP medical records.\textsuperscript{137} This is so that if the person subsequently develops the early symptoms of mesothelioma the GP will be aware that asbestos exposure has occurred and he will be alerted to

\textsuperscript{129} See calculations at Annex G
\textsuperscript{130} HSE Statistics Branch Darnton The quantitative risks of mesothelioma in relation to low-level asbestos exposure . BOHS 17 Oct 2007
\textsuperscript{131} See calculations of risks from exposure at the Action Level at Annex G
\textsuperscript{132} HSE Reducing Risks Protecting People . HSE’s Decision making process 2001
\textsuperscript{133} HSE Information document Exposure to Asbestos from Workplace activities OC265/48 Factors that influence level of risk para 3 2008
\textsuperscript{134} IOM Strategic Consulting Report: 629-00224 An assessment of the past exposure and estimation of consequent risks to health of staff that may have arisen from asbestos-containing material in cupboards at Lees Brook Community Sports College, Derby
\textsuperscript{135} Alan Jones, Andy Stelling, I Levers, Hilary Cowie April 2009 page viii
\textsuperscript{136} HSE case file “Mrs Gina Lees.” Sep 2000 – 2006. Lees personal correspondence Jun 2009
\textsuperscript{137} HSE Asbestos Policy Unit/HSC Chairman’s office CO Case CO/62/04 13 Aug 2004
\textsuperscript{137} HSE Comments on Lees Family and OC265/48 Inadvertent Exposure. Hermanns HSE Medical Inspector 19 Mar 2004
the possibility of mesothelioma. Not only are there serious implications if the exposure is not on the individual’s records, but also it means that asbestos incidents in schools and exposures of the occupants have been underreported. Centrally collated data will therefore be inaccurate and understate the actual situation.

When an asbestos incident occurs in a school then it is reported under the Regulations for Reporting Injuries, Diseases and Dangerous Occurrences Regulations (RIDDOR). The criteria for reporting an asbestos incident is generic, and states: “Escape of substances: The accidental release or escape of any substance in a quantity sufficient to cause the death, major injury or any other damage to the health of any person.” The RIDDOR guidance does not define what constitutes a “sufficient quantity,” however people are referred to LAC5/19 and OC265/48 which do, and that level is the Action Level. Therefore reports are not triggered in schools until it is estimated by the local authority, the school or their agents that the exposure of the occupants has exceeded the Action Level.

The inevitable consequence of using the Action Level as a threshold has meant that asbestos incidents in schools have not been reported. One of the purposes of RIDDOR is to build up a data bank of incidents. However the data bank will not give a true reflection of the number of asbestos incidents in the workplace, including schools, if the authorities have followed the HSE guidance. For example one local authority has followed the HSE guidance “to the letter.” Another does not consider a potentially serious incident need be reported as, in their opinion, the legal requirement for reporting under RIDDOR is defined in HSE guidance OC 265/48 as exceeding the Action Level, and the local authority does not consider the level of exposure exceeded that.

The RIDDOR data bank therefore understates the actual numbers of asbestos incidents, and it is likely that it significantly understates the numbers. As this data bank is used as the basis for Government decisions it is inevitable that incorrect conclusions have been drawn and poor policy made. This has further implications as RIDDOR data is reported to the EU, and therefore the HSE returns to them will not give the true scale of asbestos incidents in the UK.

Because this arbitrarily high threshold level has been applied to schools, bad practice has been engendered and significant fibre levels have been accepted as insufficient to cause a risk to the occupants. Staff and pupils have not been told of their exposures and incidents have been underreported so that any data bank will be unrepresentative of the actual picture. At a meeting of the DfE Asbestos Steering Group in June 2011 the Asbestos in Schools Group formally asked that the HSE guidance LAC5/19 and OC265/48 should be withdrawn. As at 22nd October 2011 a response has not been forthcoming. (The case for withdrawing the guidance is at the link in the footnote. Extracts are at Annex G)

Clearance Level and Reassurance testing. Another workplace level for asbestos contractors that has been applied to the occupants of schools is the Clearance Level. After remedial
work or removal work has been completed on asbestos materials then the enclosure is thoroughly cleaned to remove residual asbestos debris and fibres, the cleanliness of the area is checked by a visual inspection and then air sampling is carried out to ensure that the airborne fibre levels are beneath the Clearance Level of 0.01f/ml. If it is, then legally a certificate of reoccupation can be issued and people can re-enter the room. The level was chosen not because it was a safe level but instead because of the limitations of optical microscopes,\textsuperscript{142} but, by default it has been adopted as a level at which classrooms can be re-occupied following work on asbestos or an asbestos incident in a school. But it is not a safe level because at 0.01 f/ml a person inhales 6000-10,000 fibres an hour. HSE make it clear that it is not a safe level by stating:

“The threshold of less than 0.01 f/ml should be taken only as a transient indication of site cleanliness... and is not an acceptable permanent level.”\textsuperscript{143}

0.0005f/ml is the generally accepted background asbestos fibre level in schools with asbestos in good condition,\textsuperscript{144} and medical and legal opinion is that exposures above that level are “significant” and can materially increase the risk of mesothelioma developing.\textsuperscript{145} The Clearance Level is twenty times greater than the background level and will therefore materially increase the risk of mesothelioma developing.

Following an asbestos incident in a school, staff and pupils are allowed to return to their classrooms once “Reassurance” air sampling has been completed and the airborne fibre level is less than 0.01f/ml. Unless the level is substantially less than 0.01f/ml the occupants will inhale cumulatively significant levels of asbestos fibres. As this has been the standard practice for decades, it is known that staff and pupils have returned to contaminated classrooms, and it is likely that many have. They will have inhaled significant numbers of asbestos fibres.

\textbf{Environmental Limit. Lower Control Limits.} In 1983 the Institute of Environmental Health Officers (IEHO) and the Association of Metropolitan Authorities (AMA) gave evidence to the Commons Select Committee on Employment that called for an “environmental” limit for those people where exposure to asbestos is incidental to their main occupation. The IEHO submission states that “Such a limit is necessary to ensure reasonable protection for those people unaware of the presence of the material.” The AMA considered an environmental limit as “The single most important measure required to provide the foundation on which environmental programmes can be based.”\textsuperscript{146}

The Government’s Advisory Committee on Asbestos had previously drawn attention to the fact that children might be more at risk than adults from carcinogens with a long latency and that their susceptibility to cancer might be increased. The Department for Education considered the evidence and the proposals and concluded that “It may therefore be not unreasonable to suggest that in schools the levels should be lower than those for an “average” population and a factor of, say, 1/80th

\textsuperscript{142} Asbestos Risks of environmental and occupational exposure Health Council of the Netherlands 3 June 2010 p15
\textsuperscript{143} HSC CAWR 2006 Work with materials containing asbestos ACOP para 17 p68
\textsuperscript{144} Fibrous Materials in the Environment Institute for Environment and Health. P71
\textsuperscript{145} High Court QBD Liverpool District. The Hon Mr Justice Nicol . Dianne Willmore and Knowsley Metropolitan Borough Council 24 July 2009 Para 8, 57b
\textsuperscript{146} DfEE AM on asbestos AB 20/17/02 D 2 Jun 1983
to $1/100^{th}$ of the occupational limits should be adopted." The proposals have never been adopted. However a paper has recently been published in the Netherlands which proposes considerably lower Control Limits and also an Environmental Level.

The Netherlands presently have a Control Limit ten times lower than the EU level of 0.1 f/ml at 0.01f/ml. However a 2011 report published by the Health Council of the Netherlands considers that their present occupational levels are unsafe. They therefore propose an occupational exposure limit for amosite some 30 times less than their present level and 300 times less than the EU level. They also propose an Environmental level at 3,000 times less than their present occupational level.

The French Agency for Environmental and Occupational Health and Safety, Afsset, also consider that the present Control Limit is unsafe and in 2009 called for it to be reduced. A report states:

"The occupational exposure limit should “without delay” be reduced from 100 fibres per litre to 10f/l over an average period of eight hours. (0.1f/ml to 0.01f/ml) “This would reduce [the health] risk by a factor of 10,” said Afsset, insisting that the current exposure limit "which provokes 3.3 extra cases of cancer for every 1000 workers cannot be considered as acceptable... Afsset insisted that given the toxicity of asbestos “only the lowest possible level [of exposure] is acceptable” and called for the French government to “re-evaluate the limit regularly in order to reduce it.”

In 1965 the Factories Inspectorate Report concluded that mesothelioma had been shown to be caused by exposures to asbestos “sometimes of astonishingly slight degree.” In 1967 the Chief Medical Officer of the Factories Inspectorate advised the Department for Education that children were more at risk than adults from the dangers of asbestos. The 1967 Factories Inspectorate Report report concluded that as knowledge was not complete preventative measures should be taken to eliminate the escape of asbestos fibres into the air. Instead of heeding the warnings schools continued to be built using large amounts of asbestos.

Knowledge is still not complete and yet more than forty years later workplace levels are still applied to children in schools. Because of it, schools and local authorities have not given asbestos management the priority it warrants, and have not taken the stringent measures they should have to prevent the release of asbestos fibres. Numerous releases of asbestos fibres have occurred in schools, but because the levels were beneath the Action Level the incidents have not been reported. Parents and staff have not been informed and they have been advised not to enter the exposure on their medical records. Following asbestos incidents staff and pupils have been allowed to return to their classrooms once the airborne fibre levels are beneath the Clearance Level. Airborne asbestos fibres have still been present so that their exposures have therefore continued and their cumulative burden increased.
Workplace Control Levels should not be applied to schools. An Environmental Level many times lower than the present Clearance Level needs to be determined and applied to the occupants of buildings, and in particular it should be applied to schools.

In November 2011 the Department for Health Committee on Carcinogenicity (COC) will be assessing the relative vulnerability of children to asbestos. As part of that they should consider whether it is appropriate to apply the Action Level and the Clearance Level to children in schools.

**Conclusion of part 2**

Everyone attends school, and the MRC report considers that it is not unreasonable to assume that the entire school population has been exposed to asbestos in school buildings. There is no known threshold to asbestos exposure below which there is no risk. At times the occupants of schools have been exposed from many different sources. Many exposures have been and still are to amosite, and many have been at airborne fibre levels that far exceed the background levels with asbestos in good condition. Some exposures have been high level over a relatively short period of time, others occurred frequently over a prolonged period of time, sometimes every day for years. Because staff and pupils spend many years in school buildings where there are many potential sources of asbestos fibre release, the cumulative fibre burden of the occupants can be considerable. The inevitable result is that teachers, support staff and children have subsequently developed mesothelioma and died as a direct consequence of their asbestos exposure at school.

**PART 3: DEATHS FROM ASBESTOS EXPOSURE AMONGST SCHOOL STAFF**

This section looks at the mesothelioma deaths among school teachers and support staff, the section after this examines the implications of the teachers’ deaths for the pupils.

**Increasing numbers of school teachers dying of mesothelioma**

A total of 228 school teachers have died of mesothelioma since 1980 aged 16-74. 140 school teachers died of mesothelioma in the ten year period between 1999 to 2008 aged 16-74. (See Annex A)

**Increasing mesothelioma deaths amongst school teachers**

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**Notes:**

49 school teachers died of mesothelioma in the three year period 2006 to 2008. On average during the period 16 school teachers died each year of mesothelioma. The numbers have increased year on year since mesothelioma occupational records began in 1980 when 3 school teachers died on average each year of mesothelioma.

**Numbers of teachers dying of mesothelioma is possibly significantly more than shown in the statistics**

The numbers of teachers dying from mesothelioma is more, and possibly significantly more, than shown in the statistics. That is because the occupational statistics do not list a person’s death from mesothelioma once they are over the age of 74, and because of the long latency of mesothelioma, many people die at a greater age than this. The numbers are probably greater amongst the “low” exposure groups such as teachers, because on average the latency for mesothelioma caused by low level exposure is longer than those exposed at industrial levels, and therefore the disease will develop later and they will die at a greater age.\(^{155}\)

The scale of the statistical anomaly is shown in the fact that since 1968 about a quarter of male mesothelioma deaths were over the age of 74, and 44% of females were.\(^{156}\) A significant number of females do not have an occupation recorded in their death certificate, for instance 603 women died from mesothelioma over the age of 74 in the period 1991-2000 and their deaths have not been included in the occupational statistics. The statistics also give 456 non-working female deaths between the ages of 16-74 in 1991 to 2000.\(^{157}\) Consequently a total of 1,760 females died from

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\(^{156}\) HSE Death certificates mentioning mesothelioma, 1968-2005 table Mes02 Mes03

\(^{157}\) HSE Meso01 Death certificates mentioning mesothelioma. Compared with HSE Mesothelioma occupational statistics Table 8.
mesothelioma during this period, of which for various reasons 1,059\(^{158}\) have not been included in the occupational statistics. Similarly, for instance, for males during the period 2002-2005 a total of 6,613 died of mesothelioma, 4,007 of these deaths were listed under an occupational code, however 2,606 had no occupational classification.

It is known that school teachers have died of mesothelioma over the age of 75 and it is likely that a significant number have, and yet they have not been listed in the occupational statistics. It is also known that teachers have left the profession after a number of years and have gone into other occupations, therefore their deaths will not be recorded as “teacher” but instead as their final occupation. In addition there are a significant number of particularly female teachers who work in the teaching profession for a number of years and then leave to bring up a family.\(^{159}\) Some do not return, and therefore, although their exposure might have taken place as a teacher in a school, their subsequent death is not recorded as a teacher.

Consequently the actual number of teachers who have died of mesothelioma could be substantially more than the number recorded in the mesothelioma occupational statistics.

**Schools support staff have died of mesothelioma**

In addition school support staff have died of mesothelioma.\(^{160}\)

Nursery nurses, education assistants, midday assistants and childcare related occupations have died of mesothelioma. They also work with children, many of them in classrooms in schools, the only difference in most cases being that they do not hold a professional qualification and hence they are not coded in the occupational statistics under the “professions.” It is only since 1991 that these occupations have been listed separately therefore it is not possible to make definitive conclusions on the trends, however in the ten year period from 1991-2000 there were 17 deaths in this group and in the five year period from 2001-2005 there were 12 deaths. The weighted average Proportional Mortality Ratios (PMRs) for the group in both periods are above 100, which indicates a significant asbestos exposure in occupations where one should expect none. Although the numbers are not high enough to be statistically significant on their own, they tend to confirm all the other evidence of asbestos fibre release in schools and the exposure of the occupants whatever their occupation.

Five school secretaries died of mesothelioma between 2001-2005. There is anecdotal evidence that school secretaries commonly remain in the job for long periods of time, and therefore the occupation on their death certificate is probably an accurate record of their main lifetime occupation. Their Proportional Mortality Ratio is high at 231, but the total number of deaths is relatively small and therefore is not statistically significant. However their deaths do add to the evidence of asbestos exposures of the occupants of schools.

There are a significant number of deaths amongst cleaners and caretakers, and the individual occupational code with the greatest number of mesothelioma deaths amongst females, are cleaners.

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\(^{158}\) HSE Mesothelioma statistics Tables MESO01, MESO03


\(^{160}\) For further information see: [http://www.asbestosexposureschools.co.uk/Statistics%20of%20deaths%20teachers,%20support%20staff%20children.pdf](http://www.asbestosexposureschools.co.uk/Statistics%20of%20deaths%20teachers,%20support%20staff%20children.pdf)
However the occupational codes include caretakers and cleaners in every occupation and not just schools, therefore it is not possible to state how many had worked in schools. It is known however that school cleaners and caretakers have died of mesothelioma.

School caretakers are acknowledged to be at risk as they are likely to disturb asbestos materials. There are numerous cases of school maintenance men and caretakers drilling walls to hang up notice boards, fitting ceiling tiles, removing ceiling tiles to mend leaks, patching up dents in walls and a whole plethora of other tasks all of which can potentially disturb asbestos. HSE and DfE highlight the risk by stating “School caretakers have been identified as a particular group at risk due to the nature of their work (ie. Drilling and fixing.)

In the USA studies have been carried out into the prevalence of asbestos related disease amongst school custodians. In one large study more than a fifth had pleural plaques and in that group there was no evidence of asbestos exposure before they became custodians. The Health Effects Institute report stated “In both studies, a significant proportion of custodians, without known asbestos exposure prior to their employment with the school board, had radiographic abnormalities (parenchymal, pleural or both) consistent with the presence of asbestos-related disease.”

All the evidence points towards the fact that school caretakers have been exposed to frequent and significant levels of asbestos fibres.

It is known that there have been frequent releases of asbestos fibres in schools, the teaching staff, support staff and pupils have been exposed and statistics show that school teachers and school support staff have died of mesothelioma. However, because of the long latency, there are no statistics that show how many children have subsequently died. It is inevitable that if school staff are dying of asbestos related disease then the children are also subsequently dying.

See Annexes A and B for the mesothelioma statistics. The next section examines the relevance of the teachers’ deaths, and a later section the particular vulnerability of children.

