Health and Safety Commission Paper			HSC/06/55
Meeting Date:	4 July 2006	**Open Gov. Status:**	Open
Type of Paper:	Above the line	**Paper File Ref:**	
Exemptions:	None		

HEALTH AND SAFETY COMMISSION

A comparison of the risks from different materials containing asbestos

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Issue

1. To provide further background information for the Commission to reach agreement on the risks from work with textured decorative coatings containing abestos (TCs); and to agree that a limit for sporadic and low intensity exposure should be included in the Regulations rather than the ACoP (in accordance with legal advice).

Timing

2. For discussion at 4 July meeting. Draft Regulations for decision will be put before the Commission at its meeting on 25 July.

Recommendation

3. That the Commission:

a) notes the further work done to compare the risks arising from work with different types of asbestos containing materials (ACMs) with one another and with other non-asbestos related risks (the results are summarised in Annex 1); and

b) agrees to the inclusion of a regulation providing for the approval (by the Commission) of a "peak exposure" level of fibres in the air which, if exceeded, could not be considered to give rise to "sporadic and low intensity exposure".

Background

4. The development of the evidence supporting the proposal to remove TCs from the licensing regime has followed the stages as summarised below:

a) the Consultative Document (CD) issued last year included proposals for TCs to be removed from the licensing regime. This was on the basis of research carried out by the Health and Safety Laboratory (HSL) which showed that that the upper end of exposures that could arise for employees engaged in the removal of TCs was 0.08 fibres/cm^3 (f/cm^3) when it is carried out in compliance with the proposed new Regulations. This figure is below the proposed control limit of 0.1 f/cm^3;

b) HSL's research was peer reviewed in February by the independent Working Group on Action to Control Chemicals (WATCH). This concluded that the results of the research were reliable in the context in which the research was carried out;

c) In response to early comments about the limits of this research (eg what were the levels of exposure when TCs were removed from a wider range of surfaces; when poor controls or removal techniques were used; what were the exposures beyond the immediate area of removal), HSL carried out further research and found that:

- The fibre concentrations were still less than the control limit when removed from a wider range of surfaces and personal airborne fibre concentrations were increased by less than a quarter when air extraction was switched off;
- It is unlikely that fibre releases would exceed 0.01 f/cm^3 in the immediate area just outside removal enclosures whilst TCs are being removed;
- When appropriate controls were not used (not in compliance with the Regulations) and TCs were dry scraped with no air extraction, short terms peaks of up to 0.2 f/cm^3 could be produced. However, it was unlikely that the proposed control limit would be exceeded.

5. At its meeting on 9 May 2006, the Commission discussed a paper (HSC/06/49), which sought a steer on the way forward for the proposed Asbestos Regulations following consultation. This included a summary of the results from the later research (above). Following discussion, the Commission agreed that:

a) there should be a risk-based approach to the licensing of asbestos, with licensing reserved for high risk products and processes;

b) HSE should produce a paper on a wider range of issues around asbestos licensing and relative areas of risk to inform the Commission's final decision on TCs.

Argument

6. HSL has now produced a paper that addresses the Commission's request. A summary of the results is included at Annex 1; the Commission is asked to note this. The conclusion from HSL's paper is clear and confirms our belief that the inclusion of work with TCs within a licensing regime is not justified. The full paper is at Annex 2.

Inclusion of sporadic and low intensity exposure level in draft Regulations – not ACoP

7. At the 9 May meeting, the Commission agreed that including in the Approved Code of Practice (ACoP) a peak exposure level of 0.6 fibres per cm^3 in the air measured over a ten minute period would provide a useful determinant of when exposure might be considered to be sporadic and of low intensity. We have discussed this further with Solicitors and their advice is that this should be included in the Regulations – not the ACoP. Its inclusion in the Regulations would also provide greater certainty to dutyholders.

8. It might also allay concerns that have been raised by some trade associations on whether the derogation on sporadic and low intensity exposure in AWPD has been fully transposed into the draft regulations. They have raised the possibility of legal challenge on whether we have fully implemented AWPD in this respect. The concerns are that the use of a simpler provision in regulation 3(2) omitting certain words in Article 3(3), widens the application of the derogation beyond the intent of the Directive (paragraphs 30-32 of the CD addressed the point; for convenience Annex 3 highlights the omitted words). These concerns are given some extra significance because of the link made in the Regulations between this derogation and the requirement to be licensed (although licensing is not a requirement of AWPD so we are free to specify when licensing is required).

9. The purpose of Article 3(3) is to provide for circumstances where the risk of release of asbestos fibres is considered low enough to justify exempting dutyholders from the more onerous requirements, for example, notification, medicals and record keeping. These latter requirements are essentially additional administrative measures necessary where the risk of exposure to asbestos fibres is high and which are over and above the normal controls necessary to prevent exposure when dutyholders carry out work. Notification, for example, allows HSE to concentrate its enforcement action on such work.

10. We consider that including the omitted words would cause confusion and legal uncertainty about when the derogation applied. It would divert attention to a debate about the nature or state of the materials (whether or not they are friable, deteriorated or degraded within the meaning of the Directive), rather than the important criteria – the extent of risk of release of fibres in relation to the condition of the materials. We therefore continue to consider that the omission of the words in regulation 3(2) is justified and legal advice, based on the above arguments, is that this approach would be consistent with a purposive interpretation of the meaning of Article 3(3). However, the inclusion of a peak exposure level in the Regulations would provide further clarity and legal certainty.

11. We therefore seek the Commission's agreement to the inclusion of a peak exposure level in the derogation for sporadic and low intensity exposure in the Regulations. This could be done by including the level of 0.6 fibres per cm^3 in the air measured over a ten-minute period directly into regulation 3(2). However, we recommend, instead, that a power for the Commission to approve such a level is included in the regulation. Initially, we would envisage the Commission approving the level of 0.6 fibres per cm^3. But a power to approve would allow changes to be made more quickly should the Commission want to approve a different level at some point in the future.

Consultation/Presentation/Costs and Benefits

12. These were addressed in HSC/06/49.

Financial/Resource Implications for HSE

13. The licensing regime is designed to recover costs, so the removal of TCs from the regime will be cost neutral. Overall, we believe that the costs in the development and completion of this package of measures will be £730K. This includes the costs incurred by HSL in carrying out the further research on textured coatings.

Other Implications

14. The proposed Regulations implement Directive 2003/18/EC which amends AWPD.

Action / Next Steps

15. The Commission is asked to make a decision on the recommendation set out in paragraph 3 above.

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RISK FROM ASBESTOS PRODUCTS

Introduction

1. This annex summarises the results of the further work that HSL has carried out in response to the Commission's request at its meeting on 9 May 2006 for a paper addressing a wider range of issues around asbestos licensing and relative areas of risk. The full HSL paper is at Annex 2.

2. This builds on the risk assessment in CD205 and work carried out to look at the level of fibre emissions which arise during the removal of textured coatings (TCs). Annex B to HSC/06/49 (which was discussed at the 9 May HSC meeting) provides further details. This work demonstrated that the levels of asbestos fibres released during work with textured coatings were substantially lower than that for work with other licensed materials such as asbestos insulation board. Figure 1 of Annex B to HSC/06/49 shows this as a bar chart and **Figure 1** below further restricts the height of that bar chart to enable the current and proposed control limits to be shown. In order to do so, the full height of the bars for sprays and lagging and for working with AIB in a dry state cannot be shown.

3. HSL has now looked at the level of risks related to work with different types of asbestos products and compared them:

a) one with another – **Figure 2**; and

b) with the risks found in certain sectors and with general workplace risks – **Figure 3**

4. The risk assessment was carried out using two assumptions

- Mainly dry removal with only limited controls in place (eg no sanding or use of power tools).
- Controlled removal (mainly wet and with other controls in place).

