HSE

Health and Safety Executive

Post Implementation Review of the Control of Asbestos Regulations 2012

S.I. 2012/632

Presented to Parliament
by the Secretary of State for Work and Pensions
by Command of Her Majesty

March 2017

Cm 9431

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Post Implementation Review of the Control of Asbestos Regulations 2012 (SI 2012/632)

Introduction

1. This report undertaken by the Health and Safety Executive (HSE) provides an overview of the Post Implementation Review (PIR) of the Control of Asbestos Regulations 2012 (S.I. 2012/632) (CAR 2012) implemented in Great Britain (GB). These regulations revoked and re-enacted the Control of Asbestos Regulations 2006 (CAR 2006) with some minor changes, fully transposing the main elements of Directive 2009/148/EC on the protection of workers from the risks related to exposure to asbestos at work in the same way as CAR 2006.
2. On 23 June, the EU referendum took place and the people of the United Kingdom voted to leave the European Union. Until exit negotiations are concluded, the UK remains a full member of the European Union and all the rights and obligations of EU membership remain in force. During this period the Government will continue to negotiate, implement and apply EU legislation. The outcome of these negotiations will determine what arrangements apply in relation to EU legislation in future once the UK has left the EU. The assumptions used in this post-implementation review have been chosen accordingly.
3. CAR 2012 continues to transpose Directives 90/394/EEC, as codified in Directive 2004/37/EC on the protection of workers from the risks related to exposure to carcinogens at work and Directive 98/24/EC on the protection of the health and safety of workers from the risks related to exposure to chemical agents at work.
4. CAR 2012 is made under the Health and Safety at Work etc Act 1974 and therefore applies only in Great Britain. Northern Ireland and Gibraltar have separate legislation which implements the Directive in those territories. The Maritime and Coastguard Agency is responsible for the extension of the Directive to sea transport.
5. The Regulations are further supported by the Approved Code of Practice (ACOP) *Managing and working with Asbestos* (L143), published by the Health and Safety Executive which sets out in more detail what dutyholders are expected to do in order to comply with the legal requirements. Other printed and online guidance material is also available.
6. This Command paper and PIR Report (found at Annex 1) set out the Government's views on the effectiveness of the regulatory regime now the Directive has been transposed and operational for a period of time. It covers:
    a. the extent to which the regulation is achieving its objectives;
    b. whether those objectives remain valid;
    c. whether the Regulations are still required and remain the best option for achieving those objectives;
    d. if they can be improved to reduce burdens on business and their overall costs and whether there have been any unintended consequences.

Size and nature of the problem

7. Asbestos is a naturally occurring mineral and was used in GB extensively for about 150 years until the late 1990s. It was versatile, plentiful and ideal as a fireproofing and insulation material and, as a result, was used for many different purposes before the health hazards it posed were fully understood. Although the importation, supply and use of asbestos have now been banned (for blue and brown asbestos from 1985; for white asbestos from 1999) and much of the material has been removed, it is still present in a large number of buildings. In 2002, it was estimated that about half a million non-domestic premises still contained some form of asbestos.

8. Following the prohibition on import, supply and use of asbestos and improved working conditions the risks for many workers have been virtually eliminated. A formal ban on the use of all types of asbestos is now in place and extends to all European Member States. However, building maintenance workers and tradespeople remain at significant risk as they may be unknowingly exposed to asbestos-containing materials which remain in place in buildings.

9. All forms of asbestos are category 1 human carcinogens,[1] although blue and brown forms (crocidolite and amosite - amphiboles) are considered to be more hazardous than white asbestos (chrysotile). Inhalation of asbestos fibres can cause a range of lung diseases with the three main fatal diseases being mesothelioma (a cancer of the lining of the lung), lung cancer and asbestosis. Asbestos can also cause cancer of the larynx and ovary, as well as non-malignant respiratory effects including diffuse pleural thickening and pleural plaques. The only effective safeguard is to avoid or minimise exposure to asbestos fibres.

10. Asbestos-related disease continues to be the single greatest cause of occupational death in Great Britain estimated to cause over 5500 deaths per annum. Due to the latent nature of the disease, there is usually a long delay of anything between 15 to 60 years after the initial exposure to asbestos fibres to the onset of asbestos related disease – the average being around 35 years.

11. The Health and Safety Statistics 2014/15[2] confirm that in 2013 the great majority of asbestos-related deaths were as a result of exposure to asbestos during the 1960s and 1970s when it was less well-regulated than today and widely used in industry. The statistics, in summary show that:

    - In 2013, there were 2,538 deaths due to mesothelioma (Figure 1)
    - The latest projections show that there will be ~2,500 deaths per year for the rest of the decade before numbers start to decline (Figure 2)
    - The annual number of lung cancer deaths caused by asbestos is likely to be similar to the number of deaths from mesothelioma. It is unclear the exact number of people who died of lung cancer solely attributable to exposure to asbestos as it is not easily distinguishable from lung cancer attributed to other causes such as smoking. However, it is estimated that there is about one asbestos-related death due to lung cancer for each death from mesothelioma.
    - In 2013, there were 217 deaths with the underlying cause reported as asbestosis.

[1] http://monographs.iarc.fr/ENG/Classification/ - Compounds or physical factors assessed by IARC (International Agency for Research on Cancer) are classified in 4 groups based on existing scientific evidence for carcinogenicity. Group 1: Carcinogenic to humans - Enough evidence to conclude it can cause cancer in humans.

[2] http://www.hse.gov.uk/statistics/overall/hssh1415.pdf

Figure 1: 2014/15 statistics for deaths due to work-related ill health including from asbestos