**In an occupation where one would expect few deaths the teachers death are far higher than they should be**

The Teaching profession should have little or no contact with asbestos, but HSE statistics show that teachers are dying of asbestos disease at a rate of death far higher than they would had they had no asbestos exposure. The death rate is, for instance, significantly higher that occupations such as farming or forestry where they genuinely have little or no contact with asbestos.
The term "Expected Deaths" is used in the HSE tables. It is a misleading term for all it shows is the numbers of mesothelioma deaths that can be "Expected" in each profession based purely on a mathematical calculation of proportions. What it does not show is the number of deaths one would expect in each profession based on the assumed risk from asbestos exposure.

The incidence of mesothelioma between occupations is compared by the “Proportional Mortality Ratio” (PMR). The number of people in each occupation is different, therefore a large number of deaths from mesothelioma in an occupation employing very few people would be more remarkable than the same number of deaths in an occupation employing many thousands of people. A PMR of 100 shows that the number of mesothelioma deaths in a particular occupation is average for all the occupations. However that includes the high risk professions such as ship-building and the construction industry where asbestos exposure is known to occur. In those occupations the number of actual deaths is understandably far higher than the number of "Expected Deaths" and consequently the PMRs are far higher than 100.

One would presume that a teacher should suffer little or no asbestos exposure, and hence the number of deaths that one would expect should be in line with people who have had no exposure or only background levels of exposure. The HSE mesothelioma statistics have a section entitled "Interpretative issues" which describes a hypothetical scenario where a group of females with “zero exposure to asbestos would record a PMR of approximately 36.” As well as comparing the incidence of mesothelioma between occupations it is therefore equally relevant to compare the actual PMR with the “background” PMR.

**Teachers PMRs significantly greater than “background” levels.** From 1980 to 2005 the PMR for female school teachers was 92, which is just under the average for all occupations. This shows that there has been a significant level of asbestos exposure among female school teachers, for the PMR would be considerably lower at 36 if there was no exposure or it was at purely background levels. The number of deaths is more than two and a half times higher than one should expect in an occupation where the asbestos fibre levels should be no more than that of normal background levels.

Male teachers’ deaths also significantly exceed the number that one should expect in a profession with little or no asbestos exposure. The same interpretative issues give a PMR of 6 for men with a hypothetical zero exposure. (This figure is less than that of females purely because the total number of male mesothelioma deaths is far greater than that of females, and the number of background cases represents a smaller proportion of the whole.) Between 1980 - 2005 the PMR of male teachers in higher education was 100 and for male school teachers was 62.

When one considers that these PMRs are formulated from a comparison with other occupations, including high risk ones such as asbestos stripping, boiler lagging and the building maintenance trades, one can see that male teachers' deaths in higher and further education is 17 times higher
than they would have been if there had been purely “background” exposure and the male school teachers’ deaths are 10 times greater. It can therefore be concluded that male teachers’ deaths from mesothelioma far exceed the number that one would expect from an occupation where there should be minimal or no asbestos exposure.

**Teachers’ PMRs significantly greater than some other occupations.** Asbestos exposure normally takes place amongst manual occupations and trades that frequently come into contact with asbestos, one should therefore not expect the members of a white collar profession such as teaching to be dying of asbestos related disease at a rate on par with or greater than some manual occupations. And yet they are. Male teachers have a proportionately greater number of mesothelioma deaths than for instance bakers, bus drivers/conductors, cooks, farmers and motor mechanics, which demonstrates that they have been exposed to significantly more asbestos. If they are compared with broadly similar professions such as solicitors, doctors, the clergy, government administrators or police officers the teachers’ deaths are proportionately higher than all of them. Again this shows that as a profession they have suffered a significantly greater extent of asbestos exposure than other similar professions. (See Annex B)

If female teachers are compared with a similar profession then marked differences are also shown, in the twenty year period 1980-2000 the school teacher’s PMR was 100, which is the average amongst all occupations. Broadly there are similar numbers of female teachers as there are female nurses and yet in the same period the proportion of female teachers dying of mesothelioma was precisely twice that of female nurses, as the nurses had a PMR of 50. One would have thought that neither profession should experience asbestos exposure, however the statistics demonstrate that both professions have experienced significant exposure, with the exposure of the teachers being twice that of the nurses. (See Annex B)

School teachers’ mesothelioma deaths have been relentlessly rising since the 1980’s. In a profession where one should expect minimal or no asbestos exposure the statistics indicate that there has been widespread, significant and increasing exposure to school teachers over the course of many years. There is evidence to show that school teachers, and the other occupants of schools, have been exposed to asbestos at school. The next section examines why a death certificate that states “School teacher” is likely to have been the occupation during which the exposure took place.

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Howie. From the HSE mesothelioma statistics for the period 1980-2005, excluding 1981 and 2001, there were 109 male and 59 female teacher deaths, 55 deaths in male nurses, clergy and doctors and 51 deaths in female nurses. If the number of deaths in nurses, clergy and doctors are corrected for the all causes deaths in these occupations for the period 1979-1990, excluding 1981, the mesothelioma rates in male teachers are about 60% higher than in male nurses, clergy and doctors and in female teachers are about 70% higher than in female nurses. From official statistics it can be therefore considered that school teachers have experienced at least 60% higher mesothelioma rates than those in comparative professions. Howie 6 Jan 2010. Drever F 1995 Occupational Health Decennial Supplement OPCS. HSE 2008 Mesothelioma mortality in Great Britain. Analyses by Geographical area and occupation 2005. HSE 2003. Mesothelioma occupational statistics. Male and female deaths aged 16-74 in Great Britain.

173 HSE statistics Mesothelioma Occupational statistics 1980-2000 Table 6
Teachers’ death certificates are invariably a true record of their life time occupation. The mesothelioma statistics are derived from death certificates which record “The most recent full time occupation of the deceased (i.e. the occupation at retirement or death).”174 Consequently if a person was exposed to asbestos in one occupation and then subsequently changed occupation their death certificate will record the final occupation and not the one in which the exposure occurred. That is undoubtedly the case with some death certificates, but with a profession such as teaching if the certificate records “School Teacher” then that is likely to be the occupation the person had when they retired through age175, ill health, took early retirement or because they died in post.

If a school teachers’ death certificate shows that they have died of mesothelioma then it is likely that is the profession that they have had for most of their working life and any asbestos exposure they experienced in a school will have contributed to their mesothelioma and subsequent death.

Until relatively recently teaching used to be considered a lifetime profession176 and statistics confirm that to be the case, for the average length of service on retirement for a teacher is about thirty years.177 Their deaths are therefore generally recorded under the occupation that they spent their working life – as a teacher in a school. Their death certificates and the mesothelioma statistics are therefore invariably a true reflection of the occupation in which asbestos exposure took place that contributed towards their deaths.

Caretakers, teaching assistants, nursery nurses, school secretaries, cooks and school cleaners have died of mesothelioma. As has been seen in an earlier section in addition to the teachers, other people who work in schools have died of mesothelioma including caretakers, teaching assistants, nursery nurses, school secretaries, cooks and school cleaners. The deaths amongst the support staff add to the evidence that the occupants of schools die of asbestos related disease.178

Although there is data on the career pattern of school teachers there is a lack of similar data on the support staff occupations and therefore each case has to be examined separately to determine whether they had previously worked in high risk occupations and whether they are likely to have experienced asbestos exposure at school. It must be borne in mind that even if it is established that a person had previously worked in a high risk occupation it does not exclude the fact that they could also have been exposed to asbestos at school and that exposure materially contributed towards the development of mesothelioma. The next section examines an HSE mesothelioma case control study and how incorrect conclusions and misleading statements have been made because school teachers,

174 Mesothelioma mortality in Great Britain: Analyses by Geographical area and occupation 2005, Occupational analysis para 7
175 Normal Retirement Age for a teacher is 60. DCSF 3.7 Schools: Teaching Population a. Number of full-time teachers by age in maintained nursery, primary and secondary schools, England, March 2006 and March 2007
176 House of Commons Education and Skills Committee Secondary Education: Teacher Retention and Recruitment Fifth Report of Session 2003–04 para 110
177 E-mail DCSF Workforce Group /Lees 27 January 2010 15:47 Case Reference 2010/0004693 “The average length of service for full-time teachers is about 30 years”. And Scottish Parliamentary written answer S2W-15080 18 Mar 2005 http://www.scottish.parliament.uk/Apps2/Business/PQA/Default.aspx Death certificate is based on last occupation. Therefore occupation on retirement or death. Average length of service at retiring age, early retirement or because of ill health is about 33 years.
178 See Statistics - Deaths in the Education Sector from Mesothelioma at www.asbestosexposureschools.co.uk
teachers and lecturers in higher and further education and support staff data had been grouped together as a single group.

**Misleading statements based on HSE case control study.**

In 2009 an HSE case control study examined the significance of lifetime occupational and residential histories from a large number of mesothelioma patients and population controls.\(^{179}\) The report and its conclusions were generally well written, however the study made a statement about the teachers’ occupational exposures and subsequent mesotheliomas that cannot be justified from the data. The statement in the study is incorrect and misleading and has been repeated by senior HSE officials,\(^{180}\) Ministers\(^{181}\) and the DfE.\(^{182}\) The study incorrectly stated:

“Among teachers, for example, 7 of the 11 male mesotheliomas and 7 of the 18 female cases had also worked in higher risk jobs.”\(^{183}\)

The numbers quoted for teachers in the statement are incorrect. The group in question, as examined in the study, comprised “Teachers and school workers,” and therefore it was not just the “teachers” mentioned in the statement, for in addition to “primary and secondary school teachers” it also included “school workers” and “higher education teachers and workers.” In addition some of the occupations that had been included in the data had been misclassified and were later removed, although the published study has not been corrected. Based on data provided in 2011 by the HSE Epidemiology Unit,\(^{184}\) one can make a more accurate statement that:

“Among school teachers, for example, 2 of the 5 male mesotheliomas and 1 of the 7 female cases had also worked in higher risk jobs.”

In 2011 DfE continued to make statements based on the study which are incorrect and misleading. They stated “Recent research commissioned by the HSE, indicates that the risk of mesothelioma among men or women who worked for at least 5 years as teachers, was no higher than to individuals who had only ever done other low risk jobs (i.e. office work), and that a substantial proportion of men and women with mesothelioma who had done teaching work had also worked in higher risk occupations.”\(^{185}\)

The study, the Minister and DfE compare teachers’ mesothelioma deaths with office workers with the incorrect implication that as both are low risk, and few office workers die, the teachers’ deaths are therefore not statistically significant. This is a misleading impression as considerable numbers of office workers have died of mesothelioma.

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\(^{179}\) HSE RR696 Occupational, domestic and environmental mesothelioma risks in Britain. 2009.  
\(^{181}\) HSE Chief Medical Adviser and Head of Epidemiology Dr J Osman/ Lees 24 Mar 2009  
\(^{182}\) Parliamentary written answer Brooke/Minister of State for Employment Grayling 13 Dec 2010  
\[^{183}\] [http://www.publications.parliament.uk/pa/cm201011/cmhansrd/cm101213/text/101213w0005.htm#1012145000563](http://www.publications.parliament.uk/pa/cm201011/cmhansrd/cm101213/text/101213w0005.htm#1012145000563)  
\(^{184}\) E-mails DfE 20 Jun 2011 and 7th September 2011 Senior Press Officer/Speechwriters’ Team  
\(^{185}\) HSE RR696 Occupational, domestic and environmental mesothelioma risks in Britain. 2009 para 3.2  
\[^{186}\] E-mail HSE Epidemiology unit Darnton/Lees 25 Feb 2011  
\[^{187}\] E-mails DfE 20 Jun 2011 and 7th September 2011 Senior Press Officer/Speechwriters’ Team
The use of office workers by HSE as a reference group must be questioned as statistically and numerically they have a significant incidence and numbers of mesothelioma. 642 office workers died of mesothelioma between 1980 and 2000. The incidence of mesothelioma amongst male office workers for instance is more than twice as great as farmers, and for females the incidence among office workers is almost twice as great as nurses. (See comparison table at Annex B) Rather than female office workers having a low incidence of mesothelioma, the very opposite is true as they have one of the highest incidences of mesothelioma and this is emphasised by HSE in their explanation of the mesothelioma occupational statistics. They state “The occupations with the highest risk for females were labourers in process and plant operations n.e.c. (PMR 230, 95% CI 142 to 351, 21 deaths) General office assistants/clerks (PMR 125, 95% CI 82 to 183, 26 deaths)”

The fact that teachers and school workers have a similar incidence of mesothelioma to office workers shows that both groups have suffered significant asbestos exposure. This was acknowledged by the HSE Epidemiology unit who were careful to explain that:

“It’s important to note that these results do not imply that there is no risk to teachers. However, it really does appear that the risk to teachers is very much on a par with that in the reference category of office workers.

Clearly there have been mesothelioma deaths among teachers, as there have also been among other low risk groups such as health care workers, retail workers various others - and some of these cases will have been caused by asbestos exposure during the course of their work in these jobs.”

(See Annex C for further comment on the HSE case control study)

Because others are dying it doesn’t make teachers’ deaths acceptable, rather than accepting them as being the same as other occupations HSE should instead examine the implications. The difference between the school teachers’ deaths and the office workers is that there are many children in a classroom with each teacher, and if the teachers are being exposed to asbestos then so are their children.

PART 4: INCREASED VULNERABILITY OF CHILDREN TO ASBESTOS

The teacher’s and support staff deaths are the tip of the iceberg, for if they are being exposed to asbestos in schools and dying of mesothelioma then so are their children. It is known that because of the long latency children are more vulnerable to the effects of asbestos as they will have time for the disease to develop, it is also thought that they might be more vulnerable because of their physical immaturity.

Statistics do not show the subsequent children’s deaths.

For every teacher there are significantly more children so it is reasonable to assume that proportionately there will be more deaths. But this is not reflected in the mesothelioma occupational statistics because the long latency means that the children’s subsequent deaths occur

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186 HSE Mesothelioma occupational statistics Male and Female deaths aged 16-74 in Great Britain 1980-2000 tables 5 and 6
187 HSE Mesothelioma Mortality in Great Britain: Analyses by Geographical Area and Occupation 2005 P15
188 E-mail HSE Statistics Branch Darnton/Lees GB Mesothelioma case control study 6 Apr 2009
long after they have left school and are not recorded as the result of asbestos exposure in a school. Amongst all workplaces schools are unique places as the statistics only reflect the mesothelioma deaths of a small percentage of the occupants who have been exposed to asbestos, as the vast majority are children.

Studies have shown that low level exposures can on average have a longer latency than the norm. Latencies for mesothelioma from first exposure to first symptoms have been recorded from less than 10 years to over 60 years, and throughout the whole population on average the latency is 30-40 years. In comparison, studies have shown that those exposed to low level exposure on average can develop the disease some 50-56 years later. Consequently a child exposed to asbestos at school will die many years later and their death will be recorded under whatever occupation they had at the time.

It is known that the occupants of schools have been exposed to asbestos. It is known that teachers and support staff have died of asbestos related disease and there is a clear and direct correlation between their deaths and the exposures. But of greatest concern is that there is also a direct correlation between their deaths and those of the children.

USA estimated for every teacher and support staff death there are nine subsequent children’s deaths.

The school teachers’ mesothelioma deaths are significant because for every teacher there are about twenty children in their class who are being exposed to asbestos at the same time. Therefore if over 228 school teachers have died of mesothelioma since 1980 one would reasonably expect proportionately more children to subsequently develop mesothelioma. In the USA their best estimate was that nine children would die to each teacher and support staff death (and the estimate did not take into consideration the increased vulnerability of children). In the UK that would equate to more than 2,000 subsequent children’s deaths. If the ratio was 20 to one then it would equate to 4,500 deaths. The actual figure cannot be definitively determined but unlike the USA, an official assessment has never been made.

(See Annex F)

Widespread asbestos exposure of children at school. Children can inhale more fibres

There is evidence that there has been, and continues to be, widespread asbestos exposure of staff and children in UK schools. The fact was acknowledged by the Medical Research Council who examined the extent of asbestos in schools and concluded “It is not unreasonable to assume,
therefore, that the entire school population has been exposed to asbestos in school buildings.” 193

...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.”194 However, as has been seen in a previous section, the exposures experienced by many children are in all probability considerably greater than estimated by MRC.