In both the above, no account is taken of respiratory protective equipment (RPE).

5. These comparisons show that:

a) unlike other licensed materials where the annual risk of death (mainly dry removal) are calculated to be in hundreds/million (AIB) or thousands/million (spray and other insulation), the risk of death from TCs is calculated to be less than one in a million;

b) the risks from TCs are comparable to those from work with other unlicensed asbestos products such as asbestos cement and flooring;

c) the risks from work with TCs is orders of magnitude lower than for activities such as work in construction and agriculture.

Conclusion

6. At the last meeting HSC agreed that there should be a risk-based approach to the licensing of asbestos, with licensing reserved for high risk products and processes. Figure 1 demonstrates that both dry and wet removal of sprays and lagging and AIB will result in fibre levels considerably above the control limit and this justifies the need for licensing. Both dry and wet removal of TCs will be below the control limit and licensing is unnecessary. Both figures 2 and 3 demonstrate that continuing to require licensing for work with TCs would not meet with HSC's agreed approach.

Figure 1

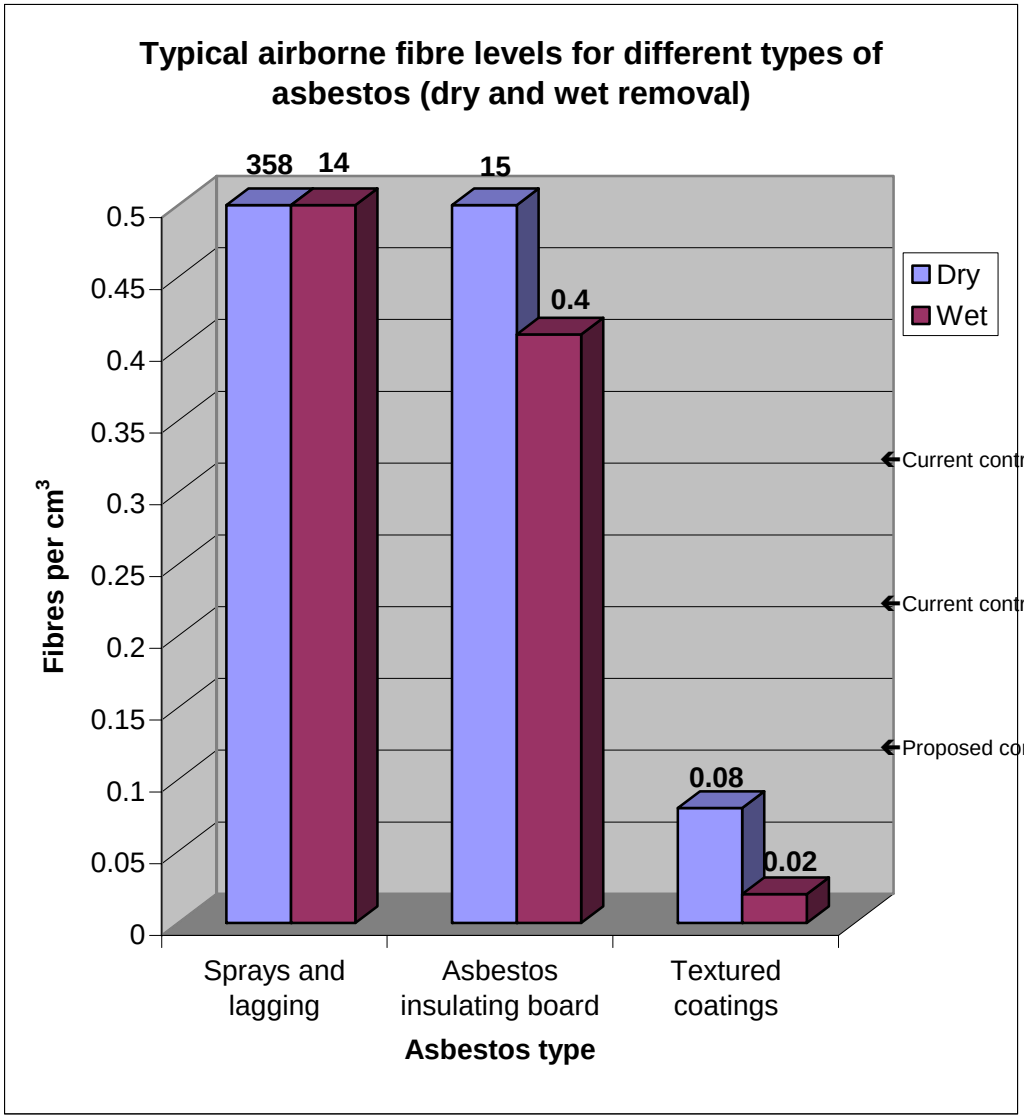


Figure 1 above is based on Figure 1 from Annex B to HSC/06/49 which the HSC considered at its meeting on 9 May 2006. It demonstrates potential releases of fibres for well controlled removal (wet) and poorly controlled removal (dry) of different types of licensed asbestos materials. No account is taken of RPE.

For sprays and lagging, the average fibre levels during poorly controlled dry removal are about 360 fibres per cm^3 and for asbestos insulating board (AIB) are about 15 fibres per cm^3 (some 3600 and 150 times the proposed control limit respectively). Even with controlled (wet) removal, when HSL scientists were on site to monitor, there is significant potential release of fibres of around 40 times the proposed control limit for sprays and lagging and 4 times the proposed control limit for AIB.

In contrast, poorly controlled (dry) removal of TCs produces potential fibre levels around 0.08 fibres per cm^3, which is below the new proposed control limit and well controlled wet removal will reduce this to about 0.02 fibres per cm^3 or around one fifth of the proposed control limit.