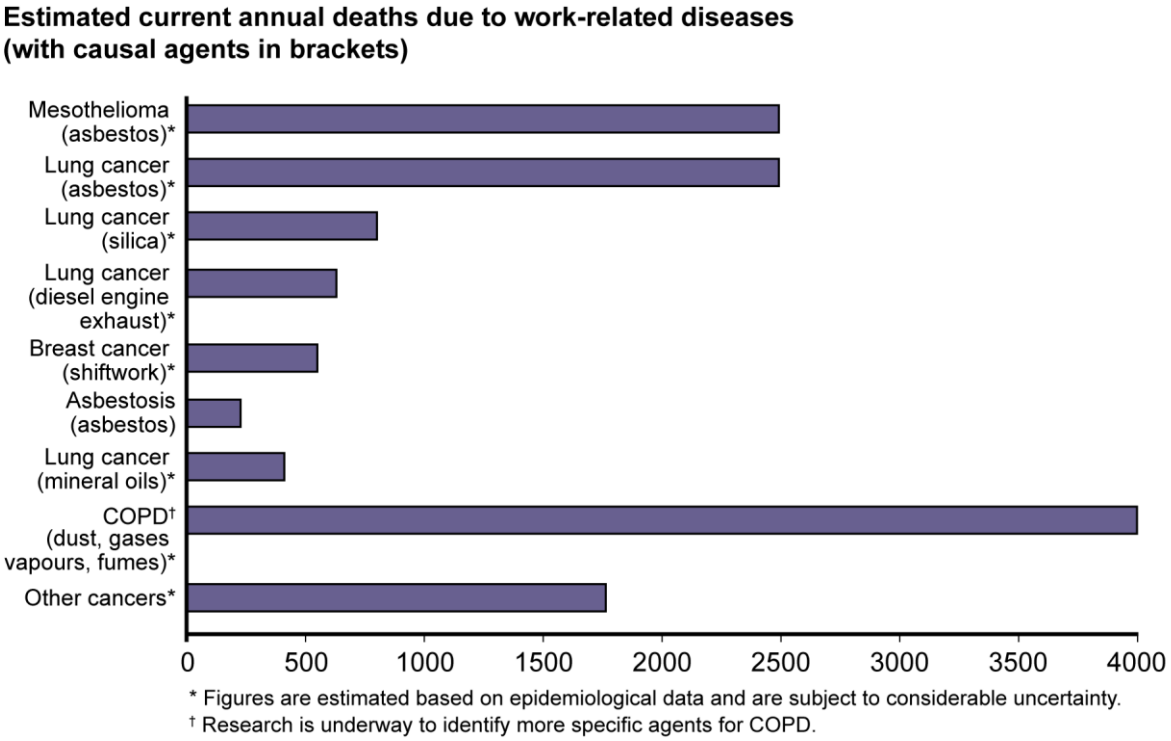
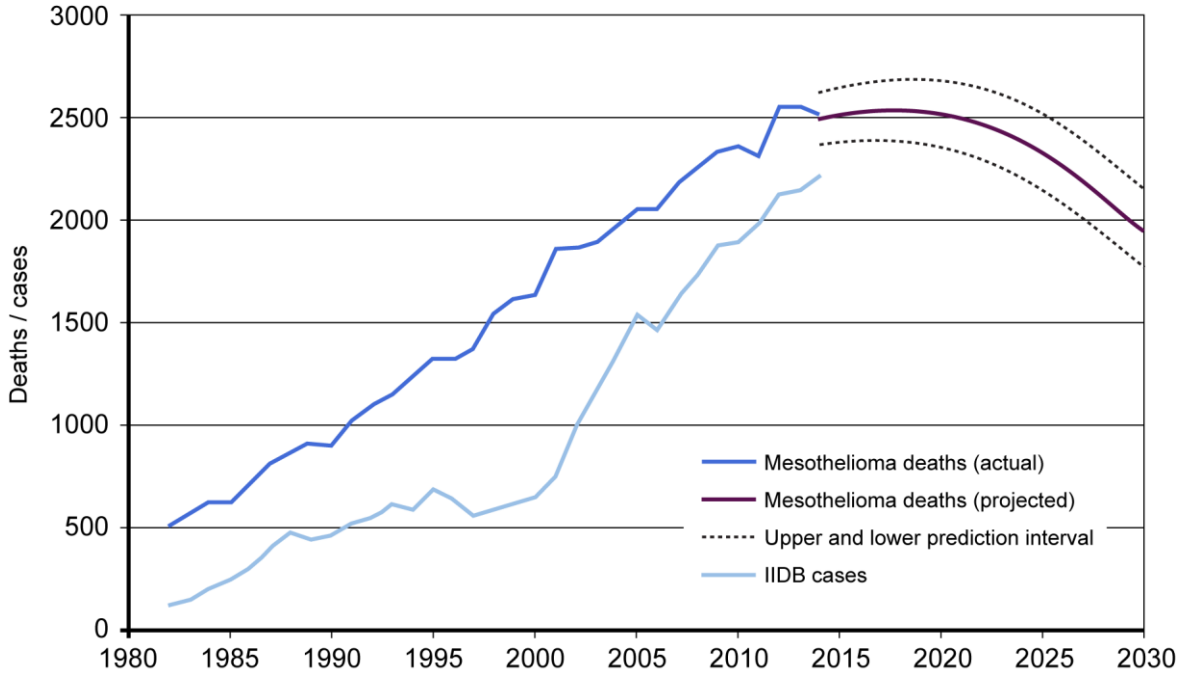


Figure 2: Mesothelioma in Great Britain – annual actual and predicted deaths



12. Studies[3] have confirmed that virtually all of the cases of mesothelioma that have occurred in Britain over the past half century are a consequence of asbestos exposure, either via direct handling of asbestos-containing materials (ACMs), or secondary exposures at work or elsewhere that occurred as a consequence of such handling or the disturbance of ACMs. Mesothelioma is almost always

[3] Gilham C, Rake C, Burdett G, Nicholson AG, Davison L, Franchini A, Carpenter J, Hodgson J, Darnton A, Peto J. Pleural mesothelioma and lung cancer risks in relation to occupational history and asbestos lung burden. Occup Environ Med. 2016 May;73(5):290-9

fatal, and often within twelve months of symptom onset, which means that annual incidence is approximately equal to annual mortality.

13. The close relationship between mesothelioma and asbestos means that of the cancers that can be caused by asbestos, mesothelioma is the easiest to study. Appendix 3 provides a comprehensive report on the historical context and potential impact of regulatory changes on long-term health outcomes. It uses the HSE mesothelioma model to project future annual mesothelioma deaths under a number of scenarios for average annual population exposure from 1980. The report presents comparisons to illustrate the potential scale of health benefits that overall regulatory changes – which encompass a range of specific control requirements – since the 1980s may have had. It does not make any definite claims that specific changes have prevented a given number of deaths.

Background to the Control of Asbestos Regulations 2012

14. CAR 2012 revoked and re-enacted most of CAR 2006 with some updating changes, and are made under the Health and Safety at Work etc Act 1974. These Regulations are required primarily to protect workers and others from the risks of exposure to asbestos by implementing Directive 2009/148/EC, which codified and replaced EU Directives 83/477/EC (the 'Asbestos Worker Protection Directive' (AWPD) on the protection of workers from the risks related to exposure to asbestos at work) and 2003/18/EC (whose purpose was to strengthen protection for maintenance workers). The main aim of the amending Directive was to update the necessary protective measures to increase protection for those workers who are now most at risk from exposure to asbestos fibres.

15. In addition to the requirements of Directive 2009/148/EC, CAR 2012 (in the same way as CAR 2006), continues to implement requirements of other Council Directives insofar as they relate to asbestos, namely:

    - 90/394/EEC on the risks related to carcinogens at work; and
    - 98/24/EC on the protection of workers from the risks related to chemical agents.[4]

16. CAR 2012 continues the well-established requirements, consolidated in CAR 2006, for the control of exposure to asbestos at work and licensing of high risk work. Direct acting EU prohibitions meant CAR 2012 no longer included prohibitions on supply and use of asbestos. CAR 2006 brought together these requirements into a single set of regulations, thus simplifying the pre-existing legislative framework by revoking and replacing three sets of Regulations:

    - The Control of Asbestos at Work Regulations 2002;
    - The Asbestos (Licensing) Regulations 1983 (as amended); and
    - The Asbestos (Prohibitions) Regulations 1992 (as amended)

17. CAR 2012 continues to implement Directive 2003/18/EC which aims to provide further protection for those working with materials containing asbestos over and above that was already provided for in the original Asbestos Worker Protection Directive 83/477/EC. Some of the amendments introduced by Directive 2003/18/EC had already been implemented through provisions in CAR 2006, in particular:

    - establishing a single control limit of 0.1 fibres per cubic centimetre (f/cm^3) and a Short Term Exposure Limit (STEL) introduced in the supporting ACOP of 0.6 f/cm^3. This replaced the dual

[4] CAR 2006 also implemented requirements of Council Directive 76/769/EEC insofar as it related to asbestos however, the prohibitions on the importation and use and placing on the market of asbestos containing articles are now annexed in 'direct acting' EU Regulations (REACH Enforcement Regulations 2008 – **R**egistration, **E**valuation, **A**uthorisation & restriction of **CH**emicals). Prohibition applies to all Member States. The REACH 2008 Regulations therefore removed the existing prohibitions from UK national legislation and so this requirement was no longer required in CAR 2012.

limits of 0.3 f/cm^3 for chrysotile (white asbestos) and of 0.2 f/cm^3 for amphiboles (blue and brown asbestos);

- providing for the requirement to notify work to the enforcing authority and requirement for medical surveillance of workers would not apply to certain specified types of work where a) the worker exposure to asbestos fibres is sporadic and low intensity worker exposure and b) and that the STEL will not be exceeded;
- requiring a more accurate method to measure compliance with the single control limit ie the 1997 World Health Organisation (WHO) recommended method;
- providing for employers using their employees on their own premises to be no longer exempt from licensing requirements; and
- establishing mandatory, detailed training requirements for those exposed or liable to be exposed to asbestos at work.