Many children exposed to asbestos at home
As well as being exposed to asbestos at school many children return home to houses that contain asbestos materials. The asbestos is vulnerable to disturbance because there is a general lack of asbestos awareness, there is no legal requirement of landlords to inform their tenants of the presence of asbestos195 and almost no regulation. Therefore there is little to prevent the occupants damaging the asbestos by either DIY, vandalism or just normal fair wear and tear. HSE acknowledge that public sector housing generally contains considerably more asbestos than private houses196 and it is likely that most public sector houses constructed or renovated before 1985 contain asbestos.197 Conventionally built houses and flats are known to contain asbestos materials, but, as with schools, the non-traditionally built flats are likely to contain considerable quantities. MRC state:

“Approximately 394,000 non-traditional or system-built flats constructed between 1945 – 1980 are likely to contain significant amounts of amphibole asbestos products (sprayed coatings, partitioning) as well as chrysotile materials (lagging partitions) in vulnerable locations with a high potential for fibre release.”198

Sampling in two high rise flats found airborne fibre levels of 0.0004 f/ml of amosite and chrysotile in one and 0.0007 f/ml of amosite, chrysotile and crocidolite in the other.199 In another study air sampling was carried out in 25 System built flats of “CLASP” construction. Samples were taken throughout the day and averaged 0.0004 f/ml, and at night the average was 0.0002 f/ml. In one flat the level was 0.002f/ml and in another it was 0.003f/ml. In seven flats amosite fibres were found, in six chrysotile and in twelve flats there was a mixture of both amosite and chrysotile. 200

MRC estimated the asbestos fibres typically inhaled by occupants of flats and stated “Assuming an occupancy in a non-traditionally built flat of 12 hr/day, 7 day week and 50 weeks a year, average airborne fibre levels of 0.0005 f/ml and a respiratory rate of 8f/ml, the total number of respirable asbestos fibres inhaled over a 30 year period of residence would be 30,240,000...”201

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195 As Safe as Houses? Dealing with Asbestos in Social Housing A Report for UCATT Dr Linda Waldman and Heather Williams June 2009 p15.
197 As Safe as Houses? Dealing with Asbestos in Social Housing A Report for UCATT Dr Linda Waldman and Heather Williams June 2009 “Asbestos is estimated to be present in 90% of all public sector housing”
198 MRC and BRE Fibrous materials in the environment 1997 p76
201 MRC and BRE Fibrous materials in the environment 1997 p74
If a child lived in the flat for 15 years from birth they would inhale about 15 million asbestos fibres, and this would take place at the most vulnerable part of their life. Once again the MRC estimate was based on the asbestos being in good condition, however all the asbestos is now old and many of the flats have not been well maintained and therefore fibre levels are likely to be higher, in some cases significantly higher than the MRC estimate.

A child can therefore spend about six hours a day in a school with a low level exposure to asbestos and then return home to for the remainder of the day and night where they continue to be exposed to asbestos. Although most of the exposures are low level, in many cases they are either continuous because of raised background levels or they occur frequently when disturbance takes place. In both schools and many homes the predominant fibres are likely to be to amosite. Over time a child’s cumulative burden of amosite fibres can therefore be considerable.

Because of the widespread use of asbestos at school and in many homes, a very large number of children are entering adult life having already been exposed to asbestos so that the process of tumour development has already started. Later exposures as an adult then add to the cumulative burden and increase the likelihood of a tumour developing.

The incidence of mesothelioma in Britain is the worst in the world, and it could be argued that this has in part been caused by the widespread asbestos exposure of many, and perhaps most, children in the country. It is clear that preventing millions of children from acquiring a significant asbestos burden in their lungs is an important step towards cutting the exceptionally high incidence of mesothelioma in Britain.

**Possibility that more asbestos fibres are retained in children's airways and lungs**

As well as the asbestos exposure of a large number of children in schools and homes it is also possible that they will inhale more asbestos fibres than adults, and having inhaled them that they might be deposited in the airways and lungs more readily.

A report by the US Committee on Environmental Hazards entitled Asbestos exposures in schools considered the exposures and the risks to children, and concluded “In addition to their long life expectancy, children in school exposure settings are a particular concern because, compared to adults, they are more active; they spend more time close to the floor, where sedimeted dust and fibres accumulate; and they are more likely to seek direct contact with deteriorating surfaces out of curiosity or mischief. These factors must be considered when childhood exposures are estimated.”

Studies have shown that having inhaled the asbestos fibres, children’s airways and lungs might retain more fibres. However the amount of data on the retention of specifically asbestos fibres in children’s lungs is limited, a paper stated “The effect of lung size on fiber retention might suggest that children would retain more asbestos fibers at the same exposure level than adults, but this is unproven and only speculative at this time.”

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202 HSE Occupational, domestic and environmental mesothelioma risks in Britain. A case-control study Mar 2009
203 Asbestos Exposures in Schools. Committee on Environmental Hazards American Academy of Pediatrics 1987 ;79;301
204 Women and Mesothelioma Dorsett D. Smith CHEST December 2002 vol. 122 no. 6 1885-1886
A report by the Californian Environment Protection Agency on environmental exposures considered the greater volume of air inhaled by children relative to their weight and lung surface area, and concluded that particles in general would deposit more readily in children’s airways and lungs. They stated:

“Respiratory minute ventilation is increased in infants and children, resulting in a greater exposure per unit time on a weight basis and per unit surface area of lung, compared to adults. For inhalation exposures to equivalent chemical concentrations, both indoor and outdoor, infants and children are at the same or greater risk of exposure based on their much higher minute ventilation on a body weight and lung surface area basis.

The deposition of inspired particles in the lungs is dependent on particle size and anatomical features of the respiratory tract. Deposition occurs primarily through impaction for coarser particles and through Brownian motion for finer particles. Greater fractions of inhaled particles less than five μm in diameter reach the distal airways compared to larger particles. Particle deposition tends to be greater in children because of the smaller diameters of the airways compared to adults, and models of particle deposition indicate larger deposition in the pulmonary region of 3 month old infants relative to adults.”

The US Department of Health and Human Services also examined how asbestos fibres are deposited in the airways and lungs of children and their findings add to the evidence that a greater number of the smaller diameter fibres in general are deposited, however they could not find specific studies on asbestos, they stated:

“Differences in breathing patterns, airflow velocity, and airway geometry between adults and children can result in age-related differences in deposition of inhaled particles in the respiratory tract. Deposition of particles in various regions of the respiratory tract in children may be higher or lower than in adults depending on particle size, but for particles with diameters <1 μm, fractional deposition in the alveolar, tracheobronchial, and nasopharyngeal regions in 2-year-old children has been estimated to be about 1.5 times higher than in adults. This information may be relevant to inhalation exposure to asbestos fibers, but direct information regarding age-related differences in deposition of inhaled fibers was not located.”

More particles in general are deposited on young children’s airways and lungs, however the science on whether more asbestos fibres are deposited is incomplete. Therefore until more is known any assessment of the relative vulnerability of children to asbestos must consider the possibility that a greater number of asbestos fibres are deposited in their airways and lungs.

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205 Noncancer Reference Exposure Levels. California EPA Air Toxicology and Epidemiology Branch Office of Environmental Health Hazard Assessment Jun 2008 p15-16
208 TOXICOLOGICAL PROFILE FOR ASBESTOS U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES Public Health Service Agency for Toxic Substances and Disease Registry September 2001 p179
Increased risk to children because of age.

Children are more vulnerable to the effects of asbestos. The latency of mesothelioma from first exposure is very long and therefore children are more at risk as they will live longer for the disease to develop.

The increased risk to children was stressed by Professor Landrigan a world expert on children’s health, who stated “It is important to consider that all segments of our society children have the longest latency in which to allow for the expression of mesothelioma. Given that the risk of mesothelioma increases as approximately the fourth power of time, young children have 60 or 70 years of life ahead of them from the time of first exposure are at considerable risk compared to adults who are exposed in later life.”

In 2007 the Government’s advisory committee meeting on science, WATCH, were tasked with examining the risks from low level exposure to asbestos. Professor Peto, one of the expert members, raised the significance of the increased risks from exposure to asbestos at a young age. He stressed how childhood exposure to asbestos was likely to be an important factor in mesothelioma developing in later life. The minutes record:

"A WATCH member asked Professor Peto for further insights into the relationship between age, asbestos exposure and cancer risk. Professor Peto commented that first exposures to asbestos before the age of 30 were much more critical in terms of cancer risk than first exposures that occurred after 30. If first exposures occurred after the age of 40, the risks of developing cancer were relatively low.

However, limited insights could be gained from age alone; time since first exposure was a more critical determinant of risk than the actual age at which exposures took place. This implied that exposure to asbestos in childhood would be an important factor in determining the appearance of cancer in later adult life.”

This increase in risk for children is clearly demonstrated by the following table based on the Hodgson and Darnton paper which estimated the risks from asbestos exposure. Of particular relevance is the increase in risk to children of school age, with a 5 year old child having an increase in risk of 2.7 to 5.2 times greater than their teacher of 30. However many children attend nurseries from a far younger age, and if they happen to live in a non-traditionally built flat that contains asbestos then their exposure can start from birth. The following is the table:

<table>
<thead>
<tr>
<th>Age</th>
<th>0</th>
<th>5</th>
<th>10</th>
<th>15</th>
<th>20</th>
<th>25</th>
<th>30</th>
<th>35</th>
<th>40</th>
<th>45</th>
<th>50</th>
<th>55</th>
</tr>
</thead>
<tbody>
<tr>
<td>Factor (at risk for 60 years)</td>
<td>2.8</td>
<td>2.7</td>
<td>2.6</td>
<td>2.4</td>
<td>2.1</td>
<td>1.5</td>
<td>1.0</td>
<td>0.6</td>
<td>0.4</td>
<td>0.3</td>
<td>0.2</td>
<td>0.1</td>
</tr>
<tr>
<td>Factor (at risk for 80 years)</td>
<td>6.6</td>
<td>5.2</td>
<td>4.0</td>
<td>3.0</td>
<td>2.1</td>
<td>1.5</td>
<td>1.0</td>
<td>0.6</td>
<td>0.4</td>
<td>0.3</td>
<td>0.2</td>
<td>0.1</td>
</tr>
</tbody>
</table>

210 WATCH committee minutes. Assessing the risks arising from exposure to low level exposure to asbestos 7 Nov 2007
211 HSE Statistics Branch Darnton The quantitative risks of mesothelioma in relation to low-level asbestos exposure Table 9
It should be noted that in February 2011 the Government’s advisory committee on science, WATCH, concluded that “The risk will be lower, the lower the exposure, but “safe” thresholds are not identifiable.”\textsuperscript{213} However they also considered that definitive numerical figures cannot be put on the risks from low level exposures. That is because the calculation of the risks is extrapolated from the very high levels experienced from occupationally exposed cohorts. Therefore the figures in the above table should not be taken as definitive figures, but instead give an approximate scale of the increase in risk because of age.

Quantifying the increased risk to children because of physical immaturity
It is not disputed that children are more at risk from the dangers of asbestos because they have longer for the disease to develop, however some experts consider that children may also be more vulnerable to the affects of asbestos because of their physical immaturity. HSE stated in relation to pupils’ asbestos exposure at school “Due to their physical immaturity they are at greater risk of suffering from asbestos related disease than adults, and will live longer for any disease to develop.”\textsuperscript{214}

The vulnerability of very young children to some environmental hazards is greater than that of older children or adults. A conference on environmental hazards to children emphasised that “Children are not little adults - children are at greater risk than adults for exposure to and possible illness from environmental hazards...”\textsuperscript{215} The US Committee on Environmental Health and Ambient Air Pollution examined the health hazards to children and confirmed that “Children are more vulnerable to the adverse effects of air pollution than are adults. Eighty percent of alveoli are formed post natally, and changes in the lung continue through adolescence. During the early postneonatal period, the developing lung is highly susceptible to damage after exposure to environmental toxitants.”\textsuperscript{216}

However there have been insufficient studies to determine whether that is the case with asbestos, consequently it is not possible to quantify the level of risk. Statements that are made are therefore based on expert opinion that exposures to a carcinogen such as asbestos are likely to cause more harm to children than adults. Professor Peto stressed the increased risk from asbestos exposure in childhood because a child will live longer for the disease to develop, and also he put forward the possibility of an increase in risk because of the developing physiology of a child, he stated:

*The effects of childhood exposure cannot be predicted. The models described above imply a roughly fourfold increase in risk for mesothelioma, but not for lung cancer, when exposure begins soon after birth rather than age 20, reflecting the cubic residence time assumption. Such an age-related effect would be expected for any carcinogen which initiates the induction of multi-stage carcinogenic process;*

\textsuperscript{213} WATCH committee final position statement Feb 11
\textsuperscript{214} HSE paper LAFORUM/04 Asbestos management in schools. 23 Nov 2004.
\textsuperscript{215} Preventing Child Exposures to Environmental Hazards: Research and Policy Issues Children’s Environmental Health Network, (not dated 1997)
\textsuperscript{216} US Committee on Environmental Health ambient Air Pollution: Health Hazards to Children. Pediatrics 2004; 1 14;1699
but this prediction takes no account of the possibility that children are particularly susceptible to carcinogenesis by virtue of factors such as stem cell expansion during growth and development. The risks caused by exposure in childhood may therefore be substantially greater than those predicted for both mesothelioma and lung cancer.”

Assessments of asbestos risks for children incorrectly based on risks to adults.
Professor Peto considers that the risks caused by asbestos exposure in childhood may be substantially greater than predicted for both mesothelioma and lung cancer. However insufficient research has been carried out to quantify the increase in risk. Instead adult risk assessments are applied to children and as a consequence adult workplace asbestos fibre levels are also applied to them. Because of that the asbestos policy for schools in the UK treats schools as any other workplace, when they should have special treatment because of the children’s increased vulnerability.

In the 1980’s the USA recognised the particular vulnerability of children to asbestos because they will live longer for an asbestos related disease to develop and they acknowledged the possibility that because of their physiology they could be more vulnerable. They consequently introduced stringent asbestos regulations specifically for schools. However it was acknowledged that too little research has been carried out into the potentially hazardous exposures to children. A 1997 US symposium sponsored by the EPA, the Californian Department of Health Services and others concluded:

“Key Issues: Children are exposed to preventable environmental hazards such as lead, solvents, asbestos, pesticides, air pollution, and environmental tobacco smoke. Children are not little adults - children are at greater risk than adults for exposure to and possible illness from environmental hazards.....
Children are underprotected.
• No national research or policy agenda exists to address potentially hazardous exposures to children.
• There are very few data sources that have information on children’s exposures.
• Regulations for permissible exposure levels are based on data from adult animals and humans.
• Risk assessments do not routinely differentiate between children and adults, and do not consider multiple or cumulative exposures.”

Since then some research has been carried out in the US. The studies did not specifically look at asbestos, however they did find that for some carcinogens the risk assessments for adults significantly underestimate the risks to children, and the potency of the exposure increases significantly for younger children:

217 (Fibre Carcinogenesis and Environmental Hazards, J Peto IARC 90 1989 p463 )
218 EPA Support document Asbestos–containing materials in schools Health effects and magnitude of exposure EPA-560/12-80-003 Oct 1980
219 Preventing Child Exposures to Environmental Hazards: Research and Policy Issues Children’s Environmental Health Network, (undated 1997)
“When laboratory animals are exposed early in life (e.g., from birth to weaning), the chemical cancer potencies (measured as cancer slope factors; CSFs) are often different from what was found in studies of adult exposures. Typically, but not always, chemical cancer potency is greater when the animals are exposed in early life. For many carcinogens, using CSFs calculated from adult animal studies or adult epidemiological studies underestimates lifetime exposure cancer risk.

The Air Hotspots Program of the California Office of Environmental Health Hazard Assessment (OEHHA) in evaluating the age-adjusted cancer potency determined that available data suggest the lifetime cancer potency for carcinogens regardless of the mode of action are likely underestimated when early-life susceptibility is not included in models. Separate calculations of the mean variation from adult potency for chemicals with a mutagenic mode of action and all modes of action differ by a small amount.

For 0 through < 2 and 2 through < 16 year-olds the mean cancer potency for mutagens is 10 times and 3 times more potent, respectively, as the adult cancer potency. For carcinogens regardless of the mode of action, early-life potency is 7 to 8 times and about 3 times as potent, respectively, as adult potency. Differences in calculated means have not been shown to be precise enough to support different default adjustments for carcinogens with specific modes-of-action.

The science is incomplete as far as determining whether there is an increased risk to children to asbestos exposure because of their physical immaturity. As there is a possibility that there is an increased risk to children, then the precautionary principle should be adopted.

The Precautionary Principle

In 2000 the European Commission published a Communication on the Precautionary Principle. They stressed the importance of a scientific evaluation of the level of risk, and where there was a risk, but it was not possible to put a definitive numerical value on the precise level, then the precautionary principle should be adopted. The paper states:

“The precautionary principle applies where scientific evidence is insufficient, inconclusive or uncertain and preliminary scientific evaluation indicates that there are reasonable grounds for concern that the potentially dangerous effects on the environment, human, animal or plant health may be inconsistent with the high level of protection chosen by the EU....

Recourse to the precautionary principle presupposes that potentially dangerous effects deriving from a phenomenon, product or process have been identified, and that scientific evaluation does not allow the risk to be determined with sufficient certainty.