Figure 2

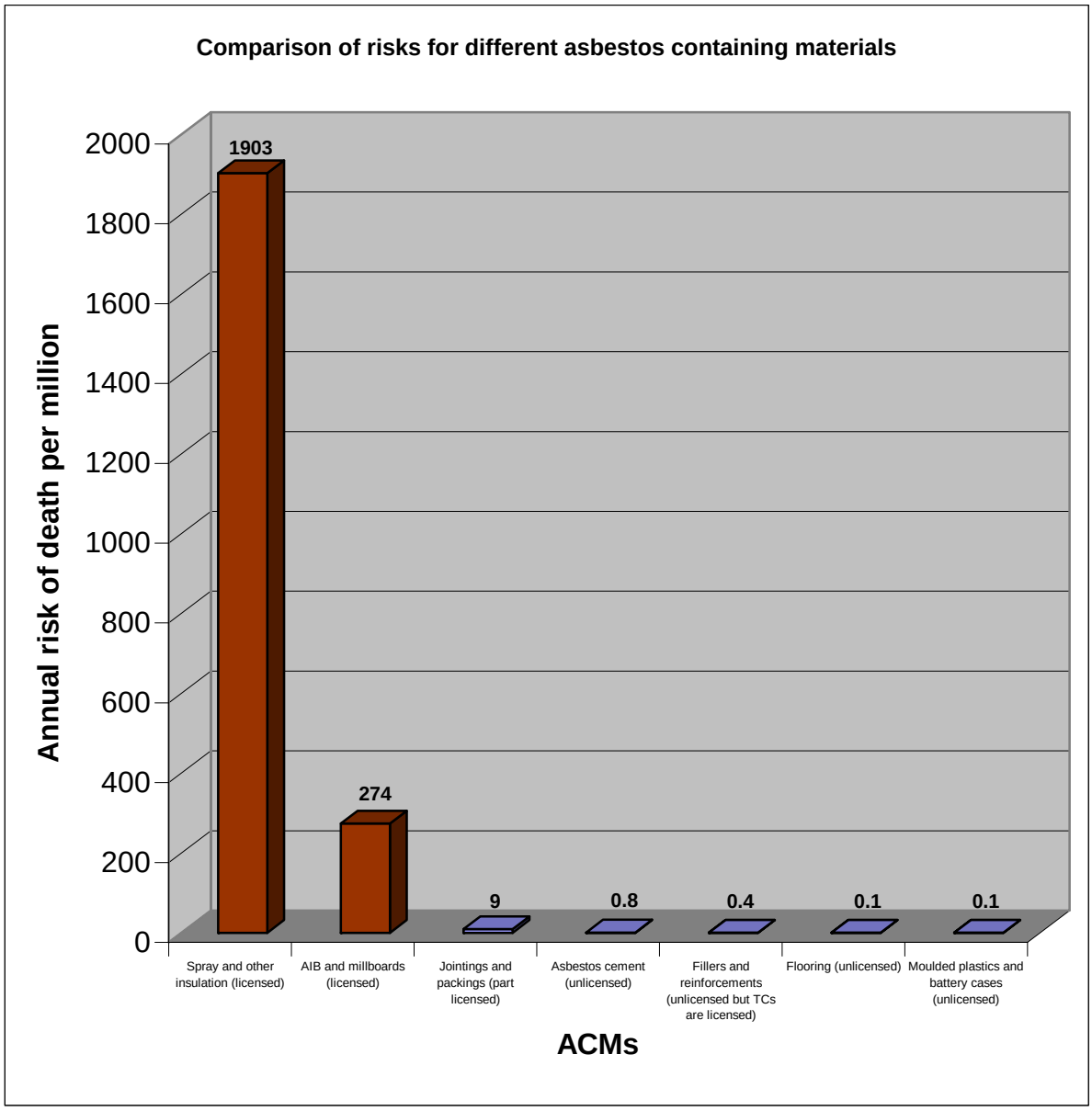


Figure 2 above is based on Figure 7 from HSL's paper dealing with the risks from asbestos products (see Annex 2). It is based on an assumption of workers spending 10% of their time working with particular products for 40 years from age 20. By way of comparison, it has been estimated that licensed removal workers currently spend about 15% to 20% of their time on active removal of asbestos. No account is taken of respiratory protective equipment.

It demonstrates that the risks from work with sprays and other insulation are nearly 20,000 times the risk from TCs and the risks from AIB are nearly 2700 times the risks from TCs. The risks from TCs are comparable to the risks from other unlicensed asbestos materials.

Figure 3

Figure 3 above is based on Figure 9 from HSL's paper dealing with the risks from asbestos products (see Annex 2). It compares the risks from work with various asbestos products (dry and wet) to work in certain sectors and general workplace risks to put the risks from work with asbestos in context.

The figure clearly demonstrates that the risk from work with sprays and other insulation and AIB is greater than other activities such as work in agriculture and construction. It is also clear that the proportion of risk from work with TCs is much lower than from such activities.

Comparison of Article 3(3) of Directive 2003/18/EC and regulation 3(2) of proposed Control of Asbestos Regulations highlighting words omitted* from Directive that are the subject of concerns about under-implementation

Article 3(3)

Provided that worker exposure is sporadic and of low intensity, and when it is clear from the results of the risk assessmentreferred to in paragraph 2 that the exposure limit for asbestos will not be exceeded in the air of the working area, Article 4, 15 and 16 may be waived where work involves:

a) short, non-continuous maintenance activities *in which only non-friable materials are handled*;

b) removal *without deterioration of non-degraded* materials in which asbestos fibres are firmly linked in a matrix;

c) encapsulation or sealing of asbestos-containing materials which are in good condition;

d) air monitoring and control, and the collection of samples to ascertain whether a specific material contains asbestos.

Regulation 3(2)

Regulations …….shall not apply where -

a) the exposure of asbestos fibres is sporadic and of low intensity;

b) it is clear from the risk assessment that the exposure of any employee to asbestos will not exceed the control limit;

c) the work involves-

   (i) short non-continuous maintenance activities,

   (ii) removal of materials in which the asbestos fibres are firmly linked in a matrix,

   (iii) encapsulation or sealing of asbestos-containing materials which are in good condition, or

   (iv) air monitoring and control, and the collection of samples to ascertain whether a specific material contains asbestos

* words in Article 3(3) omitted from regulation 3(2) highlighted in underlined italics

Risk from asbestos products

1 Introduction

The HSC has asked for a further assessment of risk based on a wider range of asbestos product types to help inform its deliberations on which products fall within the scope of the asbestos licensing regime. As it has been estimated that there are between two to three thousand asbestos products, it is necessary to arrange the data into a smaller number of product groups. In the first instance, to give an overview of the risk by asbestos type, this has been done by assuming a single group of all asbestos containing materials (ACMs). A more detailed analysis has then been undertaken based on product groups with the assumption that no asbestos licensing regulations existed and only limited compliance with the current control of asbestos at work regulations (CAWR, 2002) took place (e.g. dry removal and poor controls with no use of respiratory protective equipment (RPE)).

2 Overview

There are three main types of asbestos used in commercial products, these are:

- Chrysotile (white) asbestos,
- Amosite (Brown) asbestos and
- Crocidolite (Blue) asbestos

The epidemiological evidence from asbestos workers and well-conducted animal tests shows that while all types of asbestos share the same hazards (e.g. the potential of an early death from lung cancer, asbestosis and mesothelioma) they have varying degrees of risk (the likelihood that death from one of the hazards will occur). The relative risk from the same level of exposure but to different asbestos fibre types is shown in figure 1(as derived by Hodgson and Darnton, 2000). The relative risk from crocidolite asbestos is some 500 times greater than chrysotile asbestos and the relative risk from amosite asbestos is 100 times greater than chrysotile asbestos. This means that the type/s of asbestos in the product are particularly significant when assessing risk.

If the estimated usage of asbestos in GB from the published RIA (CD 205, see figure 2) is combined with the risk factors for each asbestos type in figure 1, it is possible to obtain an assessment of the relative risk for each asbestos type installed (figure 3). The values in figure 3 have been normalised to the asbestos type with the lowest overall calculated risk (i.e. chrysotile = 1). Therefore it can be seen that amosite represents a risk some 18.5 times greater than chrysotile and crocidolite represents some 9.3 times the risk of chrysotile.

Although this is an initial estimate and does not take any account of whether the materials are present in a product type that will be worked on, or the magnitude of the concentration of airborne fibres that would be released, it clearly shows that amosite and crocidolite asbestos need more consideration than chrysotile, if a risk based approach to licensing is to be followed.