New requirements introduced in CAR 2012

18. CAR 2006 set out the licensing requirements for work with asbestos and required any business carrying out high risk work with ACMs to hold a licence before they can undertake such work. This effectively created two categories of work with asbestos: a) licensed work to which all the requirements applied; and, b) non-licensed work which is exempt from certain requirements including notification, medical examinations and registers of work (also known as health records).
19. However, in 2006 a complaint was made to the European Commission alleging under-implementation of Article 3 of Directive 2003/18/EC, designed to strengthen protection for maintenance workers. As a result of its investigation, the Commission issued a reasoned opinion in 2011 relating to the omission of the terms *'non-friable'* and *'without deterioration of non-degraded material'* from Regulation 3 of CAR 2006, which exempts 'low risk' work with asbestos from certain duties in the regulations. In the Commission's view the omission of these terms had the effect of widening the scope of the exemption. CAR 2012 subsequently made the changes required to comply with the reasoned opinion but avoided inappropriately extending the application of the UK requirement to hold a licence to short term low risk work. CAR 2012 achieved this by de-coupling the exemption for licensing from the other exemptions and separately defining the work for which a licence is required.
20. Fully transposing the main elements of the EU reasoned opinion on CAR 2006 and the Directive, CAR 2012 introduced a new category of 'notifiable' work with asbestos. This included a number of measures the EU considers further strengthens the control of exposure to asbestos and provide greater protection for building maintenance workers and tradespeople, such as plumbers, electricians and joiners. These workers, who routinely disturb the fabric of buildings, are the group now considered most at risk of exposure to asbestos due to the legacy of ACMs that remain in building stock.
21. CAR 2012 introduced additional requirements for this 'notifiable' non-licensable work with asbestos for a) notification of specified particulars, as described in the Directive, to the relevant enforcing authority before work starts; b) medical examinations to be carried out before an employee starts work, and then at least every 3 years as long as work with asbestos continues; and for c) a register of work with asbestos to be kept by the employer for each employee.
22. These changes resulted in clearly defining three categories of work with asbestos:

    - Licensed work – this is work where the concentrations of asbestos fibres in the air during work activity are likely to exceed specified limits or involve specific asbestos-containing materials (ACMs). This includes large scale asbestos removal and building refurbishment/demolition work and can only be carried out by licensed contractors and to which all requirements apply;

- Notifiable non-licensed work – this is work where concentrations of asbestos fibres during work activity are unlikely to exceed specified limits and the activity is sporadic and of low intensity. It does not need to be carried out by licensed contractors but is subject to the specific requirements a) – c) as outlined above; and
- Non-licensed work[5] – this work is where the concentrations of asbestos fibres in air during work activity are likely to be low and covers such activity as maintenance and small scale asbestos work and does not therefore require notification. This work is exempt from the requirements to notify, carry out medical examinations, and keep registers of work.

23. CAR 2012 also allowed for the modernisation of language and changes to reflect other legislation. For example, the removal of the prohibition of supply and use of asbestos section as this is now covered by the direct acting EU REACH (Registration, Evaluation, Authorisation and Restriction of Chemicals Regulation (EC) No 1907/2006).

Background to GB's compliance regime for the Directive

24. CAR 2012 are enforced by HSE, Local Authorities (LAs) and the Office of Rail and Road (ORR). LAs are the principal enforcing authority in retailing, wholesale distribution, warehousing, hotel and catering premises, offices and the consumer/leisure industries; ORR is responsible for railway stations, depots and other rail premises.
25. HSE considers that appropriate use of enforcement powers is important to secure compliance with health and safety law and ensure that dutyholders are held to account for significant failures. HSE uses a risk based approach when deciding which dutyholders to proactively inspect, taking into account such factors as size, type of activities, industry sector and the associated death, injury and ill-health rates.
26. With respect to asbestos, HSE carries out a programme of work to secure a national minimum commitment to the inspection of licensed work with asbestos insulation, asbestos coating and asbestos insulating board (AIB). HSE gives inspection priority to where:
    - uncontrolled stripping is planned;
    - work is proposed in hot environments;
    - the use of power tools is planned.
27. HSE also gives priority to inspecting:
    - new licence holders;
    - licensees whose licence expires within next 4-6 months and they have not been inspected in the previous 12 months;
    - licensees who have been issued with a warning letter by HSE's Asbestos Licensing Unit or where performance has been unsatisfactory.
28. HSE works alongside LAs to ensure dutyholder compliance to safely manage asbestos and uses a range of enforcement tools to secure compliance with the law and ensure a proportionate response to any breaches including:
    - Improvement notices (INs) – where an inspector is of the opinion that there is a breach of the law and which specifies the remedial action and the date to complete any action;
    - Prohibition notices (PNs) – where an activity needs to be stopped immediately when an inspector is of the opinion that there is a risk of serious personal injury associated with a work

[5] The Health and Safety Laboratory (HSL) conducted an independent and comprehensive dutyholder analysis and the report at Appendix 2 refers to 'non-licensed' work as 'non-notifiable' for ease of distinction between the work categories for the purpose of the focus groups.

activity or process or a serious deficiency in measures is identified. There does not need to be a breach of the law.

- Prosecution – where there is a failure to comply with either type of notice and/or there has been a serious breach of law
- Revocation of asbestos licences where there has been a breach of health and safety law in relation to asbestos.

29. HSE publishes details of notices, prosecutions and fines relating to dutyholders who breach the Regulations and/or the Health and Safety at Work Act 1974 in relation to asbestos and the detailed Enforcement Data Report for notices, prosecutions and penalties can be found at Appendix 4.

Scope of the Post Implementation Review

30. CAR 2012 Regulation 35 implements the requirement of Directive 2009/148/EC, Article 22 to carry out a review of the Regulations and produce a report before the end of the period of five years since the Regulations came into force.

31. The scope of the review, as pre-defined by Regulation 35, covers the extent to which the Regulations have achieved their objectives, assesses the costs and benefits, and identifies any unintended consequences This review has also considered any identified areas of under- or over-implementation of the Directive and the cost implications, justification and benefits.

32. In line with current Government guidance in the 'Better Regulation Framework Manual' and 'Guide for conducting PIRs', consideration was given to the scope of the review and the level of evidence and resourcing required. It was agreed from the outset in consultation with Government economists, social scientists and legal advisers that this PIR required a high level of evidence given that CAR 2012 are considered to be high impact, high profile and attract high level of scrutiny.

33. To provide robust findings on the outcomes and impacts of the Regulations, the review methodology comprehensively considered whether the Regulations are achieving their effect by consultation and research with:

- Dutyholder groups segmented by duties under CAR 2012 (ie those carrying out licensable, notifiable non-licensable, non-notifiable and, duty to manage) using focus groups/workshops
- European partners and desk-based research using questions to the Labour Inspectorates in other EU Member states via the Senior Labour Inspectors Committee (SLIC) Knowledge Sharing System (KSS)
- Light-touch communications and engagement strategy to gather views from the wider asbestos community via the HSE's Asbestos e-bulletin and by placing key messages regarding the PIR on HSE's Asbestos webpages.