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The implementation of an approach based on the precautionary principle should start with a scientific evaluation, as complete as possible, and where possible, identifying at each stage the degree of scientific uncertainty.\textsuperscript{223}

It is therefore contrary to EU guidance that in 2011 the Government have still not assessed the scale of the asbestos problem in schools or the risk to the occupants of schools, and in particular have not assessed the increased risk to children.

There is considerable evidence that the presence of asbestos in schools presents a very real danger to the occupants. However there is scientific uncertainty about the precise level of risk. Until the scientific evidence is available the precautionary principle should therefore be applied to schools, and rigorous measures taken to prevent asbestos fibre release.

**CONCLUSION**

Most schools in the UK contain asbestos and much of it is amosite. All is old and because schools have not been well maintained much of the asbestos material is deteriorating. There is substantial evidence that asbestos fibres have been, and are being, released in schools. In many cases the releases are frequent and are of amosite. There is evidence that normal classroom activities can regularly release fibres, and although they are often at a low level, they are cumulatively significant. Maintenance work can release high peak levels which are less frequent but nonetheless add to the cumulative burden. There is evidence that teachers, support staff and children have been exposed to asbestos, in some cases over the course of many years.

Statistics show that school teachers have died of mesothelioma and are dying in increasing numbers. Support staff are also dying of mesothelioma.

Children have been exposed to asbestos but because of the long latency there are no statistics that show how many have subsequently developed mesothelioma. It is known that because they have longer to live they are more at risk. There is a possibility that there is an increased risk to children from asbestos because of their physical immaturity, but further investigation is needed. There is also a possibility that children will inhale and retain more asbestos fibres than adults, but again the science is not complete.

Forty years ago the USA carried out an audit of friable asbestos in their schools and assessed how many children were likely to subsequently die. They fully acknowledged then, as they do now, that the science is not complete but, because of that, they adopted the precautionary approach and treated schools as a special place because they contain children. They implemented stringent asbestos regulations specifically for schools and allocated realistic resources so that schools really could manage their asbestos. The range of measures that have been introduced in the USA has brought the incidence of mesothelioma under control so that since 1999 it has stabilised at 14 per million per annum.

\textsuperscript{223} COMMUNICATION FROM THE COMMISSION on the precautionary principle 2 Feb 2000
In contrast in the UK as at October 2011 no assessment has been made of the extent of asbestos in schools and it is only now that the Department of Health intends to assess the relative vulnerability of children to asbestos.\textsuperscript{224} Consequently schools have been treated as just another workplace and workplace asbestos fibre levels and regulations have been applied to children. Forty five years ago the Department for Education were warned about the increased vulnerability to children from asbestos, but for financial, commercial and political reasons the warnings were not heeded.\textsuperscript{225} Instead asbestos materials continued to be used in science and other lessons and schools continued to be built using large amounts of asbestos.

There has been a lack of asbestos awareness and a lack of resources so that schools have failed to adequately manage their asbestos. Numerous asbestos incidents have occurred and the exposure of the occupants has been widespread. The Medical Research Council concluded that it is not unreasonable to assume that the entire school population has been exposed to asbestos in school buildings. Teachers, support staff and children have subsequently died.

Every one attends school. Very large numbers of children have been exposed to asbestos at school and in their homes so that the first step that can contribute towards the development of mesothelioma has been taken by a large proportion of the population at a very young age. For many of them the exposures have continued throughout much of their childhood. The United Kingdom has not brought the incidence of mesothelioma under control, instead the very opposite is true as the incidence of mesothelioma in Britain increases year on year and is now at 36.5 per million per annum – the worst in the world.

If Britain is to bring the incidence of mesothelioma under control then preventing most children acquiring a significant asbestos burden in their lungs is an important step. It is essential that a long overdue assessment is made of the asbestos risks to children. The assessment must be honest and open and not governed by hubris or vested commercial and political interests.

At the end of the assessment if it is decided that, as the science is incomplete, no definitive conclusion can be reached, then we cannot carry on as we have for the last fifty years by making unjustified claims that there is no problem. Instead we must adopt the precautionary principle and implement rigorous measures specifically for schools. Only then will we ensure that the most vulnerable people in our society, our children, are protected from the dangers of asbestos.

\textit{The Asbestos in Schools Group}

\textit{31\textsuperscript{st} October 2011}

\textsuperscript{224} COMMITTEE ON CARCINOGENICITY OF CHEMICALS IN FOOD, CONSUMER PRODUCTS AND THE ENVIRONMENT Relative Vulnerability of Children to Asbestos compared to Adults. CC/2011/10 \url{http://www.iacoc.org.uk/papers/documents/CC201110Asbestosinschoolsintro.pdf}

\textsuperscript{225} Department for Education Asbestos. 1966-1968 files National Archives ED 50/842
Asbestos in Schools

Annexes

Annex A. Mesothelioma deaths in the Education Sector 1980-2008
Annex B. Comparison Teachers with Other Occupations
Annex C. HSE Case control study Teachers’ mesothelioma deaths.
Annex D. HSE WATCH paper on fibre Levels. 2nd series of HSL tests in CLASP buildings.
Annex E. Risks from displaying work with drawing pins.
Annex F. A Comparison. Incidence of mesothelioma in Great Britain and the USA.
Annex G. Incorrect use of Action Level as a threshold for a long term risk to health.
Annex H. Asbestos incident Silverhill school.
Annex A. Mesothelioma deaths in the Education Sector 1980-2008

| Mesothelioma deaths School Teachers and Teachers and Lecturers 1980-2008 aged 16-74 |
|----------------------------------|----------------------------------|----------------------------------|----------------------------------|----------------------------------|
| Higher/Further Education          | 6                                | 12                               | 22                               | 26                               |
| School Teachers Teachers NEC      | 15                               | 25                               | 31                               | 43                               |
| TOTAL                            | 21                               | 37                               | 53                               | 69                               |
| Higher/Further Education          |                                   | 92                               | 72                               | 23                               |
| School Teachers Teachers NEC      |                                   | 27                               | 49                               | 116                              |
| TOTAL                            |                                   | 116                              |                                  |                                  |
| TOTAL                             |                                   | 344                              |                                  |                                  |

A total of 228 school teachers have died of mesothelioma since 1980 aged 16-74. If teachers and lecturers in higher and further education are included, then 344 have died.

It should be noted that the Southampton codes only listed teachers in higher education and teachers NEC, whereas the SOC1990 codes break the occupation down into three separate codes for each and the SOC2000 into three groups for higher education and four for school teachers, with an additional code for senior educational administrators. Therefore to compare like with like in the tables the higher education numbers have been added together, as have the school teaching professions.

The five year tables above from 1980-2000, includes the only two groups of teachers under Southampton occupational coding - Teachers NEC and teachers in higher education. For some reason the HSE table does not include female teachers in higher education, even though statistics show that there were some deaths. In addition education assistants, nursery nurses and childcare related occupations are not classified separately under this coding but are “lost” amongst other groupings. Therefore some mesothelioma deaths are not included.

The mesothelioma statistics published on the HSE web-site omit two years. The first is 1981 where, because of industrial action, statistics were not collated for that year. The second is 2001 when the occupational coding was changed from was SOC90 to SOC2000. HSE’s explanation is that: “Due to difficulties in mapping between these classifications and the more recent SOC 2000, this updated analysis is restricted to the four-year period 2002-2005 for which SOC 2000 applies.”

The fact that 2001 is missing means that trends can be masked or false conclusions reached, therefore the data for the mesothelioma deaths in the education sector up to and including 2008 were obtained from HSE’s Statistics Branch, however at the time the associated PMRs had not been calculated and therefore

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227 E-mail HSE Statistics Unit/Lees 15 Jul 2008. Mesothelioma deaths in the education sector for males and females 2001-2005. HSE
228 Mesothelioma mortality in Great Britain: Analyses by Geographical area and occupation 2005 Tables 11, 13 (2002-2005)
229 Mesothelioma deaths for occupations relating to schools for males and females aged 16-74 (SOC 2000) 2001-2008. E-mail HSE CSAG Epidemiology Unit. Benson/Bonney 10 Feb 11
230 (HSE mesothelioma occupational statistics male and female deaths aged 16-74 1980-2000 (Southampton coding) 5 year time period. Tables 3,4.)
the PMRs are for the four year period 2002-2005. The occupational classifications for the Education Sector remained the same, however comparisons between other occupations from 2001 is more problematic when their classification has changed.

**Mesothelioma deaths for the education sector 1999 - 2008**

<table>
<thead>
<tr>
<th>Occupation</th>
<th>Sex</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Male</td>
<td>Female</td>
<td>Total</td>
<td></td>
</tr>
<tr>
<td>Higher education teaching professionals</td>
<td>25</td>
<td>2</td>
<td>27</td>
<td></td>
</tr>
<tr>
<td>Further education teaching professionals</td>
<td>31</td>
<td>4</td>
<td>35</td>
<td></td>
</tr>
<tr>
<td>Education officers, school inspectors</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td></td>
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<tr>
<td>Secondary education teaching professionals</td>
<td>67</td>
<td>4</td>
<td>71</td>
<td></td>
</tr>
<tr>
<td>Primary &amp; nursery education teaching professionals</td>
<td>7</td>
<td>53</td>
<td>60</td>
<td></td>
</tr>
<tr>
<td>Special needs education teaching professionals</td>
<td>2</td>
<td>1</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Registrars and senior administrators of educational establishments</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Teaching professionals n.e.c.</td>
<td>4</td>
<td>2</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>Nursery nurses</td>
<td>0</td>
<td>6</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>Childminders &amp; related occupations</td>
<td>0</td>
<td>5</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Playgroup leaders/assistants</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Educational assistants</td>
<td>2</td>
<td>5</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>School mid-day assistants</td>
<td>0</td>
<td>6</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>School secretaries</td>
<td>0</td>
<td>7</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td></td>
<td>139</td>
<td>95</td>
<td>234</td>
<td></td>
</tr>
</tbody>
</table>

**Note:**
The following Standardised Occupational Classifications are used in this table

**1999-2000: SOC90**

**2001: SOC90 & SOC2000** where the following SOC 2000 & SOC 90 occupation codes are assumed to be equivalent.

- 2311 - Higher education teaching professionals & 230 University & polytechnic teaching professionals
- 2312 - Further education teaching professionals & 231 Higher and further education teaching professionals
- 2313 - Education officers, school inspectors & 232 Education officers, school inspectors
- 2314 - Secondary education teaching professionals & 233 Secondary (& middle school deemed secondary) education teaching professionals
- 2315 - Primary & nursery education teaching professionals & 234 Primary (& middle school deemed primary) & nursery teaching professionals
- 2316 - Special needs education teaching professionals & 235 Special education teaching professionals
- 2317 - Registrars and senior administrators of educational establishments & No equivalent
- 2319 - Teaching professionals n.e.c. & 239 Other teaching professionals nes
- 6121 - Nursery nurses & 650 Nursery nurses
- 6122 - Childminders & related occupations & 659 Other childcare & related occupations nes
- 6123 - Playgroup leaders/assistants & 651 Playgroup leaders
- 6124 - Educational assistants & 652 Educational assistants
- 9244 - School mid-day assistants & No equivalent
- 4213 - School secretaries & No equivalent

**2002-2008: SOC2000**

---

231 HSE Epidemiology Unit CSAG, table 0977. 2 Mar 2011
### Female mesothelioma deaths for the education sector 2001 - 2008

<table>
<thead>
<tr>
<th>Occupation</th>
<th>2001-2005</th>
<th>2006-2008</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>2311 - Higher education teaching professionals</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>2312 - Further education teaching professionals</td>
<td>3</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>2313 - Education officers, school inspectors</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2314 - Secondary education teaching professionals</td>
<td>2</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>2315 - Primary &amp; nursery education teaching professionals</td>
<td>18</td>
<td>25</td>
<td>43</td>
</tr>
<tr>
<td>2316 - Special needs education teaching professionals</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>2317 - Registrars and senior administrators of educational establishments</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2319 - Teaching professionals n.e.c.</td>
<td>2</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>6121 - Nursery nurses</td>
<td>4</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>6122 - Childminders &amp; related occupations</td>
<td>2</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>6123 - Playgroup leaders/assistants</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>6124 - Educational assistants</td>
<td>3</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>9244 - School mid-day assistants</td>
<td>3</td>
<td>3</td>
<td>6</td>
</tr>
<tr>
<td>4213 - School secretaries</td>
<td>5</td>
<td>2</td>
<td>7</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>44</strong></td>
<td><strong>36</strong></td>
<td><strong>80</strong></td>
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</table>

### Male mesothelioma deaths for the education sector 2001 - 2008

<table>
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<tr>
<th>Occupation</th>
<th>2001-2005</th>
<th>2006-2008</th>
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</thead>
<tbody>
<tr>
<td>2311 - Higher education teaching professionals</td>
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<td>6</td>
<td>16</td>
</tr>
<tr>
<td>2312 - Further education teaching professionals</td>
<td>13</td>
<td>16</td>
<td>29</td>
</tr>
<tr>
<td>2313 - Education officers, school inspectors</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>2314 - Secondary education teaching professionals</td>
<td>36</td>
<td>17</td>
<td>53</td>
</tr>
<tr>
<td>2315 - Primary &amp; nursery education teaching professionals</td>
<td>5</td>
<td>2</td>
<td>7</td>
</tr>
<tr>
<td>2316 - Special needs education teaching professionals</td>
<td>0</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>2317 - Registrars and senior administrators of educational establishments</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2319 - Teaching professionals n.e.c.</td>
<td>1</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>6121 - Nursery nurses</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>6122 - Childminders &amp; related occupations</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>6123 - Playgroup leaders/assistants</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>6124 - Educational assistants</td>
<td>0</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>9244 - School mid-day assistants</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>4213 - School secretaries</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>66</strong></td>
<td><strong>46</strong></td>
<td><strong>112</strong></td>
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</table>

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232 HSE Epidemiology Unit, table 0925. 25 Feb 2011

56
### Education Sector Mesothelioma Occupational Statistics 2001-2005

<table>
<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td>2311</td>
<td>Higher education teaching professionals</td>
<td>10 [10]</td>
<td>[40]</td>
<td>1</td>
<td>[1]</td>
<td>163</td>
<td></td>
</tr>
<tr>
<td>2312</td>
<td>Further education teaching professionals</td>
<td>13 [16]</td>
<td>[61]</td>
<td>3</td>
<td>[2]</td>
<td>164</td>
<td></td>
</tr>
<tr>
<td>2313</td>
<td>Education officers, school inspectors</td>
<td>1 [1]</td>
<td>[57]</td>
<td>0</td>
<td>[0]</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>24 [WA 48]</td>
<td>4</td>
<td>[WA 164]</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total male and female</td>
<td></td>
<td>28</td>
<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

### SCHOOL TEACHERS

<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
<th></th>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>2315</td>
<td>Primary and nursery</td>
<td>5 [7]</td>
<td>[72]</td>
<td>17</td>
<td>[18]</td>
<td>79</td>
<td></td>
</tr>
<tr>
<td>2316</td>
<td>Special needs</td>
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<td>[0]</td>
<td>1</td>
<td>[1]</td>
<td>140</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>42 [WA 80]</td>
<td>22</td>
<td>[WA 86]</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total male and female</td>
<td></td>
<td>64</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Higher Education + School Teachers</td>
<td>Male 66</td>
<td>Female 26</td>
<td>92</td>
<td></td>
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</tr>
</tbody>
</table>

### NURSERY. ASSISTANTS. CHILDMINDERS

<table>
<thead>
<tr>
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<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>6121</td>
<td>Nursery nurses</td>
<td>4 [2]</td>
<td>[192]</td>
<td></td>
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<td></td>
<td></td>
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<tr>
<td>6122</td>
<td>Childminders and related occupations</td>
<td>2 [2]</td>
<td>[57]</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6123</td>
<td>Playgroup leaders/assistants</td>
<td>0 [0]</td>
<td>[0]</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6124</td>
<td>Educational assistants</td>
<td>2 [3]</td>
<td>[66]</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9244</td>
<td>School mid-day assistants</td>
<td>3 [4]</td>
<td>[46]</td>
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<td>Total</td>
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<td>11</td>
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<td>[WA 105]</td>
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<td></td>
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<tr>
<td>Total male and female</td>
<td></td>
<td>11</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### TOTAL EDUCATION SECTOR

- Male: 66
- Female: 37
- Male and female: 103
- Weighted average PMR [2002-2005]: [Male 68] [Female 100]

---

School caretakers, cleaners, cooks and maintenance personnel are also known to have died of mesothelioma, but their deaths are classified under a general occupational heading and not as a “school” caretaker or cleaner. Their deaths are therefore not included in the statistics for schools.