Fig 1: Risk factor by fibre type

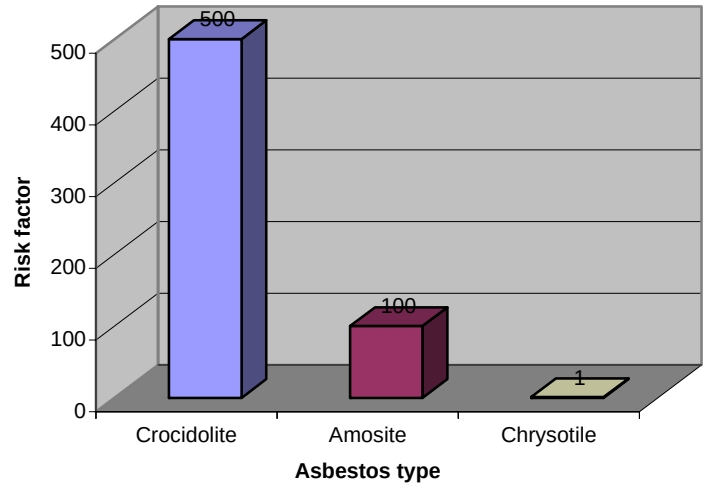


Fig 2: Amount of asbestos installed

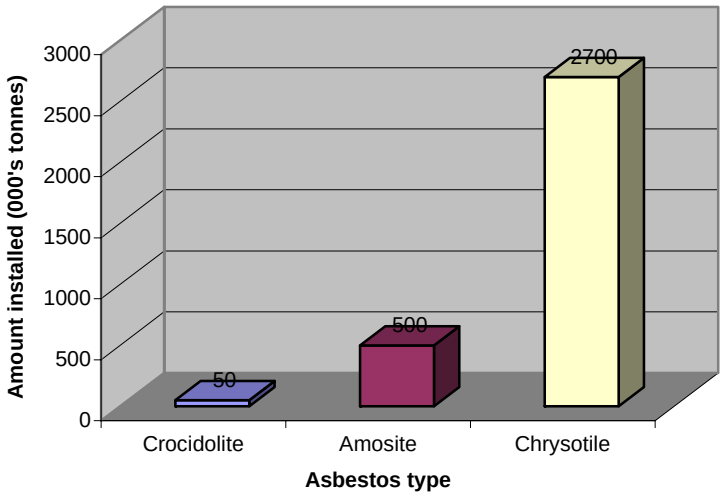
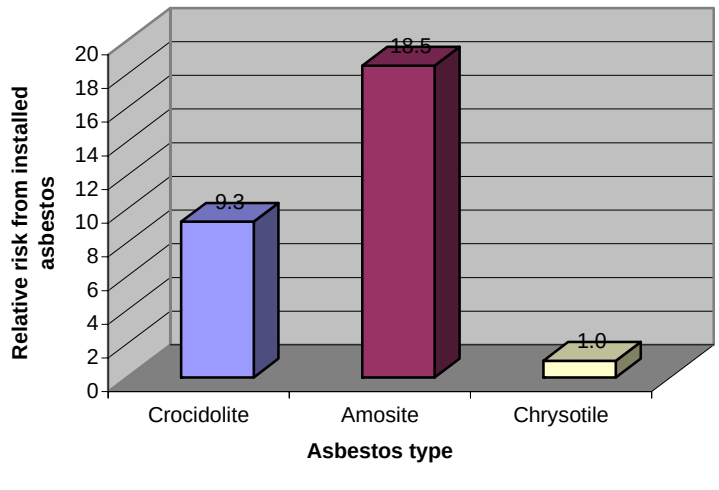


Fig 3: Relative risk from asbestos intalled



3 Estimation of exposure and risk by product group.

The exposure from each product group was assessed by determining:

- The overall usage of each product group;
- The types asbestos in the product;
- The airborne fibre concentration produced when the product is disturbed / removed with good control and with limited controls.
- The exposure has been taken to be the same as the airborne concentration and therefore assumes no use of RPE.

3.1 Selection of product groups

Evidence on asbestos usage submitted to the Advisory Committee on Asbestos in the 1970s (Simpson, 1977) has been used as the initial basis for determining the product groups. The product groups listed in table 1 have the advantage that both amount and type of asbestos usage is known. Jointings and packing include: various sealing materials such as raw asbestos, asbestos gaskets, sheets, strings and ropes, and resin products containing asbestos paper. Fillers and reinforcements includes: textured coatings (TC), paints, mastics asbestos paper and millboard. Asbestos paper was widely embedded in bitumen for use as roofing felt and damp proof products and in some flooring products.

Both in the current (CAWR,2002) and in the proposed asbestos regulations (CD205), no product groups are defined, but the ACOP refers to three groups of licensed materials and four groups of non-licensed materials. The licensed materials are:

A. Asbestos insulation used for thermal, acoustic or other insulation purposes including fire protection;
B. asbestos insulating board (including wallboards and millboards);
C. asbestos surface coatings, which contain asbestos for fire protection or as both heat and sound insulation.

The groups of asbestos products specifically excluded from licensing are:

D. Asbestos cement;
E. asbestos containing textured coating (paints and plasters used to produce visual effects);
F. any article of bitumen, plastic, resin or rubber where its thermal or acoustic properties are incidental to its main purpose (e.g. vinyl floor tiles, electric cables roofing felt);
G. asbestos materials such as paper linings, cardboards, felt, textiles, gaskets, washers and rope where the products have no insulation purposes

Table 1: Summary of asbestos product groups and type and amount of UK asbestos usage in 1973

Product group (ACoP group)	Asbestos type used (000's of tonnes)		
	All	Chrysotile	Amosite
1. Asbestos cement for buildings (D)	55.6	55.6	0
2. Fillers and reinforcements incl. TC (E,G)	25.7	25.3	0.4
3. Asbestos insulating board -AIB (B)	22.5	3.8	18.7
4. Friction materials (F)	18.5	18.5	0
5. Flooring (F)	16.2	16.2	0

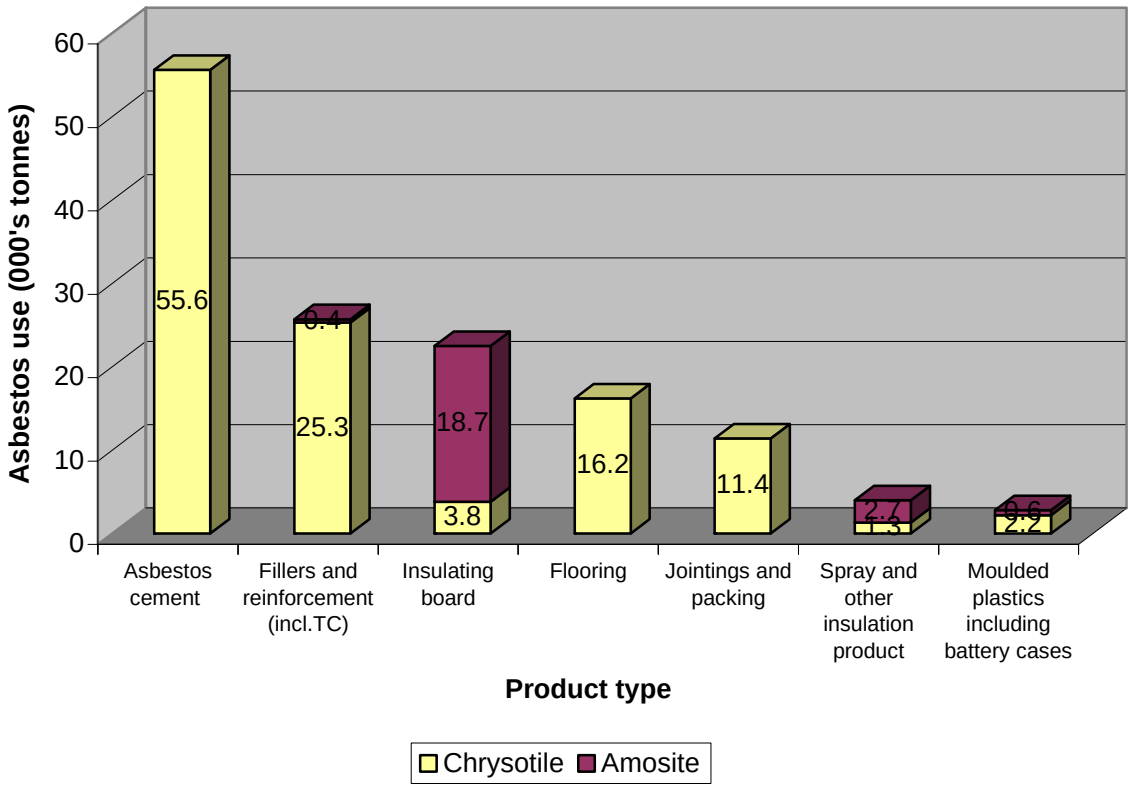
6. Jointings and packing (G)	11.4	11.4	0
7. Asbestos cement pressure pipes	9.0	7.8	1.2
8. Textile products (other than J &P's) (G)	8.3	6.0	2.3
9. Spray and other insulation product (A,C)	4	1.3	2.7
10. Moulded plastics & battery cases (F)	2.8	2.2	0.6