34. The evidence sought was aimed at determining whether CAR 2012 had met its objectives and understanding how implementation could be improved. The research sought both qualitative and quantitative evidence from organisations required to comply with the legislation.

Research and analysis

35. To inform on how policy has been implemented, what effects it had and for whom, a range of evaluation approaches were adopted, taking account of the level of evidence required for the scale of the regulations and their expected impact. The approaches used ensured that the review delivered a detailed and comprehensive consideration of the evidence and included:

- Economic evaluation – Undertaken by HSE's economists, this approach assessed the costs and benefits of the regulations and, if the benefits justify the costs.

- Theory-based impact evaluation – This evaluation was informed by HSE's epidemiologists and statisticians and considered what outcomes, both positive and negative, the policy had; and what impact it had relative to other factors to generate those outcomes.
- Process evaluation – This research, commissioned, through the analysts advising policy officials, was undertaken by professional psychologists and human factors specialists in the Health and Safety Laboratory (HSL) part of HSE's Science Division. HSL is one of the world's leading providers of health and safety solutions to industry, government and professional bodies. The approach taken comprehensively explored dutyholders' views and experiences of how the Regulations work in practice and provided a measure of independence from the policy officials undertaking the broader evaluation and review of CAR 2012.

36. A range of dutyholders with different duties under CAR 2012 were included in the analysis using a combination of qualitative (workshops and focus groups) and quantitative (survey) methods. The process evaluation approach considered if the policy delivered/implemented was as intended and if there were any unintended effects; what aspects of the policy are working and if the policy is achieving its impacts and if this varies for different stakeholders or contexts.
37. The PIR guidance requires three overarching research questions to be addressed:
    - To what extent are the Regulations working?
    - Is government intervention still required?
    - Are the Regulations and the way they are implemented the most appropriate approach?
38. The main findings from the workshops, focus groups and research are detailed in sections 4 and 5 of the PIR report and the full analysis reports setting out the methodology and results of the research are at Appendices 1 and 2. In summary, the above three generic areas were explored and addressed through a series of research questions to dutyholders and further informed by the analysis carried out by HSE's epidemiologists. In addition, dutyholders were also asked more detailed research questions segmented by their respective duties under CAR 2012 in relation to the implementation, effectiveness and clarity against each specific Regulation. Responses to these questions were secured through structured focus groups, workshops and an online survey with dutyholders carrying out licensable, notifiable non-licensable and non-notifiable work and, duty to manage.

To what extent are the Regulations working?

39. The principal objectives of CAR 2012 were to fully transpose the requirements of Directive 2009/148/EC; and to continue to protect those working with or potentially exposed to asbestos from the associated risks.
40. As to the first of these, confirmation that CAR 2012 fully transposes the requirements of the Directive as intended is confirmed in the Explanatory Memorandum and Transposition Note to CAR 2012.[6]
41. As to the second, there was a clear consensus amongst all the dutyholders of the importance of the specific duties in the Regulations in keeping workers and others safe from the risks of exposure to asbestos, beyond what might be achieved through relying on more general underlying requirements for the reduction of risks "to as low as reasonably practicable" in the Health and Safety at Work Act.
42. The specific benefits expressed by all groups included minimising the risks from exposure to asbestos to keep workers and others safe, setting clear requirements for the controls that need to be implemented, raising awareness of the risks, providing an assurance to those working with asbestos that risks are being controlled effectively and, providing a level playing field for licensed contractors bidding for work.

[6] http://www.legislation.gov.uk/uksi/2012/632/memorandum/contents

43. Dutyholders also referred extensively to the supporting guidance to the Regulations and the Approved Code of Practice *Managing and working with Asbestos* (L143), which set out in more detail what dutyholders are expected to do in order to comply with the legal requirements. The prevalent view amongst the different groups was that the regulations were practical to implement and were effective in achieving their objective to protect workers and others from the risks of exposure to asbestos. The evidence also confirmed that CAR 2012, and associated guidance, specifically the ACOP, and the way they are implemented are reasonable and fair and that they contain sufficient information to enable dutyholders to comply with the requirements.

44. Analysis carried out by HSE epidemiologists using the Mesothelioma Projections Model, based on our National Statistics on mesothelioma, estimates the impact of changes in exposure to asbestos on deaths from mesothelioma and lung cancer. The model suggests that the fall in exposures to asbestos between 1980 (which is approximately when measures to control exposures started to be introduced) and 2015 will lead to 25,700 fewer deaths from mesothelioma and lung cancer in the 100 years between 2001 and 2100. The epidemiological evidence further examines and helps understand the scale of health benefits that regulatory intervention may have had up to now and may have in the future. This analysis is described in more detail in Appendix 3.

45. HSE has recently published estimates of the costs to society of work-related cancer,[7] which include costs to business and government/taxpayers, as well as costs to the individuals affected, both in terms of financial costs and the impact of quality of life and loss of life. Applying those estimates to the yearly profile of prevented cancer deaths between 2001 and 2100, the present value of the benefits to society of preventing those cases of cancer is estimated at £20.9 bn.

46. We are not able to claim that all of these deaths prevented can be attributed to the regulations, but the evidence suggests that the measures required by the regulations have been very influential in controlling exposures.

Is Government intervention still required?

47. CAR 2012 transposes in full the main elements of Directive 2009/148/EC into UK law. It is compulsory to have regulations which transpose these requirements and this means that Government intervention in some form of regulation is required.

48. Due to the latent nature of asbestos-related disease from first exposure - the average being around 35 years – the great majority of deaths are attributed to exposures to asbestos during the 1960s and 1970s when asbestos was less well-regulated than today and was widely used in industry and construction. The current burden of asbestos-related disease in Britain from past exposures is substantial and expected to remain so for many years, and projected to peak around year 2020.

49. Whilst the various prohibitions on import, supply and use of asbestos and improved working conditions have virtually eliminated the risks for many workers, ACMs remain in place in many buildings. The potential impact on workers, if they were exposed to it, would be significant. The gravity of the potential consequences of exposure to workers requires that exposures are controlled in every workplace.

50. As discussed in the Costs and Benefits section below, the costs of compliance with the requirements in CAR 2012 are estimated to be in the high single billions in present values terms over the next 100 years as set against estimated benefits in terms of averted deaths of around £28.8 billion for the same period. This clearly illustrates that the benefits of CAR 2012 outweigh the costs and will continue to do so for the foreseeable future, so long as exposures continue to be controlled.

51. Additionally, the research on costs to society of work-related cancer described in paragraph 45 shows that it is the individuals affected by work-related cancer who bear the overwhelming majority

[7] HSE (2016). The Costs to Britain of Work-related Cancer. HSE Research Report RR1074. Available at: http://www.hse.gov.uk/research/rrhtm/rr1074.htm

of the costs of that condition (98% of the total). By comparison, employers bear a disproportionately small share of the overall costs. The latency of work-related cancer, which is often decades, means that by the time most individuals are diagnosed with cancer, they are beyond retirement age, and many of those who are still working will be with a different employer or even in a different industry. This limits the financial incentives for employers to reduce those exposures based on concern for 'the bottom line' alone. The finding provides an economic rationale for government to continue to intervene in this area, and for HSE to support, incentivise and regulate businesses to address cancer risks.

Are the Regulations and the way they are implemented the most appropriate approach?