### SCHOOL SECRETARIES. CARETAKERS AND CLEANERS (All Occupations)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>DEATHS</td>
<td>EXPECT</td>
</tr>
<tr>
<td>SCHOOL SECRETARIES</td>
<td>4213</td>
<td></td>
</tr>
<tr>
<td>MALE</td>
<td></td>
<td></td>
</tr>
<tr>
<td>FEMALE</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CARETAKERS (all occupations)</td>
<td>6232</td>
<td></td>
</tr>
<tr>
<td>MALE</td>
<td>50</td>
<td>81</td>
</tr>
<tr>
<td>FEMALE</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>TOTAL</td>
<td>54</td>
<td>38</td>
</tr>
<tr>
<td>CLEANERS (all occupations)</td>
<td>9233</td>
<td></td>
</tr>
<tr>
<td>MALE</td>
<td>39</td>
<td>51</td>
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<tr>
<td>FEMALE</td>
<td>55</td>
<td>62</td>
</tr>
<tr>
<td>TOTAL</td>
<td>94</td>
<td>62</td>
</tr>
</tbody>
</table>

**NB:**
The data for the latest period is only the four years 2002-2005

SOC2000 coding lists school secretaries separately whereas previously in the Southampton coding they had been included under a general code that included all secretaries and in the SOC1990 coding had presumably been included under “other secretaries.” Although the numbers are relatively small they do add to the evidence of raised airborne asbestos fibres and cumulative exposures of the occupants of schools from all occupations.

The occupational codes include caretakers and cleaners in every occupation and not just schools, therefore it is not possible to state how many had worked in schools.

In both periods 1991-2000 and 2002-2005, the individual occupational code with the greatest number of mesothelioma deaths amongst females, are cleaners. School caretakers are acknowledged to be at risk because of their jobs they are likely to disturb asbestos materials. See the main text.

---

## Annex B Comparison Teachers with Other Occupations

Comparison of Mesothelioma incidence between teachers and other occupations. 1980-2005

### Male

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
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<th></th>
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<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>62</td>
<td>Teachers Higher Education</td>
<td>M</td>
<td>80</td>
<td>80</td>
<td>100</td>
<td>6</td>
<td>110</td>
<td>12</td>
<td>117</td>
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<td>14</td>
<td>54</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>54</td>
<td>School Teachers (net)</td>
<td>M</td>
<td>111</td>
<td>179</td>
<td>62</td>
<td>11</td>
<td>65</td>
<td>10</td>
<td>55</td>
<td>18</td>
<td>50</td>
<td>27</td>
<td>60</td>
<td>39</td>
<td>75</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Similar professions comparison

<table>
<thead>
<tr>
<th></th>
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### Outdoor occupations comparison

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<tr>
<td>62</td>
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<td>M</td>
<td>138</td>
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<td>27</td>
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<td>62</td>
<td>Fishing Agricultural Fishing traders</td>
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<td>4</td>
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<td>Deaths 3</td>
<td>PMR 22</td>
<td></td>
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<td></td>
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### Occupations comparison

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<td>Butchers</td>
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<td>89</td>
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<td>8</td>
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<td>6</td>
<td>81</td>
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<td>4</td>
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<tr>
<td>62</td>
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<td>M</td>
<td>9</td>
<td>49</td>
<td>18</td>
<td>1</td>
<td>15</td>
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<td>62</td>
<td>Food Processors</td>
<td>M</td>
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<td>69</td>
<td>35</td>
<td>Deaths 24</td>
<td>PMR 35</td>
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<td>62</td>
<td>Cooks Kitchen Porters</td>
<td>M</td>
<td>23</td>
<td>100</td>
<td>23</td>
<td>2</td>
<td>22</td>
<td>2</td>
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<td>Motor Mechanic</td>
<td>M</td>
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<td>169</td>
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<td>52</td>
<td>Bus Coach Drivers</td>
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<td>152</td>
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<td>15</td>
<td>9</td>
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<td>52</td>
<td>Bus Conductors</td>
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<td>51</td>
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<td>717</td>
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</table>

Note: The average PMR’s are calculated from the expected deaths given in the published statistics and are therefore approximate.
<table>
<thead>
<tr>
<th>PERIOD</th>
<th>DEATHS</th>
<th>PMR</th>
<th>COMPARISON</th>
</tr>
</thead>
<tbody>
<tr>
<td>1980-1985</td>
<td>4</td>
<td>79.6</td>
<td></td>
</tr>
<tr>
<td>1986-1990</td>
<td>9</td>
<td>117.3</td>
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</tr>
<tr>
<td>1991-1995</td>
<td>13</td>
<td>109.3</td>
<td></td>
</tr>
<tr>
<td>1996-2000</td>
<td>16</td>
<td>90.7</td>
<td></td>
</tr>
<tr>
<td>TOTAL</td>
<td>42</td>
<td>Average 100</td>
<td>(50% lower)</td>
</tr>
</tbody>
</table>

(Southampton Classification) Deaths between the ages of 16-74

Number of female primary and secondary teachers: 395,282
Number of female nurses: 578,269

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**Mesothelioma deaths for female teachers (other than in higher education) 1980-2000**

<table>
<thead>
<tr>
<th>PERIOD</th>
<th>DEATHS</th>
<th>PMR</th>
<th>COMPARISON</th>
</tr>
</thead>
<tbody>
<tr>
<td>1980-1985</td>
<td>4</td>
<td>79.6</td>
<td></td>
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<tr>
<td>1986-1990</td>
<td>9</td>
<td>117.3</td>
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<td>1991-1995</td>
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<td>109.3</td>
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<tr>
<td>1996-2000</td>
<td>16</td>
<td>90.7</td>
<td></td>
</tr>
<tr>
<td>TOTAL</td>
<td>42</td>
<td>Average 100</td>
<td>(50% lower)</td>
</tr>
</tbody>
</table>

(Southampton Classification) Deaths between the ages of 16-74

Number of female primary and secondary teachers: 395,282
Number of female nurses: 578,269

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**Comparison with Mesothelioma deaths for female nurses 1980-2000 (Southampton)**

<table>
<thead>
<tr>
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<th>DEATHS</th>
<th>PMR</th>
<th>COMPARISON</th>
</tr>
</thead>
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<tr>
<td>1980-1985</td>
<td>4</td>
<td>55.7</td>
<td>(23.9 lower)</td>
</tr>
<tr>
<td>1986-1990</td>
<td>6</td>
<td>52</td>
<td>(65.3 lower)</td>
</tr>
<tr>
<td>1991-1995</td>
<td>9</td>
<td>47.5</td>
<td>(61.8 lower)</td>
</tr>
<tr>
<td>1996-2000</td>
<td>13</td>
<td>49.1</td>
<td>(41.6 lower)</td>
</tr>
<tr>
<td>TOTAL</td>
<td>32</td>
<td>Average 50</td>
<td>(50% lower)</td>
</tr>
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(Southampton Classification) Deaths between the ages of 16-74
Annex C: HSE Case control study Teachers’ mesothelioma deaths.

A 2009 HSE case control study obtained lifetime occupational and residential histories from 622 mesothelioma patients (512 men, 110 women) and 1420 population controls. The report and its conclusions were generally well written, however a statement was made about the teachers’ occupational exposures and subsequent mesotheliomas that cannot be justified from the data. The statement is incorrect and misleading but it has been repeated by senior HSE officials, Ministers and the Department for Education. The study incorrectly stated:

“Among teachers, for example, 7 of the 11 male mesotheliomas and 7 of the 18 female cases had also worked in higher risk jobs.”

The numbers quoted for teachers in the statement are incorrect. The group in question was “Teachers and school workers,” and therefore it was not just the “teachers” mentioned in the statement for it also included “school workers” and “higher education teachers and workers.” It is particularly important to differentiate between school teachers and “school workers” as the latter category includes cleaners, caretakers, maintenance staff etc. Their tasks and career patterns are very different and again if they are all grouped together as “teachers and school workers” then incorrect conclusions will be reached. In addition the study did not differentiate between “school” teachers and teachers in “Higher education.” The differentiation is important as the occupations are different and false lessons can be learnt if they are grouped together purely as “teachers.”

In the published case control study the total numbers of “Teachers and school workers in the group was 11 males and 18 female mesothelioma cases.”

After the study had been published the job classifications were reviewed by the HSE and the occupations that had been misclassified were removed (eg: students, nursery workers, ski instructors, dance teachers, police cadets, home tutors, other trainees). This reduced the group from 11 males to 7 and 18 females to 17. (The published document was not amended)

In 2009 HSE had been asked how many of the group were “school teachers.” In 2011 HSE responded to the question and provided a table that split the group into “school teachers”, “other school workers” and “higher education teachers and workers.” (see below) The table clearly shows that the other school workers are not teachers, but amongst the group “higher education teachers and workers” it still does not differentiate between teachers and “workers.”
2 of the 7 males were higher education teachers and workers. 6 of the females were other school workers and 4 were higher education teachers and workers. So that out of the 7 males 5 were school teachers and of 17 females only 7 were school teachers.

The school teachers’ mesothelioma cases were therefore **5 males** and **7 females**.

The study then excluded the cases who had worked in previous “higher risk jobs.” In the published study of “teachers and school workers” of the 11 males 7 had worked in previous higher risk occupations. Of the 18 females 7 had worked in previous higher risk occupations. It was on these published statistics that officials have made the incorrect statements.

A fundamentally different picture appears from the data that was provided in 2011. When the misclassified occupations, other school workers and higher education teachers and workers were removed:

- Of the **5 male school teachers** 2 had worked in previous higher risk occupations.
- Of the **7 female school teachers** 1 had worked in a previous higher risk occupation.

The published study stated:

> “Among teachers, for example, 7 of the 11 male mesotheliomas and 7 of the 18 female cases had also worked in higher risk jobs.”

When the misclassified occupations, other school workers and higher education teachers and workers are removed, a total of 3 school teachers had previously worked in higher risk occupations, rather than the 14 stated in the published document. The statement would be accurate if it stated:

> “Among school teachers, for example, 2 of the 5 male mesotheliomas and 1 of the 7 female cases had also worked in higher risk jobs.”

The numbers involved in the original all encompassing group were small and led the HSE statistician who contributed to the study to comment “*Unfortunately, from a statistical point of view this leaves rather small numbers...*” The numbers are even smaller when school teachers are examined on their own, and definitive statements should not be made on such a small statistical sample. However statements have been made by Ministers and their Departments, based on the published study, which cannot be justified.

Other statements have been made that compare teachers’ mesothelioma deaths with office workers with the incorrect implication that both are low risk, few office workers die and therefore the teachers’ deaths are not statistically significant. This is a misleading impression as considerable numbers of office workers have died of mesothelioma.

In the HSE case control study the reference group was office workers. The use of office workers as a reference group must be questioned as statistically and numerically they have a significant incidence

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247 HSE RR696 Occupational, domestic and environmental mesothelioma risks in Britain. 2009 para 3.2
248 E-mail HSE Statistics Branch Darnton/Lees GB Mesothelioma case control study 6 Apr 2009
and numbers of mesothelioma. 642 office workers died of mesothelioma between 1980 and 2000. The incidence of mesothelioma amongst male office workers for instance is more than twice as great as farmers, and for females the incidence among office workers is almost twice as great as nurses. (See comparison table at Annex B) The fact that females who work in offices have one of the highest incidence of mesothelioma is highlighted by HSE in their explanation of the occupational statistics. They state “The occupations with the highest risk for females were Labourers in process and plant operations n.e.c. (PMR 230, 95% CI 142 to 351, 21 deaths) General office assistants/clerks (PMR 125, 95% CI 82 to 183, 26 deaths)”. The study uses the office workers as a reference and the Odds Ratio is the same for female teachers as it is female office workers and for males the Odds Ratio for teachers is greater than office workers.

The raised incidence amongst office workers is partially explained by the fact that many of them worked in offices which were part of factories where asbestos levels were known to be raised. The fact that teachers and school workers have a similar incidence of mesothelioma to office workers shows that both groups have suffered significant asbestos exposure. This was acknowledged by the HSE Epidemiology unit who were careful to explain that:

“It’s important to note that these results do not imply that there is no risk to teachers. However, it really does appear that the risk to teachers is very much on a par with that in the reference category of office workers.

Clearly there have been mesothelioma deaths among teachers, as there have also been among other low risk groups such as health care workers, retail workers various others - and some of these cases will have been caused by asbestos exposure during the course of their work in these jobs.”

The statement is clear that the study does not imply that there is no risk to teachers and he accepts that some of the cases amongst this group will have been caused by asbestos exposures during the course of their work – which in the case of teachers is as a teacher in a school.

Just because teachers are dying at a similar rate to another profession does not mean that that they are not at risk. They have been exposed to asbestos, many have been exposed at school, and a significant number have developed mesothelioma.

___________________

249 HSE Mesothelioma occupational statistics Male and Female deaths aged 16-74 in Great Britain 1980-2000 tables 5 and 6
250 HSE Mesothelioma Mortality in Great Britain: Analyses by Geographical Area and Occupation 2005 P15
251 E-mail HSE Statistics Branch Darnton/Lees GB Mesothelioma case control study 6 Apr 2009
The following table was supplied by HSE Epidemiology unit 25 Feb 2011.\textsuperscript{252}

Numbers of mesothelioma cases and controls who worked for at least 5 years before 1992 in each occupational category. Men and women with any exposure in higher risk* occupational categories are excluded in the right-hand part of the table.

<table>
<thead>
<tr>
<th>Occupational category</th>
<th>Cases</th>
<th>Controls</th>
<th>Cases</th>
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<td></td>
<td></td>
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</tr>
<tr>
<td>Primary &amp; secondary school teachers</td>
<td>5</td>
<td>39</td>
<td>3</td>
<td>27</td>
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<tr>
<td>Other school workers</td>
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<td>1</td>
<td>0</td>
<td>1</td>
</tr>
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<td>Higher Education teachers &amp; workers</td>
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<td>13</td>
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<td>Reference group\textsuperscript{1}</td>
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<td>242</td>
<td>23</td>
<td>242</td>
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<tr>
<td>Females</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Primary &amp; secondary school teachers</td>
<td>7</td>
<td>21</td>
<td>6</td>
<td>20</td>
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<tr>
<td>Other school workers</td>
<td>6</td>
<td>11</td>
<td>4</td>
<td>10</td>
</tr>
<tr>
<td>Higher Education teachers &amp; workers</td>
<td>4</td>
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<td>3</td>
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<tr>
<td>Reference group\textsuperscript{1}</td>
<td>58</td>
<td>172</td>
<td>58</td>
<td>172</td>
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</tbody>
</table>

\textsuperscript{1} The reference group worked only in non-industrial jobs (excluding teaching), or in low risk industrial jobs for less than 5 years.

* Medium risk industrial jobs and higher, and those with more than 5 years work in low risk industrial jobs \textsuperscript{253}

Annex D. HSE WATCH paper on fibre Levels. \textsuperscript{2}nd series of HSL tests in CLASP buildings.

Between 2007 and 2011 the Government’s advisory committee on science (WATCH) considered the risks from low level exposure to asbestos. At the first meeting the particular relevance of childhood asbestos exposure was raised, as was the implications of the increasing numbers of school teachers dying from mesothelioma.\textsuperscript{254} The Asbestos in Schools Group requested that WATCH should be tasked to look at the risk to children from exposure to asbestos,\textsuperscript{255} however despite their request and the concerns of WATCH committee members, no such assessment took place.

At the WATCH meeting in November 2009 HSL/HSE were asked to “summarise the knowledge it has on airborne levels of asbestos in buildings for the next WATCH meeting.”\textsuperscript{256} HSL summarised the levels and submitted the paper to the WATCH secretariat at the February 2010 meeting and the

\textsuperscript{252} E-mail HSE Epidemiology unit Darnton/Lees 25 Feb 2011
\textsuperscript{253} E-mail HSE Epidemiology unit Darnton/Lees 25 Feb 2011
\textsuperscript{254} WATCH committee minutes. Assessing the risks arising from exposure to low level exposure to asbestos 7 Nov 2007
\textsuperscript{255} Asbestos in Schools Group paper meeting with Prime Minister 13 May 2009.
\textsuperscript{256} WATCH committee papers annex 3. WATCH committee minutes. 10 Nov 2009 paras 4.38 and Actions para 4.49 (iv) http://www.hse.gov.uk/aboutus/meetings/iacs/acts/watch/101109/minutes-nov09.pdf
October 2010 meeting. The paper was never discussed and was not agreed by the committee. It includes only two figures for fibre levels from the United Kingdom, both of which are significantly lower than the average background level in buildings in the UK.

The paper does not give a balanced or true picture of fibre levels in UK buildings. None of the raised asbestos fibre levels that have been found in schools are included, but instead both the results are from the 2nd series of tests HSL carried out in CLASP buildings. One set of samples were taken in seven schools after extensive remedial action had been carried out specifically to prevent asbestos fibre release, and the other set was not even in a school but was in offices in an office block. The results are highly selective and cannot be claimed to be representative of the typical levels that have been obtained in schools. The fibre levels were further reduced by pooling the results, which in the case of the seven schools the manner in which it was carried out is contrary to HSE’s own criteria for pooling.