The approximate relationship between the two groups is given in table 1 but as two of the product groups are unlikely to be encountered (i.e. 4 & 7) and textiles can be grouped with jointing and packings, it is possible to combine the two systems, into 7 similar product groups, with textured coating (TC) forming part of the fillers and reinforcement group and millboards considered with AIBs.

3.2 The overall usage of each product group

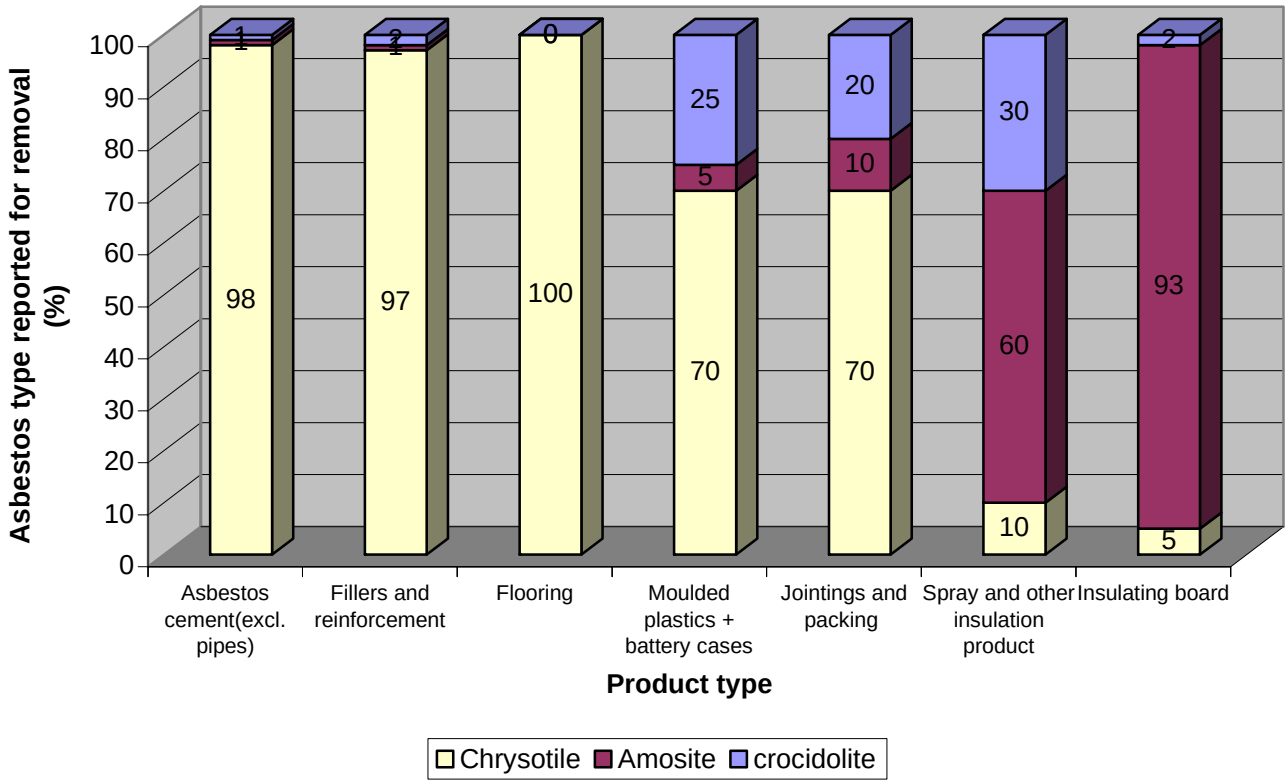
Table 1 and figure 4 summarises the main asbestos product groups and gives the estimate amount (in tonnes) of asbestos used during the peak of asbestos usage in products (1973). As different products have been introduced at different time and the rate of importation also varied with time, the distribution during the 1970's is unlikely to be fully representative of the products remaining in buildings etc. However, the distribution of products manufactured and installed in 1973 may not be far from the actual situation remaining. For example, a greater amount of thermal insulation spray and lagging was installed in the 50 and 60's but a significant proportion of this would already have been removed as the plant aged. Also as the buildings in which the asbestos was installed in the 1970's are due for major refurbishment or demolition over the next decade, and this mix of products is likely to become more representative of the products being removed. The type of asbestos in the remaining products (see Table 1 and figure 4) also give the relative use of amosite and chrysotile in 1973.

Fig 4. Product groups and asbestos usage in 1973



Usage of crocidolite effectively ended by 1970 and had been imported and used in much smaller quantities than chrysotile and amosite asbestos. Its main use was for textiles, sprayed and other insulation products, battery cases and asbestos cement pressure pipes but may also occasionally be found in board materials. Amosite was used widely for thermal insulation blocks, lagging, asbestos insulating boards and asbestos cement pressure pipes and its use effectively ended by 1980. Chrysotile was widely used in most products and although its use declined rapidly from 1980 its used continued until late 1999.

Fig 5: Estimated mix of asbestos types in main product groups



Taking into account previous usage the percentages of the different types of asbestos in the seven main groups has been estimated in figure 5. The groups containing licensed products have been arranged at the end of the graph. Non-licensed moulded plastics were estimated to contain a relatively high amount of crocidolite because of its acid resistance and hence its widespread use in lead-acid battery cases. To an extent the higher temperature and chemical resistance offered by crocidolite and amosite products, lead to a wider use of these types for jointings and packing. Although many of these may have been replaced, so it is probable a conservative estimate of what remains has been made.

3.3 Exposure during removal

The exposure from disturbing an asbestos product depends on a number of product, disturbance and environmental variables, such as the:

- Type of matrix in which the asbestos is present;
- amount of asbestos and whether the asbestos is evenly dispersed throughout the matrix or is present as a layer on the surface;
- type, rate, amount and area of disturbance inflicted on the asbestos containing material;
- frequency which disturbance or work on the asbestos material is carried out;
- controls applied to reduce airborne emissions;
- local conditions and the use of personal protective equipment.

Clearly, the number of variables will mean that for each product, a range of exposures to airborne asbestos fibres will occur. Whilst accepting that there are many potential biases in any sampling data, analysing the available personal sampling data, to estimate the mean exposure during the work, offers the most realistic chance of assessing the risk that workers would be subject to.

Table 2 summarises the estimated mean airborne asbestos fibre by product type for both controlled (e.g. wet) removal and results from removal using more limited controls (e.g. dry removal). The data available for non-licensed products is much more limited than for some licensed products.

Table 2: Assessment of average personal airborne concentration of regulatory asbestos fibres during removal of ACMs.