52. Building maintenance workers and tradespeople are still at significant risk as they may be unknowingly exposed to ACMs which remain in place in building stock. The gravity of the potential consequences to workers requires a robust regulatory framework to ensure they are protected from exposure to asbestos fibres. CAR 2012, by transposing in full the main elements of Directive 2009/148/EC into UK law, strengthens the protection given to those who might be exposed to asbestos fibres by setting clear health and safety requirements to ensure appropriate control measures are in place to prevent exposure to asbestos from work activity or reduce exposure as far as reasonably practicable.

53. The core requirements of CAR 2012 include assessing the risks from asbestos, putting in place measures to prevent exposure and to prevent the spread of asbestos; providing appropriate work equipment; and providing information, instruction and training to workers. There are also duties on others, such as the duty placed on those in control of non-domestic premises to manage asbestos in those premises.

54. The evidence from the focus groups, workshops and survey demonstrated that dutyholders are very positive about the Regulations and the way they have been implemented. Dutyholders gave their views and experiences of how HSE has implemented CAR 2012 and described the approach as 'clear and consistent', 'effective', 'practical', 'pragmatic', and as 'setting clear standards'.

55. The dutyholder qualitative and quantitative analysis revealed that the Regulations were considered to be beneficial in preventing and/or reducing exposure to the risks from asbestos, setting clear standards regarding the controls that should be in place, and raising awareness of the risks associated with exposure to asbestos.

56. Overall the Regulations were considered practical to implement although some areas were identified where greater clarification is needed, not specifically with regards to the Regulations per se but the provision of clearer guidance. The specific areas included:

    - Greater clarity around the distinction between licensable, non-licensable and notifiable work
    - Regulation 4 – Duty to manage - Greater clarity of dutyholders' roles and responsibilities, with specific guidance on conducting a management plan
    - Regulation 7 – Plans of work – Further guidance and clarity regarding how much information should be included in the written plan of work prior to commencing work
    - Regulation 22 – Health records and medical surveillance – Dutyholders were unclear as to why the frequency of medical examinations differed for licensed and notifiable work. It was expressed that exposure to asbestos carries the same risks irrespective of the type of work activity and that the frequency of medicals should be aligned.

57. Overall, the collective evidence suggests that CAR 2012 are operating as intended, but that the issues outlined above could, in the main, be addressed administratively through updated guidance.

Cost/benefit analysis

58. In line with current Government guidance, which requires for a 'high level' PIR that the costs and benefits of the regulation are quantified and monetised as far as is possible, research and analysis were undertaken to quantify and monetise the costs and benefits of CAR 2012.

59. This work was informed by earlier analysis, including previous impact assessments (IAs). However, because the individual duties in CAR 2012 have come about in a piecemeal process over approximately 20 years, with some of the duties amended at different points, there was never a definitive IA in place that captured all of the costs together, and the usefulness of the data in the different IAs was limited. The approach taken in this PIR concentrated on what the likely costs and benefits are going forward, and seek to estimate the current and ongoing costs and benefits of complying with the requirements in the Regulations.

60. The analysis of the costs used evidence gathered alongside the qualitative and quantitative work undertaken by professional psychologists and human factors specialists from HSE's Science Division as well as administrative data, published statistics and assumptions based on information provided by sector experts. For the benefits, we relied on analysis performed by HSE epidemiologists using the HSE Mesothelioma Projections Model and HSE published research on the Costs to Britain of Work-Related Cancer. Appendix 1 provides the details of the analysis and results, which are summarised below.

Costs

61. As described in Appendix 1, despite best attempts and proportionate resource expended, the information received from duty holders proved insufficient to create a reliable detailed estimate of the costs. However, since we have been able to produce a solid estimate of the benefits of the reduction of exposures that results from current working practices (which are required in the regulations), it was important to provide an estimate of the scale of the costs of those requirements to allow a judgment of whether the benefits justify the costs. Using the information gathered and, in some cases combining it with advice from sector experts to help fill in the gaps, we have produced a broad estimate of the scale of the costs.

62. Annual costs per annum for complying with the requirements in the regulations are estimated to be several hundreds of millions of pounds. **This results in a present value over the period 2016 – 2115 of high single billions of pounds.**

Benefits

63. In this context, the estimated benefits are preventing what would happen if dutyholders did not implement the requirements of CAR 2012, as costed in the Costs section. This was estimated by comparing two different scenarios, one where individuals and businesses continued to take the actions required in CAR 2012 (with the improvements suggested in this PIR, which would not have a significant impact on health and safety), and another scenario where individuals and businesses stopped taking all of those actions.

64. Analysis by HSE epidemiologists using the Mesothelioma Projections Model estimated that there is a difference of 50,500 additional cancer deaths between the two scenarios over the period 2016 to 2115 (such a long period is required to allow all the results of the changes in exposures to manifest). Of those, 40,800 are from cases of mesothelioma, while 9,700 are from cases of lung cancer.

65. The HSE estimates of the costs to society of work-related cancer include appraisal values. One of these is the average cost to society of a fatal case of work-related cancer, which is estimated to be approximately £1.3m per case. Applying this appraisal value to a yearly profile of the number of additional cases of cancer expected in each of the years from 2016 to 2115 allows us to estimate

benefits to society of preventing those cases of cancer. **These benefits have a present value over those 100 years of £28.8bn**.

66. It is acknowledged that a scenario where individuals and businesses stopped taking all the actions required in CAR 2012 is not a very plausible one for a real situation in which the regulations were removed. It is likely that some or many individuals working with asbestos would continue to take the precautions indicated in CAR 2012 or other precautions (as stated earlier, we are not able to claim all of the reduction in exposures since 1980 was due to the regulations), and therefore exposures would not increase as much as estimated. However, this is the appropriate scenario to contrast with the costs calculated in this PIR, which are the ongoing costs of taking the prescribed actions in the regulations, as it represents the impact of stopping taking those actions.

Implementation in European Member States

67. The Control of Asbestos Regulations 2012 fully implements Directive 2009/148/EC on the protection of workers from the risks related to exposure of asbestos at work.

68. Through the European Commission's Senior Labour Inspectors Committee - Knowledge Sharing System, HSE sent a questionnaire to member state labour inspectorates to ascertain whether or not the objectives of their regulatory regimes adopted a similar approach to that in the UK. The questionnaire considered the specific aspects of the regulatory framework that UK dutyholders were questioned on. The full questionnaire is at Appendix 5. All of the member states who responded were in accordance with the UK approach. It was notable that one member state went beyond the requirements of the Directive requiring annual employee medical examinations.

69. In a recent separate exercise, the 2016 Netherlands EU Presidency conducted a survey asking all member states how the Directive has been implemented to ensure work involving exposure to asbestos is conducted safely.

70. The results of the survey, presented at the 70th committee conference of EU Senior Labour Inspectors, confirmed that all Member States, Norway and Switzerland have a governmental regime in place to regulate safe work with asbestos. Some member states have chosen to specify values to be observed when undertaking particular aspects of work involving asbestos including limits which must be achieved before a site may be reoccupied and for small jobs.

71. Additionally, the Directive workplace exposure limit value is 0.1 fibre/cm^3 as an 8-hour time-weighted average. The UK, Netherlands and France have opted to adopt more stringent and conservative exposure limits based on scientific evidence about the risks and feasibility of measurement and control. For the UK, the control limit is also set at 0.1 fibres/cm^3 but as a 4-hour time-weighted average. This was adopted in the UK to better reflect the tonnage of asbestos and the normal working practices for licensed contractors in this country and was in use before the Directive introduced the single control limit. The 8-hour time-weighted period was believed to be a carryover from regulating in the asbestos manufacturing industry but patterns of work have changed and it is unlikely that the majority of UK asbestos workers will be exposed to asbestos for an 8-hour period. As this better reflects working practices in the UK, there is no intention to recommended changing this requirement in CAR 2012.