The paper includes a table of fibre levels from buildings in Italy, Poland, the USA and the UK. The UK entry has data from a paper entitled “UK schools with CLASP construction.” The level from the offices in an office block is “Average <0.00003 f/ml.” The other is the pooled results from the seven schools and the level is “Average <0.00005 f/ml.”

Comprehensive air testing was carried out over the course of five weeks in two offices in an office block, where it is apparent the activity was not typical of a busy classroom. It also appears that the offices were in good condition and very clean, which is not typical of many schools. Only one asbestos fibre was counted throughout the whole of the five weeks and a total of just 94 other PCM equivalent fibres. This was neither typical of the boisterous activity nor the cleanliness of a school full of hundreds of children, it would also appear that the office block had been maintained in a good condition, which is not typical of the school estate. However on the results from this test it was claimed that:

“The level was an order of magnitude lower than the average background value for asbestos containing materials in buildings.”

Further tests were undertaken in seven schools after silicone sealant had been applied to the gaps in the column in all the schools. The tops of the columns had been sealed in two of the schools and consequently a thorough clean would have had to be carried out following the work. Not a single asbestos fibre was collected in any of the schools despite the fact that large volumes of air had been sampled (55,000 litres). The asbestos fibre level recorded for each sample was therefore not an actual level of asbestos fibres but instead it was the calculated limit of detection. Consequently all that could be said about each sample was that no asbestos fibres had been detected at the limit of detection. The tests did not show whether or not any fibres were present below the limit of detection, and it cannot be claimed that they were or were not.

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257 WATCH committee papers 23 Feb 2010  Annex 3: Update of published asbestos concentrations in buildings under normal use and occupation. 27 Oct 2010 Annex 4: Update of published asbestos concentrations in buildings under normal use and occupation. (By G. Burdett, HSL)

258 CLASP Working Group minutes 16 July 2007
HSE guidance gives the criteria for pooling air samples: "It is permissible to achieve a measurement by pooling two or more simultaneous or consecutive samples....Samples that are pooled in this way should be taken within 1m of each other and are regarded as a single measurement."\(^{259}\) The tests had been carried out in different rooms, different schools, at different dates, even different years, some tests were not even in rooms. Eleven senior asbestos consultants and analysts were consulted over whether the pooling carried out in the series of tests in the seven schools was good practice. Eight said definitely it was not. Two said that it was, and one expressed a firm opinion but preferred not to be involved in the controversy.\(^{260}\)

Despite their own criteria, HSE pooled all 28 results and made an unjustified claim that the asbestos fibre level was significantly lower than the individual limits of detection. Instead of reporting the actual results of the tests they reported the result of their pooling calculation. HSE claimed that the results of all 28 tests showed that:

"An overall analytical sensitivity of 0.000016 f/ml was achieved and the average level in remediated schools was below the limit of detection <0.000048f/ml, some ten times lower than the average previously found in UK asbestos containing buildings."\(^{262}\)

The report lists the "limit of detection" as the "asbestos fibre concentration." The lowest asbestos fibre concentration was <0.0004f/ml and the average of all the 28 samples was <0.0008 f/ml. Therefore all that can be legitimately claimed is that the asbestos fibre concentration was <0.0004f/ml. However because HSL had pooled the results they calculated the asbestos fibre level in all seven schools as <0.000048f/ml and purely on the strength of that felt able to claim that the asbestos fibre levels were "Some ten times lower than the average previously found in UK asbestos containing buildings."\(^{262}\)

The series of tests had been carried out to determine the effectiveness of the sealing, as it had been proved during the first series of tests it had not always been effective. One of the schools had undergone partial remediation by sticking tape over the crack in the column, HSL concluded "One set of high volume samples have been taken for TEM analysis in a school where the vertical seams have been taped to cover visible separation of the casing.... This result is below the average airborne concentration of PCM equivalent asbestos fibres that are commonly found in buildings containing asbestos products and represented a two orders of magnitude reduction in the airborne concentration of asbestos fibres after partial remediation."\(^{263}\)

It is therefore likely that the asbestos fibre levels in the other schools in this series of tests were significantly higher before remedial actions had been carried out than after. The schools in the HSL WATCH paper were all sampled after remediation had taken place. It is therefore reasonable to assume that the exceptionally low fibre levels found in the tests were an order of magnitude, or possibly two orders of magnitude less than they had been prior to remediation. The schools had

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\(^{259}\) HSE Asbestos: the analysts’ guide for sampling and analysis and clearance procedures. para 5.19 p16

\(^{260}\) Howie 29 May 2008

\(^{261}\) CLASP Working Group minutes 16 Jul 2007.

\(^{262}\) HSL Further measurements of fibre concentrations in CLASP construction buildings. AS/2007/14 Sep 2007 Executive summary. RR624


been built between 1966 to 1971\(^\text{264}\) therefore it is equally reasonable to assume that amosite fibres had been released for a significant number of years at levels one or two magnitudes greater than given in the HSL WATCH paper.

Although HSE/HSL were asked by WATCH to summarise the fibre levels in buildings, they only provided data on the exceptionally low levels from their 2\(^{\text{nd}}\) series of tests in CLASP buildings, despite the fact that sampling found levels orders of magnitude greater when common classroom activities took place. Results from tests in the 1\(^{\text{st}}\) series of air sampling were more than 1,800 times greater, and they were from activities that happen every day in schools such as slamming doors or hitting columns which gave a mean of 0.09 f/ml. Although that was measured by PCM the mean of the TEM analysis that counted purely amosite fibres was 0.049 f/ml, which is 1,034 times greater. Those tests were before remediation, but 96 tests after remediation while the classrooms were normally occupied had a mean of 0.005 f/ml, more than 100 times greater with the largest value of 0.022 f/ml, 450 times greater than the data published in HSE’s WATCH paper.\(^\text{265}\) These tests were purely related to cracks in the columns and yet the 1987 tests had nothing to do with columns and had first proved that high levels of fibres were released when doors are slammed in schools. But no mention is made of those tests, or any others, in the HSL WATCH summary of UK fibre levels.

The HSE/HSL WATCH paper does not give a balanced or true summary of asbestos fibre levels in buildings in the United Kingdom. A similar misleading impression is given in the selection of some of the data from other countries. The following are comments on the tests listed in the HSE WATCH summary:

- The MRC report is included in the HSE WATCH summary and a figure of 0.0005f/ml is given as an average background level, but no mention is made that the figure is for schools with asbestos in good condition,\(^\text{266}\) and neither have the HSE included the figure in their graph of average asbestos concentrations in schools. HSE’s own tests have shown that asbestos is not necessarily in good condition in an unquantifiable number of schools, and plate 6 is testimony to that. MRC quote an HSE paper, Asbestos fibre concentrations in buildings, that gives the results of sampling in 43 buildings. The paper highlights the raised fibre levels in a school with damaged asbestos materials where an average asbestos fibre level of 0.002 f/ml was found. The average in four schools was 0.00078 f/ml, and the average in two high rise flats was 0.00055f/ml.\(^\text{267}\) These results are most relevant but the HSE WATCH paper does not include the data.

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\(^{266}\) MRC Fibrous materials in the environment Schools 1997 p 73.

Schneider, Burdett et al. HSE WATCH summary lists school children with an “Arithmetic average indoor in asbestos containing buildings” at a level of 0.000044f/ml. Five school children in Paris had personal samplers which they wore for 24 hours including commuting to and from school, at home in bed and at school. HSE appears to have included this result in its graph of average concentrations in schools, however they do not mention that the report states “Material containing asbestos was not found in any of the buildings.” The results are therefore understandably low and should not be used as an indication of levels inside UK schools or social housing flats.

Italian Schools. The average airborne asbestos fibre level was “0.00025f/ml. The asbestos materials were vinyl floor tiles and asbestos cement and the only airborne fibres were chrysotile as no “airborne amphibole fiber was detected.” Asbestos cement releases fibres far less readily than AIB and also chrysotile is released about ten times less readily from the same matrix than amosite or crocidolite, and therefore the levels in UK schools would be considerably higher where the predominant airborne fibres are amosite, mainly because of the extensive use of AIB.

The report states “Most of the school buildings that were surveyed were well maintained and ACMs within the buildings were in good repair, resulting in unmeasurable airborne fibre concentrations.” Most of the schools also had stringent systems of asbestos management, the headteachers were aware of the dangers, as were the staff who were informed of the location of the asbestos materials. The staff and pupils were also trained in asbestos awareness and how to avoid disturbing the asbestos.

The asbestos in a minority of schools was damaged. The report highlights the limitations of air sampling in schools that is most pertinent to air sampling that has been carried out in the UK. They state “Air sampling gives the number of airborne fibres during the sampling time, providing information about the average asbestos fiber concentration. In some situations a real health risk, even if limited in time, may be greater than it was assessed by sampling because of the natural behaviour of children. For example, we sometimes found that partitions and walls had greatly deteriorated, particularly near the frames of the doors where tufts of chrysotile and crocidolite could be seen with the naked eye. Even if air sampling gave a very low value of airborne fiber concentration in undisturbed conditions, such a situation was very dangerous because children scraped the wall with their hands, pens, or pencils, releasing asbestos fibers at the same moment.”

These comments reflect the situation in schools in the UK. The comprehensive sampling in the offices found only one asbestos fibre over the course of five weeks, which indicates that there were no peak exposures that might be expected in a school when a hundred students

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269 HSE Amendment to the CAWR 1987 and ACOP Regulatory Impact assessment 2002 p34
jostle each other in a corridor lined with AIB, or slam the door, or a teacher takes books out of an AIB backed stationary cupboard. If a realistic picture of fibre levels in schools is to be given then data from realistic disturbance has to be collated in addition to data on background levels.

- **Polish urban.** Again this report is about asbestos cement and not the more friable AIB typical of UK buildings. Sampling was carried out to determine the outdoors levels from external cladding. The levels were between 0.001 f/ml and 0.009 f/ml with an average 0.0018 f/ml. The report also states that tests were carried out in Moscow where the outside levels were 0.009 f/ml, however tests were then repeated indoors where the level was 0.049 f/ml “approximately 5-6 times higher than outdoors.” This corresponds with the MRC report that concluded levels inside buildings with asbestos in good condition were 5 times greater than urban outside measurements. The Lee and Van Orden report also found that the average level in schools was about five times greater than outside. As the Polish statement is relevant it is surprising that the HSE WATCH summary states that “no measurements were taken inside buildings.”

- The HSE WATCH summary includes a paper in their list of references “**Extreme airborne asbestos concentrations in public buildings,**” however the data is not included in their table or the graphs of fibre levels. Sampling was carried out in a kibbutz dining room with a sprayed crocidolite ceiling. Four SEM measurements of asbestos fibres averaged 4f/ml with a range of 3-5f/ml. The report concludes “Our findings are remarkable in that crocidolite was the type of asbestos used in the insulation material. Despite the fact that Israel and the United Kingdom the use of crocidolite in sprayed on asbestos is not unusual, most reports on airborne asbestos fibres in buildings do not consider this fibre type in their assessment of risk.... we conclude that very high exposure to airborne asbestos fibres can indeed occur in public buildings.”

- HSE’s Surveyors’ Guide lists the type of asbestos used for spraying in the UK “Crocidolite was the major type until 1962. Mixture of types including crocidolite until mid–1971. Asbestos spray applications were used up to 1974.” The MRC report gives a summary of the asbestos materials used in schools and highlights the use of asbestos in System built schools. It states “In general extensive use was made of sprayed coatings (amphiboles).”

The HSE WATCH summary does not include a study carried out by HSE of Asbestos fibre concentrations in buildings. Tests were carried out by HSE in various buildings including four UK schools, where one had “sealed sprayed amosite and chrysotile on ceilings with some damage.” The TEM asbestos fibre levels were from <0.003 f/ml to 0.012 f/ml with an

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273 MRC Fibrous materials in the environment Schools 1997 p 71
276 HSE Surveyors Guide Sprayed coatings P 53
277 MRC Fibrous materials in the environment Schools 1997 p 72
average of 0.002 f/ml. Of the four schools the average asbestos fibre level was <0.00078 f/ml. The two factories averaged <0.00046 f/ml. The two high rise flats averaged 0.00055 f/ml.

When non-standard asbestos fibres were included the levels in the school with damaged material were from <0.035 f/ml to 0.25 f/ml, with an average of 0.04 f/ml, some twenty times greater than the level for standard fibres. The average of non-standard fibres for all four schools was < 0.013 f/ml, some 16 times greater than standard fibres. The levels of non-standard fibres in schools are about twice as great as the average in two factories, seven times greater than a shop and slightly greater than a house and two high rise flats.278

The report states that “as far as possible, sampling was carried out under normal conditions of occupancy.” No mention is made whether or not the schools were occupied, but it would seem unlikely as all the sampling in the schools was undertaken in August.279 It is reasonable to assume that if the schools had been occupied the levels would have been higher. These tests are relevant and should be included in any summary of asbestos fibre levels in schools.

- The Asbestos fibre concentrations in buildings report also includes samples from High-rise flats with trowelled amosite on structural steelwork and internal partition walls of asbestos containing board. Amosite and chrysotile fibres were identified in one flat where the fibre level was 0.0004 f/ml and in the other crocidolite, amosite and chrysotile fibres were identified and the fibre level was 0.0007 f/ml. The average for the two flats was 0.00055 f/ml.280

In another study, Indoor asbestos levels on a housing estate, air sampling was carried out in 25 System built flats of “CLASP” construction. Samples were taken throughout the day and averaged 0.0004 f/ml, and at night the average was 0.0002 f/ml. In one flat the level was 0.002 f/ml and in another it was 0.003 f/ml. In seven flats amosite fibres were found, in six flats chrysotile fibres and in twelve flats there was a mixture of both amosite and chrysotile fibres.281

When one considers the types of asbestos and the length of time the occupants would spend in the flats the cumulative exposures would have been significant. MRC estimated the asbestos fibres inhaled by the occupants of similar flats and stated “Assuming an occupancy in a non-traditionally built flat of 12 hr/day, 7 day week and 50 weeks a year, average airborne fibre levels of 0.0005 f/ml and a respiratory rate of 8 f/ml, the total number of respirable asbestos fibres inhaled over a 30 year period of residence would be 30,240,000...”.282

282 MRC and BRE Fibrous materials in the environment 1997 p74
These background levels for schools, flats and factories from these two reports have not been included in the HSE WATCH summary, which is surprising as they are most relevant.

- The HSE WATCH paper does not include the extensive tests carried out at Yale university where there was a ½” to 1” sprayed coating on the ceilings. The mean level was 0.3 f/ml and the maximum 0.5 f/ml. Later tests were carried out after latex spray had been applied and a mean of 0.1 was obtained and a maximum of 0.2 f/ml from sampling the “usual activity of staff, students and faculty”. However the report considers that the airborne levels were “incompatible with the visible ceiling deterioration and contamination of the building with ceiling material.” Further tests were carried out with typical disturbance such as dusting 4 f/ml, sweeping 1.6 f/ml replacing a lighting track mean 7.7 f/ml. The report stresses the need to undertake sampling when normal custodial or maintenance activities take place so that a realistic picture can be obtained of the likely long term exposures of the occupants. The HSE WATCH paper includes no such fibre levels in their data for UK buildings.

- USA Lee RJ Van Orden DR. The data for this report has to be viewed with the understanding that “The samples from 752 different buildings nationwide were collected over a 10-year period and represent all of those analyzed by RJ Lee Group for defendants in asbestos in buildings litigation.”

The samples were taken over two days while the buildings were normally occupied and samples were taken in 317 schools and a total of 752 buildings. The report stated “There are significant differences in concentration between schools, universities, and public/commercial buildings for asbestos structures of all sizes with the school concentrations significantly higher than in the other buildings.... There appear to be marginal differences in the concentration of fibers => Sum and for optically equivalent fibers among these buildings with schools having higher concentrations than the other building types.”

The schools average for asbestos structures was 0.0273 s/ml, which was 12 times greater than other public buildings and 14 times greater than commercial buildings. For standard dimension PCM equivalent fibres the schools averaged 0.00011 f/ml which was 2.75 times greater than other public buildings and 1.6 times greater than commercial buildings. This coincides with other data and shows that schools generally have higher airborne asbestos fibre levels than other buildings. It is also very relevant that the asbestos structures were significantly higher in schools than other buildings. This shows the importance of measuring, and reporting, asbestos fibres of non-standard dimensions as well as fibres of a standard dimension. As previous sections have discussed there is a body of expert opinion that considers that non-standard asbestos fibres cause disease.