Product group	Controlled wet removal / good practice (f/ml)	Limited controls / dry removal (f/ml)
Asbestos cement	0.02	0.08
Fillers and reinforcements in a flexible matrix (incl. TCs)	0.02	0.08
AIB (incl millboards)	0.41	15
Flooring	0.01	0.05
Jointings and packing	0.05	0.2
Spray and other insulation products	14.4	358
Moulded plastics & battery cases	0.001	0.01

3.4 Calculation of risk

To calculate risk several essential pieces of information are required:

1. the type/s of ACMs being disturbed or removed;
2. the type/s of asbestos in the product / product group;
3. airborne fibre concentration (exposure) for the particular work practice;
4. the duration which the asbestos is being actively disturbed / removed
5. the frequency of the work;
6. the starting age and the number of years spent doing the work.

The data collected above for each product group were used to calculate the lifetime risk to persons using the Hodgson and Darnton risk estimates. These calculations were based on 10% of time being spent actively removing ACMs from the age 20 for 40 years, based on limited controls being applied and no use of RPE. This is therefore an assessment of the risk, as if no asbestos licensing regulations existed and only very limited compliance with the existing CAWR (2002) took place. The 10% of active removal time, has been used, as (≥10%)this has been used in previous RIAs as a definition of regularly exposed asbestos workers. (Note: about one third of asbestos removal workers are estimated to be on site each working day. Active asbestos removal is estimated to be between half to two thirds of the available time on site. This equates to about 15% to 20% of available time being spent actively removing asbestos).

To calculate risk, the airborne concentrations in the "limited controls" column in table 2 was first adjusted by the relative amounts of ACMs in each product group (see table 1) to calculate the proportional exposure for each product group over the 10% active removal time. The risks from the proportional exposure for each product group was calculated by inputting the proportional exposure into the Hodgson and Darnton model and adjusting by the mix of fibre types in each product group (figure 5).

4 Results

The results for the lifetime risk in figure 6 for 40 years exposure from the age of 20 represent a worst case continuous exposure situation. It can be seen that the highest risk is by far with the spray and other insulation group (risk 11,419 per 100,000) and AIB (risk 1,642 per 100,000). These are the two licensed groups. The next highest group is the jointings and packings, (risk 55 per 100,000) but as the risk is mainly associated with the amount of crocidolite and amosite asbestos products remaining and many gaskets and packings are replaced during routine maintenance and servicing, this is likely to be an overestimate of the remaining risk. Some of the products in this group if present for thermal insulation would be regarded as licensed materials. All the other groups are essentially non-licensed products (textured coating –i.e. some fillers and reinforcements are currently licensed). It can be seen the non-licensed product groups have a risk of over a thousand times lower than licensed sprays and other insulations group and over a hundred times lower than the licensed AIB and millboard groups.

The same exposure situation was used to calculate the annual risk of death based on an average survival age of 80 (see figure 7). The annual risk of death for the two licensed groups comes out at 1903 and 273.5 per million, the non-licensed groups are all below 1 per million.

Figure 6: Lifetime risk per 100,000 based on 10% of time spent actively removing ACMs from age 20 for 40 years with limited controls: no RPE.

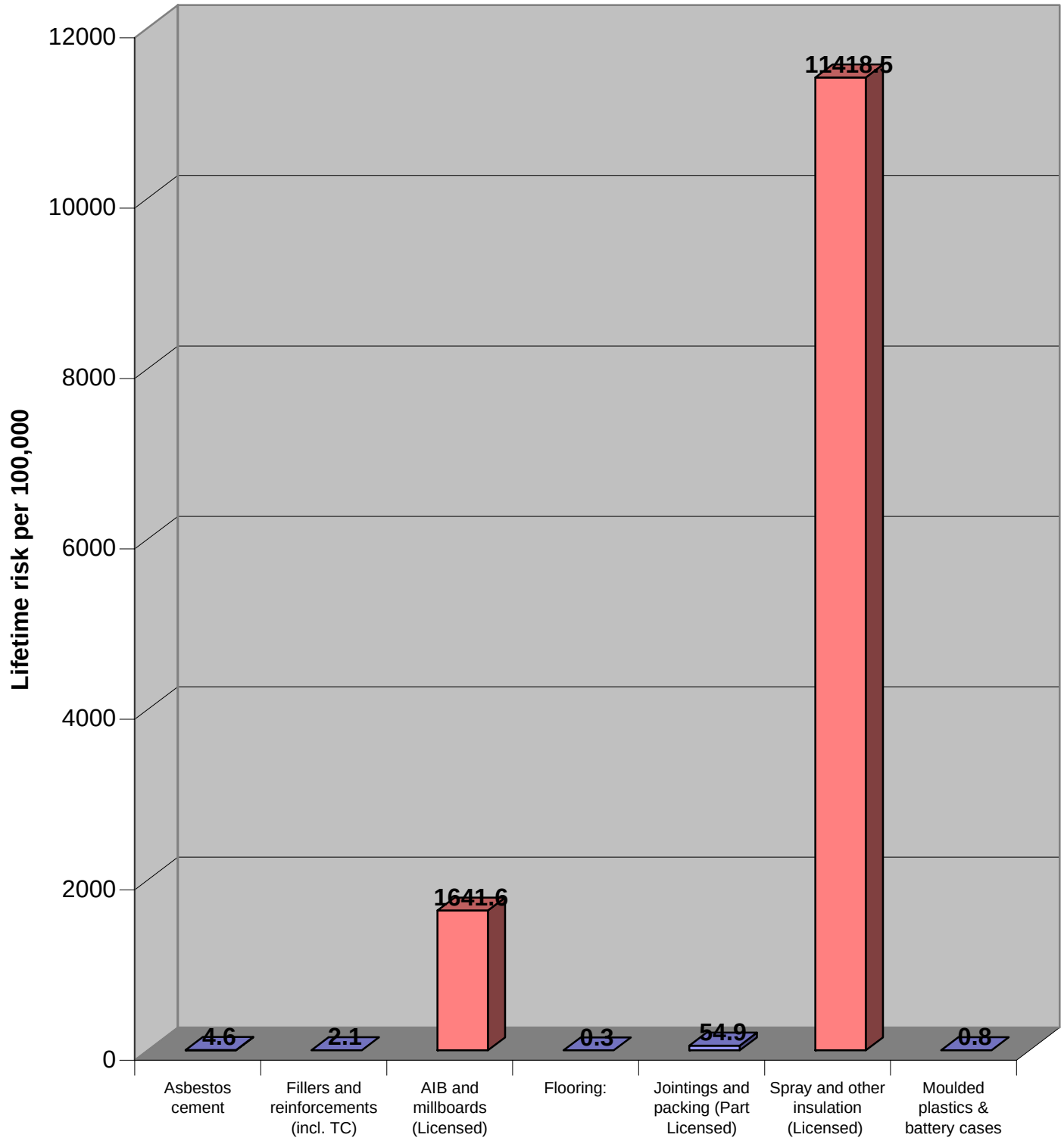
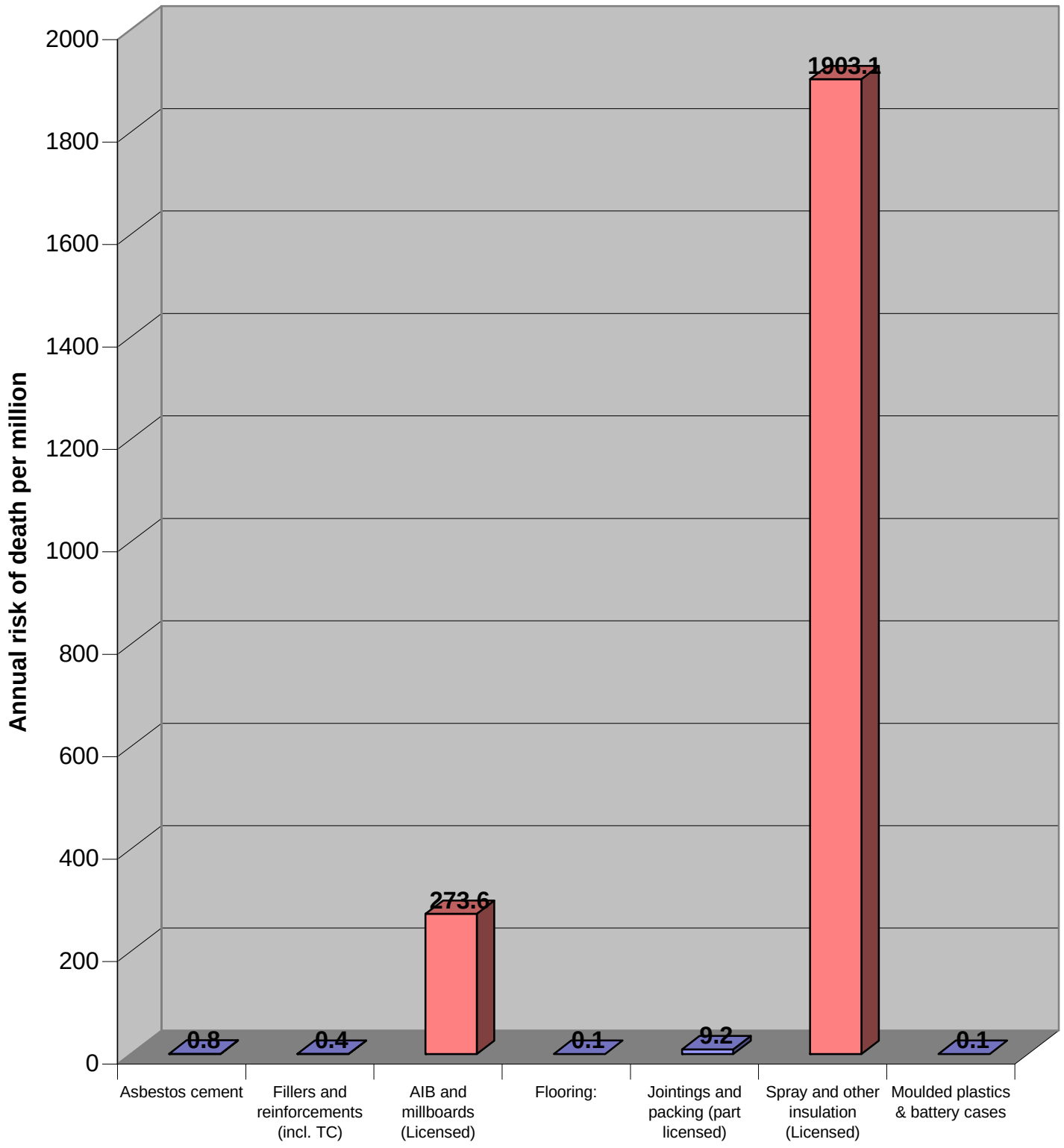