Conclusions and next steps for the Regulation

72. The evidence from the research and analysis gathered for this PIR suggests that overall CAR 2012 has met its objectives and have helped to achieve a high level of compliance.[8] CAR 2012 strengthens the protection given to those who might be exposed to asbestos fibres, setting clear health and safety requirements to ensure the appropriate control measures are in place to prevent exposure to asbestos from work activity or reduce exposure as far as reasonably practicable.

73. The gravity of the potential consequences of exposure to workers requires a robust regulatory framework to ensure they are protected from exposure to asbestos fibres and dutyholder views and experiences confirm that CAR 2012 meet their intended objective to provide greater protection for those working with asbestos. CAR 2012 achieves this by requiring that exposure to asbestos from work activity is prevented or exposure reduced as far as is reasonably practicable.

74. The process evaluation aimed to identify, as part of its research, if there were any unintended consequences of the Regulations. Whilst the research did not identify any examples of unintended consequences through consultation with dutyholders, it is not possible to conclude that there are no unintended consequences. However, the research suggests that it is unlikely that there have been any significant or major unintended consequences.

75. Based on the collective stakeholder evidence, cost/benefit analysis, epidemiological and enforcement data, the Government does not consider that it is necessary to amend the provisions of CAR 2012. There are several areas where the recommendations from the PIR can be taken forward mainly by changes to administrative guidance and processes, with the exception of one recommendation which would require further exploration of the case for a minor amendment to the Regulations. These are detailed in the PIR report but, in summary, include:

    - greater clarity around the distinction between licensable, non-licensable and notifiable work with asbestos;
    - information on dutyholders' roles and responsibilities around duty to manage asbestos in non-domestic premises;
    - guidance on practical examples of written plans of work; and
    - exploration to align the frequencies for medical examinations for licensable and notifiable work. The current requirement in CAR 2012 for licensable work goes beyond the Directive. Alignment would involve changing the frequency of medical examinations for those undertaking licensed asbestos work, from every two years, to every three years and would impact on licensed contractors only. HSE will explore the health and safety impacts of any changes to the regulations taking account of medical, epidemiological, and scientific evidence, in consultation with stakeholders.

[8] HSE enforcement data for CAR 2012 is detailed in Appendix 4.

Annex 1 – Post Implementation Review Report

Title: Post Implementation Review - Control of Asbestos Regulations 2012 **IA/PIR No:** **Lead department or agency:** Health and Safety Executive **Other departments or agencies:** **Contact for enquiries:** Lorraine Medcalf Chemical Regulations Division, Health and Chemicals Unit 020 3028 3611	Post Implementation Review **Source of intervention:** Domestic **Type of regulation:** Secondary legislation **Type of review:** Statutory Post implementation review **Date of implementation:** 6 April 2012 **Date review due:** 6 April 2017
Summary	**RPC Opinion:**

1a. What were the policy objectives and the intended effects?

The Control of Asbestos Regulations 2012 (CAR 2012) which came into force on the 6 April 2012, revoked and re-enacted the Control of Asbestos Regulations 2006 (CAR 2006). CAR 2012 fully transposes the main elements of Directive 2009/148/EC and introduced a new category of 'notifiable' work with asbestos.

In addition, to transposing the Directive, the main objective of CAR 2012 is to set out a framework for preventing exposure to asbestos from work activity or reducing exposure as far as is reasonably practicable. The core requirements of CAR 2012 include:

- assessing the risks from asbestos;
- putting in place measures to prevent exposure and prevent the spread of asbestos;
- providing appropriate work equipment; and
- providing information, instruction and training to workers.

The Regulations are supported by an HSE produced Approved Code of Practice (ACOP) 'Managing and working with Asbestos' (L143) which sets out in more detail what dutyholders are expected to do in order to comply with the legal requirements.

Work with asbestos is classified into three broad categories depending on the foreseeable level of exposure of employees and others as a result of the work activity being undertaken. These categories are:

- **Licensable work**, which refers to work where the concentrations of asbestos fibres in the air during the work activity are likely to exceed specified limits in Regulations or involve specific asbestos-containing materials (ACMs). This includes most large scale asbestos removal and building refurbishment/demolition work. This work can only be undertaken by licensed contractors who fulfil the stringent criteria set out by HSE. The work must be notified at least 14 days prior to its commencement. Air monitoring, medical surveillance and health records for workers are also required.
- **Notifiable non-licensed work**, which refers to work where concentrations of asbestos fibres in the air during the work activity are unlikely to exceed the specified limits in the regulations and the activity is sporadic and of low intensity. This work does not need to be carried out by licensed contractors. The work must be notified prior to its commencement. Air monitoring, medical surveillance and health records for workers are also required.
- **Non-notifiable work**, which refers to work where the concentrations of asbestos fibres in the air during the work activity undertaken are likely to be low, and covers such activity as maintenance and small scale asbestos work. This includes work done by workers such as plumbers, electricians, etc. who may disturb asbestos as a consequence of carrying out their jobs. There is no requirement for notification, medical surveillance or health records.

Additionally, CAR 2012 places a **duty to manage** asbestos on owners of non-domestic buildings (including public, commercial and industrial buildings and the common parts of multi-occupancy domestic buildings). This involves identifying, risk assessing, and recording the location and condition of asbestos; and putting in place a plan to manage the risks from any asbestos in the building that they own or manage. Information must be passed on to any contractors or workers who may disturb asbestos while they are working on the building, so that they can put in place appropriate control measures.

1b. How far were these objectives and intended effects expected to have been delivered by the review date? If not fully, please explain expected timescales.

Exposure to asbestos is potentially fatal and there is a cumulative effect. All persons at work who are likely to disturb building fabric or plant containing asbestos are at substantial risk and may also endanger the public. The aim of the Directive is to increase protection for workers who are at risk from exposure to asbestos fibres, with the objective of the Regulations to fully transpose the Directive and strengthen protection by implementing requirements to prevent exposure to asbestos from work activity or reduce exposure as far as is reasonably practicable.

The level of evidence to inform the PIR confirms that the Regulations continue to meet the objective, with the specific benefits including minimising the risks from exposure to asbestos to keep workers and others safe; setting clear requirements for the controls that need to be in place; raising awareness of the risks and providing an assurance to those working with asbestos that the risks are being controlled effectively.

Due to the latent nature of the disease - there is usually a long delay of anything between 15 to 60 years after the initial exposure to asbestos fibres to the onset of asbestos related disease, with the average being around 35 years - it is difficult to know whether the intended effects have been realised. However, the close relationship between mesothelioma and asbestos means that of the cancers that can be caused by asbestos, mesothelioma is the easiest to study. Appendix 3 therefore provides a comprehensive report on the historical context and potential impact of regulatory changes on long-term health outcomes. It uses the HSE mesothelioma model to project future annual mesothelioma deaths under a number of scenarios for average annual population exposure from 1980. The report presents comparisons to illustrate the potential scale of health benefits that overall regulatory changes – which encompass a range of specific control requirements – since the 1980s may have had.

2. Describe the rationale for the evidence sought and the level of resources used to collect it, i.e. the assessment of proportionality

In line with Government guidance, it was agreed from the outset this PIR required a high level of evidence given that CAR 2012 are considered to be high impact, high profile and will attract high level of scrutiny and would therefore require a high level of resource including policy, economists, social scientists, legal advisers and psychologists.