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The sampling found that only 2% of the fibres were amphiboles,\textsuperscript{287} which corresponds with the fact that over 99% of asbestos used in the U.S. has been chrysotile.\textsuperscript{288} Any conclusions or risk estimates for asbestos fibre levels in the UK that are based on U.S. publications should always bear in mind that amosite use was widespread in UK schools, hospitals and some social housing, and therefore the fibre levels are likely to be higher, as are the risks. A publication by the U.S. Department of Health and Human Services on Asbestos concludes that “Average concentrations in the United States are 10-100 times less than those found in Britain, Germany, and Canada.”\textsuperscript{289}

The HSE/HSL were asked by the WATCH committee to “summarise the knowledge it has on airborne levels of asbestos in buildings for the next WATCH meeting.”\textsuperscript{290} From the above paragraphs it can only be concluded that the paper that HSE and HSL gave to the WATCH committee does not fulfil their request. It omits relevant data and includes data that could give the impression that asbestos fibre levels in buildings, and in particular in UK schools and flats, are considerably lower than they actually are. Any assessment of the potential risks to the occupants would therefore also underestimate the actual risks.

**Annex E. Risks from displaying work with drawing pins.**

The following are calculations on the risks from inserting drawing pins in AIB to display the children’s work. The fibre levels used in the calculations are ones that the Government’s advisory committee on science, WATCH concluded were released when they considered the results from the four series of tests that had been carried out.\textsuperscript{291}

It must be borne in mind that the calculations are based on the Hodgson and Darnton risk estimates, and therefore the figures should be taken as a measure of the level of risk rather than as definitive values.

Ref: RMH/03/324


Further to the WATCH Committee meeting on 1\textsuperscript{st} February, I have carried out the following risk estimations.

1. **Estimation of mesothelioma risk to teachers from exposure to amosite**

Assume teachers are exposed to asbestos from age 25 for 5 years

1.1 – Assume a teacher’s annual cumulative exposure of 0.06 f/ml – i.e. the higher figure from the Watch Committee meeting

Cumulative exposure over 5 years = 0.06 f/ml x 5 years = 0.30 f/ml.years

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\textsuperscript{287} Toxilogical profile for asbestos . US Department of Health and Human Services Sep 2001 p163

\textsuperscript{288} Toxilogical profile for asbestos . US Department of Health and Human Services Sep p143

\textsuperscript{289} Toxilogical profile for asbestos . US Department of Health and Human Services Sep p143

\textsuperscript{290} WATCH committee papers annex 3. WATCH committee minutes. 10 Nov 2009 paras 4.38 and Actions para 4.49 (iv) http://www.hse.gov.uk/aboutus/meetings/iacs/acts/watch/101109/minutes-nov09.pdf

\textsuperscript{291} WATCH committee minutes asbestos exposure from use of drawing pins in asbestos insulating board 1 Feb 2006 Conclusions para 3.63 p15 http://www.hse.gov.uk/aboutus/meetings/iacs/acts/watch/010206/minutes.pdf

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From H&D Table 11 a cumulative exposure of 1 f/ml.years over 5 years from age 30 will generate a mesothelioma risk of 90 per 100,000 exposed persons, i.e. a risk of 900 per million (900/million).

From H&D page 581 (2nd bottom paragraph of left-hand column) the mesothelioma risk is related to the cumulative exposure to the power 0.75.

The risk from a cumulative exposure of 0.30 f/ml.years over 5 years from age 30 is therefore: 900 x (0.3/1)^0.75 = 365/million.

From H&D Table 9, the mesothelioma risk from a given cumulative exposure from age 25 is 1.5 times higher than from the same cumulative exposure from age 30.

The risk from a cumulative exposure of 0.30 f/ml.years over 5 years from age 25 is therefore: 365 x 1.5 = 547/million, i.e. about 1 in 2,000.

1.2 – Assume a teacher’s annual cumulative exposure of 0.006 f/ml – i.e. the lower figure from the Watch Committee meeting

The cumulative exposure is therefore 5 x 0.006 = 0.030 f/ml.years.

The risk from a cumulative exposure of 0.030 f/ml.years over 5 years from age 25 is 547 x 0.1^0.75 = 97/million, i.e. about 1 in 10,000.

2 Estimation of mesothelioma risk to school children from exposure to amosite

Assume primary school children are exposed to asbestos from age 5 for 5 years and that the children’s exposures to asbestos are 1/10th those of the teacher.

Assume that children’s mesothelioma risk is affected only by their likely life expectancy and not by any further susceptibility.

Assume that the Doll & Peto (1985) (D&P) model can be applied to estimate mesothelioma risk between ages 5 and 25.

For a 5-year exposure from age 5 as against age 25, the D&P correction for survival to age 80 would be:

\[ \frac{(80-5)^4 - (80-10)^4}{(80-25)^4 - (80-30)^4} = \frac{75^4 - 70^4}{55^4 - 50^4} = 2.6 \]

The mesothelioma risk from 5 years exposure from age 5 is therefore 2.6 times higher than for the same cumulative exposure from age 25.

2.1 – Assume a children’s annual cumulative exposure of 0.03 f/ml – i.e. 10% of teachers’ cumulative exposure at the higher figure for teachers from the Watch Committee meeting

From 1.1 above the risk to teachers from a cumulative exposure of 0.30 f/ml.years over 5 years from age 25 is 547/million.

The risk to children from a cumulative exposure of 0.030 f/ml.years over 5 years from age 5 is therefore: 547 x 0.1^0.75 x 2.6 = 253/million, i.e. about 1 in 4,000.

2.2 – Assume a children’s annual cumulative exposure of 0.003 f/ml – i.e. 10% of teachers’ cumulative exposure at the lower figure for teachers from the Watch Committee meeting

From 1.2 above the risk to teachers from a cumulative exposure of 0.030 f/ml.years over 5 years from age 25 is 97/million.

The risk to children from a cumulative exposure of 0.0030 f/ml.years over 5 years from age 5 is therefore: 97 x 0.1^0.75 x 2.6 = 45/million, i.e. about 1 in 20,000.
3 Comment

From the above, the consequence of reducing the teachers’ cumulative exposures to airborne amosite by a factor of 10 reduces the teachers’ mesothelioma risk by a factor of about 5.6.

The consequences of reducing the children’s cumulative exposures to 10% of the teachers’ cumulative exposures AND of the children’s greater life expectancy than the teachers, means that the children’s mesothelioma risks are only about a factor of 2 lower than that of the teachers.

CAVEAT

From H&D the resolution of the risk estimates are within the range of times divide 3 of the above figures. However, if the relative resolution is constant, the same above relative magnitude of the risks between the four exposure regimens will be unaffected.

Robin Howie
20th February 2006

Annex F: A Comparison. Incidence of mesothelioma in Great Britain and the USA.

Comparison of the mesothelioma incidence

In the USA the incidence of mesothelioma is far lower than in Great Britain and over the last few years has stabilised.

USA: 14.1 per million in 1999 and 14.0 in 2005

In Great Britain the incidence of mesothelioma has been increasing year on year.


GB: The incidence was 12.93 per million between 1985-1987 and has been rising steadily

Australia has the next highest mesothelioma incidence in the world at 12 per million in 1982 and 29 per million in 2004.

The HSE graph shows the significantly greater incidence of mesothelioma in Great Britain (and Australia) than the remainder of the world, including USA:

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292 Malignant Mesothelioma Mortality — United States, 1999—2005. Reported by: KM Bang, PhD, JM Mazurek, MD, E Storey, MD, MD Attfield, PhD, PL Schleiff, MS, JM Wood, MS, Div of Respiratory Disease Studies, JT Wassell, PhD, Div of Safety Research, National Institute for Occupational Safety and Health, CDC.


294 HSE Table Meso04; Number of mesothelioma deaths and average annual rates per million by age and sex in three year periods, 1969-2005 www.hse.gov.uk/statistics/tables/meso04.htm

295 Mesothelioma incidence and trends Australia www.asbestos.com/mesothelioma/australia/
USA has specific laws for schools because of vulnerability of children

In 1980 an EPA report was compiled for the US Congress that examined the likely extent of friable asbestos in schools, the likely exposure of the occupants and the resultant risks. The report stressed the increased risk because of the longer life expectancy but, from the evidence available, was unable to confirm an increase in risk because of the biological susceptibility of children. It stated:

“It has also been suggested that children may be more biologically susceptible than adults to carcinogens, including asbestos. ... although children may be more susceptible to the effects of asbestos exposure than adults, little firm evidence is available to determine the difference in risks. The longer remaining life expectancy of children compared with adults is the only factor that can be incorporated into quantitative risk estimates.”

The US Congress took evidence on the risks of asbestos in buildings, including the EPA report. Their findings led to stringent laws on the management of asbestos in schools. The Congressional statement stated:

“Medical evidence suggests that children may be particularly vulnerable to environmentally induced cancers.”

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296 HSE Consequence of asbestos use in Great Britain. Dr A. Darnton HSE Statistics Unit 2010
297 EPA Support document for the proposed rule on friable asbestos-containing materials in school buildings EPA report 560/12-80-003 p 52 and 55
298 (US Congressional statement of findings and purpose. Title 20> Chapter 49> 3601 14 Jun 1980)
The report to Congress estimated how many children could be expected to die of asbestos exposure at school. A report from the American Academy of Pediatrics states:

“In 1980, the EPA provided a quantitative risk estimate for asbestos-containing materials in US schools. The EPA estimated that more than 8,500 schools in the nation had friable asbestos and that approximately 3,000,000 students (and more than 250,000 teachers, maintenance workers, and other adults) were potentially exposed. Using available field studies to estimate airborne asbestos levels and assuming a 30-year life expectancy for schools with asbestos, the EPA report concluded that:

A total of approximately 100 to 7,000 premature deaths are anticipated to occur as a result of exposure to prevalent concentrations of asbestos in schools containing friable asbestos materials over the next 30 years. The most reasonable estimate is approximately 1,000 premature deaths. About 90% of these deaths are expected to occur among persons exposed as school children.”

Note: The above estimates of mesothelioma deaths were based on an incorrect assumption of the number of schools that contained asbestos. Subsequently a nationwide audit was carried out when every school was required by law to carry out an asbestos survey. The number of schools that actually contained asbestos was found to be four times higher than originally thought.

In 1986 stringent laws were introduced in the USA specifically for schools, for it was acknowledged that because of the increased vulnerability of children schools had to be treated as a special place. Resources were allocated, people were trained and systems introduced so that the asbestos was rigorously managed, and staff and parents were kept informed of the asbestos in their schools and the system of management. The problem was addressed, and although it has not solved it, it has kept it reasonably well under control for the last twenty five years. In contrast in this country no such laws existed until the 2004 CAWR duty to manage. The particular vulnerability of children has not been taken into account and schools in the UK are not treated as a special place.

98% of asbestos fibres counted in sampling tests in public buildings in the USA were chrysotile. In the UK many schools contain large quantities of the more dangerous amosite, and some contain, or have contained, crocidolite. The study also estimated that the average airborne asbestos concentration in US buildings, including schools, was 10-100 times less than in Britain. It is therefore a reasonable assumption that proportionately the number of deaths among staff and children in UK schools will be higher than in the USA.

British situation
At least three quarters of schools in Britain contain asbestos.
Britain was the largest importer of amosite in the world. Many schools contain amosite, some contain crocidolite.

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304 HSE Occupational, domestic and environmental mesothelioma risks in Britain.A case-control study Mar 2009
All the asbestos in British schools is now old and much is deteriorating.
Asbestos surveys in schools are not mandatory
Asbestos training is not mandatory
Schools are treated no differently from any other workplace
The standards of asbestos management in some British schools are poor.
Frequent asbestos incidents have occurred in British schools.
Neither a risk assessment nor an audit have been carried out in schools in Britain.
A campaign to improve asbestos management in British schools was scrapped.

American situation
Most asbestos in public buildings, including schools, in the USA is chrysotile asbestos. In the 1980’s an audit was carried out in America of all friable asbestos in schools.
A risk assessment was also carried out.
Asbestos training was made mandatory.
Schools are treated as a special place and not as any other workplace.
Because of the particular vulnerability of children in 1986 stringent asbestos laws were introduced specifically for schools, surveys were made mandatory, a policy of openness was adopted. A system of regulation introduced and funds allocated so that schools had the resources so that they can manage their asbestos.

Annex G. Incorrect use of Action Level as a threshold for a long term risk to health.
IOM assessed the asbestos exposures and the risks to staff and pupils from the practice of removing books from the classroom cupboards. They estimated that the cumulative exposures of the pupils was between 4.75 f/ml.hours and the worse case of 47.5 f/ml hours over their five years at the school, and for the teachers the likely annual exposure between 1 f/ml.hours and 7 f/ml.hours with a worst case between 5 f/ml.hours and 31 f/ml hours every year. Some staff had taught at the school for more than sixteen years.

IOM used the Action Level, a workplace level, as a threshold for a long term risk to health, and concluded that:
“In our estimation, none of the interviewees/pupils had exposure approaching the 48 fibre/ml.hrs that HSE referred to as an indicator of exposure being sufficient to pose a long term health risk. Many of the interviewees had exposure much less than that....

We interpret the HSE advice as being that at those levels of exposure it is not necessary to put the information onto individual’s medical records. Therefore, the interviewees’/ pupils’ potential for exposure was so low that we recommend that they do not need to ask their GPs to enter a note on their medical record.”

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305 Toxicological Profile for Asbestos US Department of Health and human services Sep 2001 P15, 163.
307 IOM Strategic Consulting Report: 629-00224 An assessment of the past exposure and estimation of consequent risks to health of
The table below gives an idea of the teachers’ exposure and demonstrates how the 48 fibre/ml.hours has been exceeded in both IOM’s worst case and likely case scenarios:

<table>
<thead>
<tr>
<th></th>
<th>1 year</th>
<th>19 months</th>
<th>2 years</th>
<th>4 years</th>
<th>6 years</th>
<th>8 years</th>
<th>10 years</th>
<th>12 years</th>
<th>14 years</th>
<th>16 years</th>
<th>18 years</th>
<th>20 years</th>
</tr>
</thead>
<tbody>
<tr>
<td>Worst case</td>
<td>30 f/ml.hr</td>
<td>48 f/ml.hr</td>
<td>60</td>
<td>120</td>
<td>180</td>
<td>240</td>
<td>300</td>
<td>360</td>
<td>420</td>
<td>480</td>
<td>540</td>
<td>600</td>
</tr>
<tr>
<td>Likely case</td>
<td>6</td>
<td>12</td>
<td>24</td>
<td>36</td>
<td>48 f/ml.hr</td>
<td>60</td>
<td>72</td>
<td>84</td>
<td>96</td>
<td>108</td>
<td>120</td>
<td>120</td>
</tr>
</tbody>
</table>

**Action level is unsafe.** The Action Level was a workplace level that applied to asbestos contractors, it is a cumulative exposure to asbestos and when it was in force it was 240 times greater than the “Control Limit,” and since the Control limit was reduced in 2006 it is now 480 times greater. The HSE recognise the far lower Control limit is not a safe level, and if it is likely to be exceeded contractors have to wear face masks and protective clothing. 

308 HSE state “At the moment, the control limit is 0.1 asbestos fibres per cubic centimetre of air (0.1 f/cm3). The control limit is not a ‘safe’ level.”

When in force the Action level for amosite, crocidolite and chrysotile was 48 f/ml hours and represented 240 hours at the Control Limit of 0.2 f/ml (in force until 2006). HSE acknowledge that the present Control Limit of 0.1 f/ml is not a safe level of exposure, but the Action Level is 480 times greater. If a person was exposed to the Action Level for amosite and crocidolite they would inhale about 28,000,000 fibres. That is a dangerous level of exposure for an adult and is considerably more dangerous for a child.

An exposure of 48f/ml hours is the same as 0.025 f/ml. years. The Hodgson and Darnton (H&D) risk model estimates that for a 30 year old adult an exposure at 0.025 f/ml. yrs to crocidolite would cause 366 mesothelioma deaths per million people exposed, and to amosite 55 deaths. One of the co-authors of the risk assessment also estimated that there is a 2.7 to 5.2 times greater risk to a 5 year old child than an adult of 30. Based on these estimates an expert member of the Government’s advisory committee on science calculated that there would be 1940 mesothelioma deaths per million exposed from crocidolite and 291 from amosite if a child of 5 was exposed at the Action level. For crocidolite that is the same as 1 death for 500 children exposed, and for amosite 1 death for 3,400 exposed. That is as an unacceptable level of risk, particularly for children.

**Calculation of risks from the Action Level.**

The following calculations were carried out by Robin Howie, an expert member of the WATCH committee. They show the increased risk to children, the younger the child the greater the risk. The

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staff that may have arisen from asbestos-containing material in cupboards at Lees Brook Community Sports College, Derby

Alan Jones, Andy Stelling, I Levers, Hilary Cowie April 2009 page viii

308 CAWR 1987 ACOP Reg 2 para 5

309 HSE FAQs Asbestos what is the Control Limit 2011 http://www.hse.gov.uk/asbestos/faq.htm


311 See calculations at Annex 3

312 HSE Statistics Branch Darnton The quantitative risks of mesothelioma in relation to low-level asbestos exposure . BOHS 17 Oct 2007

313 See calculations of risks from exposure at the Action Level at Annex 3

314 HSE Reducing Risks Protecting People . HSE’s Decision making process 2001
calculations are based on the H&D risk assessment model, and therefore the number of deaths should be taken as an indication of the scale of the increase in risk and not as definitive numerical value.