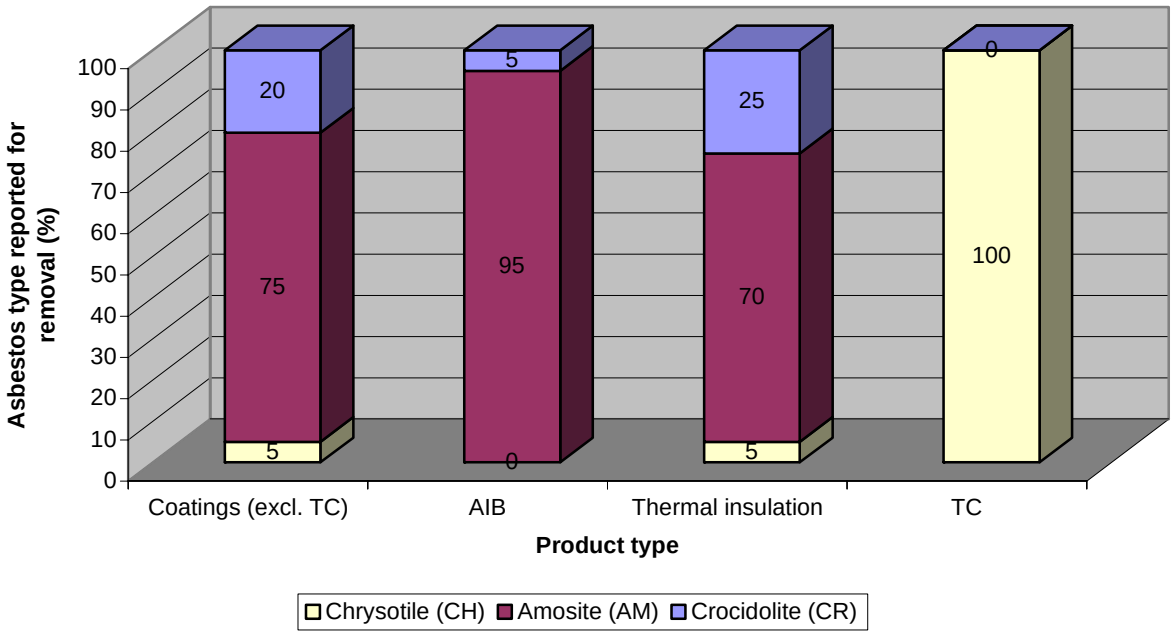
Figure 7: Annual risk of death per million based on 10% of time actively removing ACMs from age 20 for 40 years with limited controls: no RPE



5 Discussion

The overview analysis based on asbestos imports (see figure 3) found that despite the vast majority of the imports being chrysotile the main risk resides with the amosite (x18.5 higher than chrysotile) and the crocidolite (x 9.3 higher than

Fig 8. Reported types of asbestos being removed by in a sample of licensed asbestos removal contractors plans of work in 2004



chrysotile). Given the importance of asbestos type it is worth looking at the mix of asbestos types in the licensed removals of ACMs. Figure 8 summarises the asbestos content of a sample of over 900 licensed removals in 2004, shows that in terms of the asbestos type, textured coatings appear as anomalous in a risk based licensing regime, containing only chrysotile compared to the other licensed material types which in at least 95% of the removals were reported to contain amosite and/or crocidolite.

The more detailed assessment by product group again showed that by far the highest risk resides in the two product groups that contain licensed asbestos materials. The next highest risk group is jointings and packings, which contain some materials that would in some situations be regarded as licensed. The calculated annual risk of death for 40 years of exposure from age 20 are compared to the risk from other workplace fatalities in figure 9 (and HSE statistics 2004) and the lower rates for non-licensed materials are compared to public / societal risks in figure 10 (see R2P2 (2001) and Royal Society, 1981). Again it is important to remember that the estimated asbestos risk to a population of frequently exposed workers has been based on the use of limited controls and no use of RPE with a 40 year duration of exposure and must be regarded as an upper estimate.