The focus of the research and analysis was i) to explore dutyholders' perspectives of the effectiveness of the Regulations in meeting their objective of protecting workers and others from the risks of asbestos, ii) how they are applied in practice iii) to gather evidence required for the monetisation of the costs and benefits and iv) to examine the epidemiological evidence to help understand the scale of health benefits that regulatory intervention may have had up to now and may have in the future. In line with the Better Regulation Framework Manual and 'Guidance for conducting PIRs', a process evaluation approach was used, specifically suited when the aim of the research is to address questions of how a policy or regulation is implemented including which aspects work well or less well.

A mixed-method approach was adopted, which included the collection of qualitative (focus groups, workshops) and quantitative (survey) data. A range of dutyholder groups took part in the evaluation, reflecting the different categories of work with asbestos that are undertaken. The use of different methods of data collection and sources/dutyholders helped provide a comprehensive understanding of how the Regulations are implemented in practice.

The findings contributed to and informed a broader evaluation of the impact of the Regulations, which draws on epidemiological analysis as well as a cost/benefit analysis associated with implementing the Regulations. Those that took part in the workshops and focus groups as part of the process evaluation were also invited to provide information on the costs associated with the implementation of the regulations. The results of the economic evaluation are included in this report.

3. Describe the principal data collection approaches that have been used to gather evidence for this PIR

The choice of method for data collection was tailored to the various target dutyholder groups that took part in the research to minimise any potential burden on participants' time whilst ensuring that a comprehensive range of data was captured. The dutyholders that took part in the research were segmented into four categories:

- Those undertaking licensable work ('Group A'),
- Those undertaking notifiable non-licensed work ('Group B'),
- Those carrying out non-notifiable work ('Group C'), and
- Those with a duty to manage asbestos ('Group D').

For Groups A and B, a workshop methodology was adopted. Those carrying out licensable and notifiable work have to comply with most of the Regulations. Given the breadth of Regulations to be explored with Groups A and B, a workshop methodology ensured that all the areas were suitably explored and covered in enough detail to provide a comprehensive view.

For Group D, a focus group methodology was used. This was because only one Regulation applied to this group (ie Regulation 4), and dutyholders' views could be explored in more depth within the time available (up to ninety minutes) using a focus group format.

For Group C, an online survey was used to gather the views of those that conducted non-notifiable work. This method was more appropriate for this group because these dutyholders are typically self-employed or micro-organisation employers (ie up to ten employees). As such, it was anticipated that it would be harder for this group to resource travel to and attendance at a face-to-face focus group or workshop compared to larger organisations. Using an online survey meant that Group C dutyholders could

voluntarily participate in their own time, and ensured that a potentially larger number of these dutyholders could be reached. This was particularly important because those carrying out non-notifiable work are a 'hard to reach group' as they are not legally required to notify HSE of their intention to carry out work with asbestos. The table below gives an overview of the methods used and the Regulations explored for each dutyholder group.

Dutyholder groups	Group A	Group B	Group C	Group D
Method	Workshop	Workshop	Survey	Focus group
Regulations examined:				
regulation 4	-	-	-	√
regulations 5 and 6	√	√	√	-
regulations 7 and 18	√	√	-	-
regulation 8	√	-	-	-
regulation 9	√	√	-	-
regulation 10	√	√	√	-
regulations 11, 12, 13 and 14	√	√	√	-
regulations 16 and 17	√	√	√	-
regulations 19 and 20	√	√	-	-
regulation 21	√	√	-	-
regulation 22	√	√	-	-
regulation 23	√	√	-	-
regulation 24	√	√	√	-

4. To what extent has the regulation achieved its policy objectives? Have there been any unintended effects?

Analysis carried out by HSE epidemiologists using the Mesothelioma Projections Model, which is based on our National Statistics on mesothelioma, estimates the impact of changes in exposure to asbestos on deaths from mesothelioma and lung cancer. The model suggests that the fall in exposures to asbestos between 1980 (which is approximately when measures to control exposures started to be introduced) and 2015 will lead to 25,700 fewer deaths from mesothelioma and lung cancer in the 100 years between 2001 and 2100. This analysis is described in more detail in Appendix 3.

HSE has recently published estimates of the costs to society of work-related cancer, which include costs to business and government/taxpayers, as well as costs to the individuals affected, both in terms of financial costs and the impact of quality of life and loss of life. Applying those estimates to the yearly profile of prevented cancer deaths between 2001 and 2100, the present value of the benefits to society of preventing those cases of cancer is estimated at £20.9 bn.

We are not able to claim that all of these deaths prevented can be attributed to the regulations, but the evidence suggests that the measures required by the regulations have been very influential in controlling exposures.

ACMs remain in place in many buildings and so the potential impact on workers, if they were exposed to it, would be significant. The gravity of the potential consequences of exposure to workers requires that exposures are controlled in every workplace. The regulatory framework for controlling asbestos exposures to minimise the risk of mesothelioma will largely prevent other forms of asbestos-related disease.

All dutyholder groups with different duties under CAR 2012 recognised the importance of the Regulations in keeping workers and others safe from the risks of exposure to asbestos. Specific benefits that came out from the views and experiences of dutyholders are that the Regulations help to minimise the risks to workers from exposure to asbestos, set clear standards and requirements for the controls

that need to be in place, raise awareness of the risks and provide an assurance to those working with asbestos that they are controlling the risks effectively.

The Regulations and associated guidance, in particular the Approved Code of Practice (ACOP) Managing and Working with Asbestos (L143), were considered to contain sufficient information to enable dutyholders to comply with the requirements. Although there was a prevalent view for greater clarity around the distinction between licensable, non-licensable and notifiable work with asbestos as this was not always clear, and could be open to interpretation.

The overall view from the dutyholder analysis was that the Regulations were considered effective in achieving the objective to protect workers and others from the risks of exposure to asbestos, provided that they were complied with. There was some evidence to suggest that non-licence holders might not always be fully aware, or have a sufficient understanding, of the requirements under the Regulations.

The majority view among the different dutyholder groups was that the Regulations were practical to implement, and the ACOP was seen as a useful document to draw upon in applying the Regulations in practice. However, some areas were identified were greater clarification is needed, particularly:

- information on dutyholders' roles and responsibilities, in relation to Regulation 4 ('Duty to manage asbestos in non-domestic premises'), particularly guidance on how to conduct a management plan along with practical examples;
- guidance on practical examples of written plans of work, in relation to regulation 7 ('Plans of work'), to help establish consistency in standards of working across the industry; and
- alignment of frequencies for medical examinations for licensable and notifiable work, in relation to regulation 22 ('Health records and medical surveillance') as dutyholders questioned the rationale for the difference in frequency as it was considered that exposure to asbestos carried risks irrespective of whether the work was licensable or notifiable, and that the frequency of medical examinations should be the same.

5a. Please provide a brief recap of the original assumptions about the costs and benefits of the regulation and its effects on business (e.g. as set out in the IA).

As described in section 1a, the individual duties in CAR 2012 have come about in a piecemeal process over time and contributed to an existing package of mutually enforcing interventions. The Impact Assessment (IA) produced for CAR 2012 focussed solely on the change to define separately 'notifiable non-licensed work' and did not cost any of the other duties under CAR 2012 where there was no change. As a result, there was never a definitive IA in place that captured all of the costs in one place.