HSE have stated that it was unnecessary to inform parents of children who have been exposed to asbestos at school unless the Action Level was exceeded. Under the previous CAW Regulations the Action Level for the amphiboles was 48 fibres/ml.hours over a 12-week period, i.e. for a single exposure to the Action Level a Cumulative Exposure of 0.026 fibres/ml.years. It is useful to quantify the consequences of a single Action Level exposure to asbestos at different ages.

**Excess deaths/million – a single 0.026 fibres/ml.years exposure at age 30**

<table>
<thead>
<tr>
<th>Asbestos</th>
<th>Mesothelioma</th>
<th>Lung cancer</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crocidolite</td>
<td>366</td>
<td>6</td>
<td>372</td>
</tr>
<tr>
<td>Asbestos</td>
<td>55</td>
<td>6</td>
<td>61</td>
</tr>
<tr>
<td>Chrysotile</td>
<td>&lt;15 x 1.4 = &lt;20</td>
<td>&lt;4</td>
<td>&lt;24</td>
</tr>
</tbody>
</table>

**Excess deaths/million – a single 0.026 fibres/ml.years exposure at age 20**

<table>
<thead>
<tr>
<th>Asbestos</th>
<th>Mesothelioma</th>
<th>Lung cancer</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crocidolite</td>
<td>366 x 2.1 = 768</td>
<td>6</td>
<td>774</td>
</tr>
<tr>
<td>Asbestos</td>
<td>55 x 2.1 = 115</td>
<td>6</td>
<td>121</td>
</tr>
<tr>
<td>Chrysotile</td>
<td>&lt;15 x 2.1 x 1.4 = &lt;44</td>
<td>&lt;4</td>
<td>&lt;48</td>
</tr>
</tbody>
</table>

**Excess deaths/million – a single 0.026 fibres/ml.years exposure at age 15**

<table>
<thead>
<tr>
<th>Asbestos</th>
<th>Mesothelioma</th>
<th>Lung cancer</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crocidolite</td>
<td>366 x 3.0 = 1098</td>
<td>6</td>
<td>1104</td>
</tr>
<tr>
<td>Asbestos</td>
<td>55 x 3.0 = 165</td>
<td>6</td>
<td>171</td>
</tr>
<tr>
<td>Chrysotile</td>
<td>&lt;15 x 3.0 x 1.4 = &lt;63</td>
<td>&lt;4</td>
<td>&lt;67</td>
</tr>
</tbody>
</table>

**Excess deaths/million – a single 0.026 fibres/ml.years exposure at age 10**

<table>
<thead>
<tr>
<th>Asbestos</th>
<th>Mesothelioma</th>
<th>Lung cancer</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crocidolite</td>
<td>366 x 4.0 = 1464</td>
<td>6</td>
<td>1470</td>
</tr>
<tr>
<td>Asbestos</td>
<td>55 x 4.0 = 220</td>
<td>6</td>
<td>226</td>
</tr>
<tr>
<td>Chrysotile</td>
<td>&lt;15 x 4.0 x 1.4 = &lt;84</td>
<td>&lt;4</td>
<td>&lt;88</td>
</tr>
</tbody>
</table>

**Excess deaths/million – a single 0.026 fibres/ml.years exposure at age 5**

<table>
<thead>
<tr>
<th>Asbestos</th>
<th>Mesothelioma</th>
<th>Lung cancer</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crocidolite</td>
<td>366 x 5.3 = 1940</td>
<td>6</td>
<td>1946</td>
</tr>
<tr>
<td>Asbestos</td>
<td>55 x 5.3 = 291</td>
<td>6</td>
<td>297</td>
</tr>
<tr>
<td>Chrysotile</td>
<td>&lt;15 x 5.3 x 1.4 = &lt;111</td>
<td>&lt;4</td>
<td>&lt;115</td>
</tr>
</tbody>
</table>
Action Level used as a threshold for not informing staff and parents
HSE were notified of the long term and frequent amosite exposure of staff and children in an infant school where a teacher had died of mesothelioma. They were also told that the school authorities had refused to inform the parents, although that was contrary to available guidance. HSE held a meeting in 2004 to discuss the particular case and also the generic principle of informing the occupants of schools following an asbestos incident.\(^{315}\) The decision was taken that a threshold level of exposure would be set below which people need not be informed of their exposure. In future, they decided, HSE would recommend to their inspectors, local authorities and schools that people need not be informed of their asbestos exposure unless it was “significant.” This was contrary to the expert medical opinion and to the official medical guidance. The HSE minutes record that their medical expert: “Expressed doubts about our emphasis on the significance of the exposure in deciding on whether the person should be told, as it would be difficult to evaluate in many cases.”\(^{316}\) The medical expert also advised that the guidance is that: “Even when it is not possible to determine whether an exposure was significant or not, entry in the medical record is recommended.”\(^{317}\)

HSE took the decision not to follow the expert medical inspector’s opinion. Contrary to his advice they set a “significant” exposure as a threshold for informing. They further defined “significant” as exceeding the “Action level.” Following the meeting an HSE Asbestos Policy Unit briefing to the Chairman of the Health and Safety Commission informed him of their conclusion. The briefing stated:

“HSE guidance is to inform those who may have been significantly exposed to asbestos (eg exposure has exceeded the action level)\(^{318}\)

HSE were aware that the artificial threshold they were setting was not a safe level. The Action level is a workplace control level that was designed for asbestos contractors wearing breathing apparatus and protective overalls. Certain measures came into force at the level, including regular medical check-ups and the necessity to maintain health records. It was not designed for the occupants of buildings and certainly not for children.

The Department for Education refer local authorities and schools to the HSE guidance OC265/48 on actions to be taken following an asbestos incident in a school. They also refer them to the guidance’s assessment of the level of risk posed by the exposure.\(^{319}\) The guidance gives advice that is contrary to expert medical and epidemiological opinion. It states:

“Exposure would usually have been insufficient to pose a significant long-term risk to health where Action levels were not exceeded.”\(^{320}\)

\(^{315}\) HSE Head of Asbestos Policy. Issues arising from the Lees case (undated Mar 2004)
\(^{316}\) HSE The Lees family Note of video conference meeting held on 19\(^{th}\) March 2004. para 4
\(^{317}\) HSE Comments on Lees family and OC265/48 Inadvertent exposure Robert Hermanns Medical Inspector Undated ( March 2004)
\(^{318}\) HSE Asbestos Policy Unit/HSC Chairman’s office CO Case CO/62/04 13 Aug 2004 See Annex 1
\(^{319}\) Parliamentary Question Annette Brooke MP/ Minister of State for Schools Nick Gibb MP. 26 Apr 2011 51916, 51917 See Annex 7
\(^{320}\) http://www.publications.parliament.uk/pa/cm201011/cmhansrd/cm110426/text/110426w0012.htm#11042790001660

80
If a person was exposed to the Action Level for amosite and crocidolite they would inhale about 28,000,000 fibres. That is a dangerous level of exposure for an adult and is considerably more dangerous for a child.

The HSE guidance gives timescales for work on asbestos materials that it considers give exposures at the Action Level, and that if work is carried out for a shorter length of time the “exposures would usually have been insufficient to pose a significant long-term risk to health.” The message from the guidance, and the inference that people draw from it, is that if they work on asbestos materials for less time than those given in the table they will suffer little or no long term harm. This gives a totally wrong impression to anyone who might be considering disturbing asbestos materials. They are left with the impression that they can drill, cut or smash asbestos lagging, AIB and asbestos cement, and so long as they don’t exceed these times then it is unlikely that either they or the occupants of the rooms will come to any harm. That is contrary to expert scientific, medical and epidemiological opinion.

The types of asbestos materials and the timescales for work on them quoted in the guidance are:

- **Sprayed coatings... or loose lagging:** 15 minutes
- **Insulation:** 30 minutes
- **Asbestos insulating board:** 60 minutes
- **Asbestos cement:** 8 hours

The timescales quoted are related to advice given in the previous version of OC 265/48 which stated that exposures would usually have been insufficient to pose a significant long-term risk to health where Action Levels were not exceeded.

It would be dangerous to work on any of the materials for times far less than the ones quoted, and yet one could easily assume from the table that work on asbestos materials for times less than this it is unlikely that harm will be done. It is known that in addition to IOM, local authorities have used the Action level in schools as a threshold for an exposure insufficient to cause long term risk to health.

The table below gives the activities, the fibre levels and the approximate number of fibres a person would inhale during the period HSE consider that the exposure would be insufficient to cause a long term risk to health:

<table>
<thead>
<tr>
<th>Activity and material</th>
<th>Fibre levels f/ml</th>
<th>Time</th>
<th>Fibres inhaled</th>
</tr>
</thead>
<tbody>
<tr>
<td>De-lagging Dry stripping of crocidolite</td>
<td>100 - 1000</td>
<td>15 minutes</td>
<td>13,500,000 To 130,500,000 Crocidolite</td>
</tr>
<tr>
<td>Uncontrolled dry stripping of lagging</td>
<td>1-100</td>
<td>15 minutes</td>
<td>135,000 To 13,500,000 Amosite, or Chrysotile</td>
</tr>
</tbody>
</table>

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321 HSE Information document Exposure to Asbestos from Workplace activities OC265/48 Factors that influence level of risk para 3 2008
322 HSE OC 265/48 version 3. Information document (part 1) - Exposure to Asbestos from work activities: Advice for employers
LAC 5/19 The level of risk from occupational exposure to asbestos: guidance for HSE and LA staff when responding to enquiries To: Health and Safety Enforcing Authorities. For the attention of: Local Authority Health and Safety Enforcement Managers, Health and Safety Regulators and others. Factors that influence level of risk. [http://www.hse.gov.uk/lau/lacs/5-19.htm](http://www.hse.gov.uk/lau/lacs/5-19.htm)
323 HSE EH 35 Probable asbestos dust concentrations at construction process
324 HSE A comprehensive guide to managing asbestos in premises HSG 227 2004 p95
Annex H: Asbestos incident Silverhill school.
A serious incident occurred at a primary school where 30 windows were replaced with no precautions taken over the course of three weeks while the staff and pupils looked on. The window surrounds, window heads and panel beneath the windows were AIB. The windows and panels beneath them were ripped out using a power jigsaw and crowbars, the debris was then thrown in the playground while staff and pupils looked on. The new windows were then screwed in place into the remaining AIB surrounds. There was extensive damage to the AIB, widespread contamination of the school and asbestos debris remained in the classrooms. The teachers then returned to their classrooms and swept up the asbestos debris with a dustpan and brush. The children then returned and lessons continued.  

The use of a jigsaw on AIB can release 5-20 f/ml, breaking and ripping out AIB 5-20 f/ml rough handling of insulating board and removal of pieces greater than 15f/ml, drilling the AIB window reveals 2-5 f/ml, and drilling the window heads 5-10 f/ml. HSE warn that “Very high exposures arise if the tiles are broken during removal and when the debris is cleaned up and bagged.” A level of 73 f/ml was obtained during a test brushing up and bagging a single AIB panel. This demonstrates the high levels that can be obtained when cleaning up after damage to AIB, and

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### Table 1: Asbestos Concentrations during Different Tasks

<table>
<thead>
<tr>
<th>Task Description</th>
<th>Dust Concentration</th>
<th>Time</th>
<th>Concentration Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drilling AIB overhead</td>
<td>5-10 f/ml</td>
<td>60 min</td>
<td>2,700,000 To 5,400,000 Amosite</td>
</tr>
<tr>
<td>Removal of asbestos insulating board and tiles. Breaking and ripping out</td>
<td>5-20 f/ml</td>
<td>60 min</td>
<td>2,700,000 To 10,800,000 Amosite</td>
</tr>
<tr>
<td>Circular saw without exhaust ventilation asbestos insulating board</td>
<td>Greater than 20 f/ml</td>
<td>60 min</td>
<td>Greater than 10,800,000 Amosite</td>
</tr>
<tr>
<td>Breaking a single AIB ceiling tile (8ftx4ft)</td>
<td>50 f/ml</td>
<td>60 min</td>
<td>27,000,000 Amosite</td>
</tr>
<tr>
<td>15 minutes dry brushing and bagging of AIB dust and debris after breaking of</td>
<td>73 f/ml</td>
<td>60 min</td>
<td>39,420,000 Amosite</td>
</tr>
<tr>
<td>Abrasive disc cutting asbestos cement sheet or pipes</td>
<td>15-25 f/ml</td>
<td>8 hours</td>
<td>64,800,000 To 1,080,000,000 Chrysotile</td>
</tr>
</tbody>
</table>

325 HSE A comprehensive guide to managing asbestos in premises HSG 227 2004 p95
326 HSE EH 35 Probable asbestos dust concentrations at construction process
327 HSE EH 35 Probable asbestos dust concentrations at construction process
328 Risks with asbestos insulating board. Howie ACADemy Autumn 2001 p11-12
329 Risks with asbestos insulating board. Howie ACADemy Autumn 2001 p11-12
330 HSE EH 35 Probable asbestos dust concentrations at construction process
332 HSE a comprehensive guide to managing asbestos in premises HSG 227 Table 15 p95 Feb 04
334 HSE a comprehensive guide to managing asbestos in premises HSG 227 Table 15 p95 Feb 04 HSE EH 35 Probable asbestos concentrations at construction processes, Dec 1989. HSE EH71 Working with asbestos cement and asbestos insulating board Nov 1996
336 Risks with asbestos insulating board. Howie ACADemy Autumn 2001 p11-12373 f/ml personal sampler. 15 minutes dry brushing and bagging of AIB dust and debris after breaking of single 8ft x4 ft AIB panel.
although perhaps the teachers’ exposures were probably lower than this, they would still have been considerable.

The exposures of the workmen were very high, the exposure of the teachers who swept up would have been high, and as the work continued in the school there was considerable contamination. The asbestos fibre levels would have been significant and therefore so would the exposures of the occupants including the pupils.

IOM, were employed by the council to carry out a risk assessment and stated: “These risks predictions for this incident at Silverhill school are very low and none of them, not even the predictions for workers who removed the windows, exceeded the level that is considered to represent a minimal or negligible risk.”

“Pupils, staff and cleaners. We believe that no further action should be taken in respect of this incident to monitor the health of those exposed. In particular, we do not recommend that any record be kept of this incident on people’s health or personnel records of children or school staff.”

All of the predicted risks are so low that we do not believe that there is any realistic possibility that anyone will eventually die from an asbestos-related cancer as a result of this incident.”

IOM’s estimates of exposure levels, report, conclusions and recommendations were criticised by HSE, asbestos consultants and by other risk experts. HSE assessed the fibre release and risks to be significantly higher than IOM had, in the case of the teachers 130 times higher. The recommendation that the incident should not be recorded in medical health records is contrary to expert medical guidance, but because of the recommendation it is known that a number of people have not entered the incident in their records. IOM concluded that no one would die from the incident, however the HSE Senior Medical Officer for the Midlands, Wales and the South West disagreed and stated that:

"Whilst the estimated fibre concentrations and risk levels are reassuring for the exposed population as a whole, stochastic risks are not evenly spread across an exposed group. Thus, an estimated (average) risk of, say, one in a thousand or one in ten thousand does not tell you how many of those who were exposed at the school will actually develop a mesothelioma in later life. It could be none, one, five or any number you care to think of, simply because the risk is not evenly spread.

This means that you cannot reassure any individual that they will not get a mesothelioma."

There was considerable contamination of the school and exposure of the occupants. Although £750,000 was spent on an environmental clean the remaining asbestos in the schools was not removed and asbestos debris was even left in the walls and sealed in place with duct tape. This is a

340 Statement of witness HSE Senior Medical Inspector for the Midlands, Wales and the South West Dr A Scott 11 Mar 2005
system built school and more than 200 columns containing AIB required sealing. It is not unreasonable to assume that amosite fibres had been released from the columns during the previous thirty years.

IOM assessed the risk from this incident in isolation but it is probable that the occupants had been exposed before this incident as the system of asbestos management was non-existent. The headteacher admitted at his trial that “I knew you shouldn’t take chunks of it and bite it, but I had no knowledge of asbestos, its capabilities or where it is found. It was a complete foreign language to me.”

Regrettably this school is not unique and many other schools have had asbestos incidents where high levels of asbestos fibres have been released. But these peak releases are often in addition to a raised background levels and then periodic, and sometimes frequent, releases from displaying children’s work with drawing pins, slamming doors or just taking books out of a cupboard. All the exposures are cumulative. All increase the likelihood of mesothelioma developing.

The Asbestos in Schools Group
31st October 2011

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341 Silverhill Primary School Derby Sealing plan 21 Jun 2007
342 Court report Bolitho 25 Nov 2006