Figure 9: Comparisons of asbestos product group annual risk of death per million to other workplace fatalities. (asbestos risk based on 10% of time actively removing ACMs from age 20 for 40 years with limited controls and no RPE)

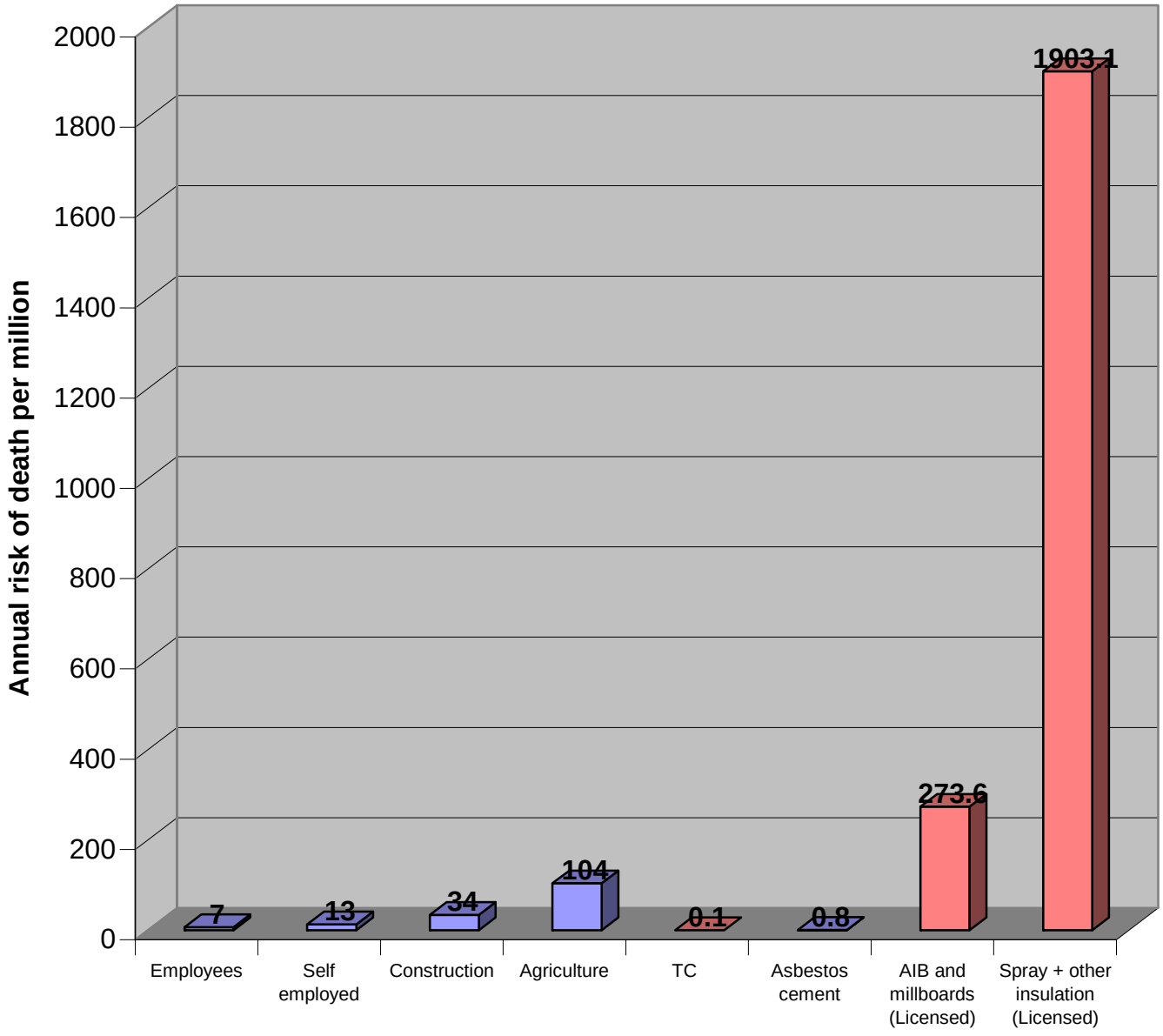
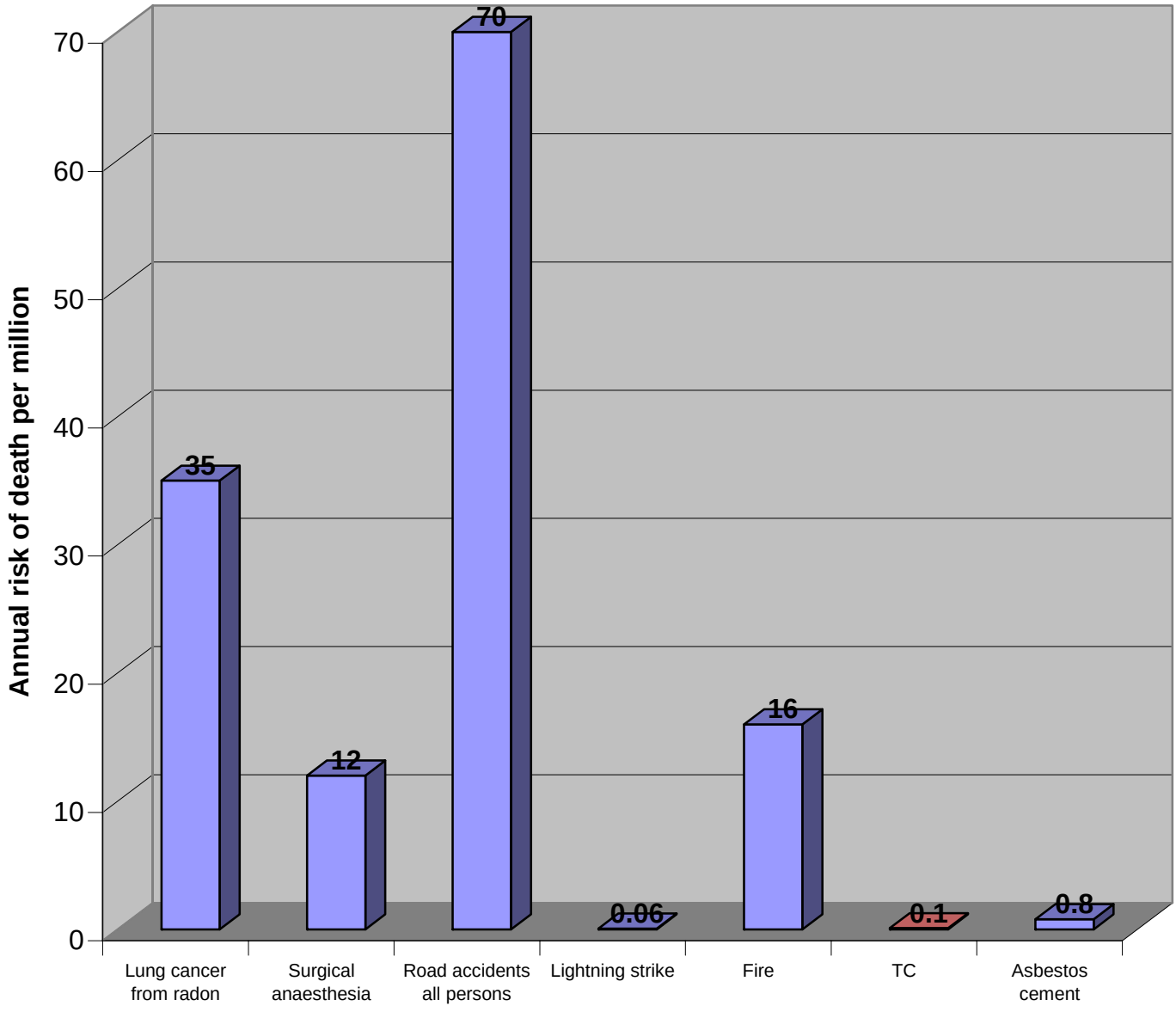


Figure 10: Comparisons of textured coating and asbest cement product group annual risk of death per million to other public risks. (asbestos risk based on 10% of time actively removing ACMs from age 20 for 40 years with limited controls and no RPE)



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