An IA was produced for the Control of Asbestos at Work Regulations 2002, specifically around the introduction of the explicit duty to manage. An evaluation of the duty to manage asbestos was commissioned by HSE in 2011.[9] One of its objectives was to reassess the assumptions made in the IA which accompanied the introduction of the Regulations about costs/benefits of the duty. However, it found that collecting accurate information about costs and isolating the impact of the duty were not possible. This was partly because the way the costs were calculated in the IA (directly relating them to the size of the property involved) was incompatible with what information on costs was available from dutyholders. This lesson was taken into account in how the cost information for this PIR was gathered.

[9] www.hse.gov.uk/research/rrpdf/rr783.pdf

5b. What have been the actual costs and benefits of the regulation and its effects on business? Please highlight how these differed from the original assumptions and any reasons which explain these differences.

Appendix 1 provides a detailed analysis and describes the process undertaken to quantify and monetise the costs and benefits of CAR 2012. This analysis describes the steps taken in an attempt to complete this estimation, the barriers encountered and the results of the work undertaken.

Costs

As described in Appendix 1, despite best attempts and proportionate resource expended, the information received from duty holders proved insufficient to create a reliable detailed estimate of the costs. However, since we have been able to produce a solid estimate of the benefits of the reduction of exposures that results from current working practices (which are required in the regulations), it was important to provide an estimate of the scale of the costs of those requirements, to allow a judgment of whether the benefits justify the costs. The information gathered was used and, in some cases combined with advice from sector experts to fill in the gaps, to produce a broad estimate of the scale of the costs.

Annual costs per annum for complying with the requirements in the regulations are estimated to be several hundreds of millions of pounds. **This results in a present value over the period 2016 – 2115 of high single billions of pounds.**

Benefits

In this context, the benefits are preventing what would happen if dutyholders did not take any of the actions required by CAR 2012 (costed in the Costs section). This is estimated by comparing two different scenarios, one where individuals and businesses continued to take the actions indicated in the regulations (with the improvements suggested in this PIR, which would not have a significant impact on health and safety), and another scenario where individuals and businesses stopped taking all of those actions.

Analysis by HSE epidemiologists using the Mesothelioma Projections Model estimated that there is a difference of 50,500 additional cancer deaths between the two scenarios over the period 2016-2115 (such a long period is required to allow all the results of the changes in exposures to manifest). Of those, 40,800 are from cases of mesothelioma, while 9,700 are from cases of lung cancer.

The HSE estimates of the costs to society of work-related cancer include appraisal values. One of these is the average cost to society of a fatal case of work-related cancer, which is estimated to be approximately £1.3m per case. Applying this appraisal value to a yearly profile of the number of additional cases of cancer expected in each of the years from 2016 to 2115 allows us to estimate benefits to society of preventing those cases of cancer. These benefits have a present value over those 100 years of £28.8bn.

The scenario where individuals and businesses stopped taking all the actions indicated in the regulations is acknowledged as not a very plausible one for a real situation in which the regulations were removed. It is likely that some or many individuals working with asbestos would continue to take the precautions indicated in CAR 2012 or other precautions (as we state earlier, we are not able to claim all of the reduction in exposures since 1980 was due to the regulations), and therefore exposures would not increase as much as estimated. However, this is the appropriate scenario to contrast with the costs calculated in this PIR, which are the ongoing costs of taking the prescribed actions in the regulations, as it represents the impact of stopping taking those actions.

6. Assessment of risks or uncertainties in evidence base / Other issues to note

Dutyholder qualitative and quantitative analysis

One of the key strengths of the dutyholder analysis is that a mixed methods approach was adopted, combining different methods of data collection (eg workshops, focus groups, online survey) across a range of groups with different duties under the Regulations. The research was conducted across a

spread of geographical locations within the GB, mapping of the known locations of duty holders using GIS software was undertaken to inform the selection of locations. This approach enabled comprehensive evidence to be obtained across different dutyholder groups, providing a rich picture regarding the effectiveness of the Regulations and how they work in practice, including their benefits as well as issues encountered in their implementation. Further, there was a good level of engagement in the research, which was evident in the number of dutyholders that attended the workshops and focus groups, as well as in the number of survey responses obtained from the generally 'hard to reach' dutyholder group (referred to in the analysis report as 'Group C').

With the exception of one dutyholder group, the workshops conducted with dutyholders that carried out notifiable work primarily consisted of licensed dutyholders (as opposed to those that purely carried out notifiable work but did not hold an HSE licence). The main reason for this is that, during the recruitment process, it became evident that, in practice, contractors with an HSE licence tend to carry out both types of work with asbestos (licensable and notifiable). During these specific workshops, dutyholders were encouraged to think about the issues purely from a 'notifiable non-licensed' perspective.

Additionally, the analysis of the survey data yielded some useful insights into the views of a well-known 'hard to reach' group. HSE has run a number of targeted campaigns over recent years such as 'Hidden Killer'[10] to raise awareness around exposure to asbestos and to try to engage with notoriously 'difficult to engage' dutyholders. Against this backdrop and in an attempt to reach as many dutyholders who undertake non-notifiable work, a number of trade associations/professional bodies were approached to help distribute the survey, which ran for three weeks, among their members. This included the British Woodworking Federation; the Chartered Institute of Plumbing and Heating Engineers; the Electrical Contractors Association; the Institute of Carpenters; the National Association of Shop Fitters; the National Federation of Builders; the Residential Landlords Association, and Select. To extend the reach of the survey, efforts were made to identify additional participants to take part in the survey through other channels, including delegates that had previously attended training courses on asbestos run by the Health and Safety Laboratory. This provided a suitable sample survey to extrapolate key views and conclusions from the data.

Cost/benefit analysis

The analysis undertaken to quantify and monetise the costs and benefits of the CAR 2012 was the most feasible and practical method both within the timeframe and which did not place a disproportionate burden on business given commercial pressures to undertake profitable work. However, despite best attempts and proportionate resource expended, the information received from dutyholders proved insufficient to create a reliable detailed estimate of the costs. Instead, it has proved necessary to provide only a broad estimate of the scale of the costs by using the information gathered and, in some cases combining it with advice from sector experts to fill in the gaps. This has allowed comparison with the estimated benefits, which are considered more reliable.

Epidemiological data

Assessing the long-term health benefits of past initiatives to control asbestos exposure is challenging. The long-latency of asbestos-related diseases means that there is a long delay between any improvements in exposure control and consequent reduction in the rate of disease occurrence. Since mesothelioma is essentially only caused by asbestos, national trends in mortality can be used to infer how asbestos exposures in general must have changed over time. The full report at Appendix 3 uses the statistical model developed by HSE as a basis for estimating the scale the long-term health consequences of different scenarios for how asbestos exposures may have changed since the 1980s in order to illustrate the potential benefits of asbestos control.

[10] http://www.hse.gov.uk/asbestos/campaign/video.htm

7. Lessons for future Impact Assessments

As there was no IA available that estimated the costs of CAR 2012 in a robust manner to use as a comparator, it is not possible to estimate whether the original IA figures were estimated in a reasonable manner compared to what we now know. As described in point 6 above, a detailed estimate of the ongoing costs going forward also proved unfeasible with the methodology used. A number of lessons have been drawn from this and will be applied to future PIRs. These are described in Appendix 1.

8. What next steps are proposed for the regulation (e.g. remain/renewal, amendment, removal or replacement)?

Based on the collective research supporting the PIR including stakeholder evidence, cost/benefit analysis and the epidemiological data, the Government considers that i) the Regulations are achieving their intended objectives and that those objectives remain valid, ii) that Government intervention by regulation is still required and remains the most effective way to control the risks of exposure to asbestos.

There are several areas where the recommendations from the PIR can be taken forward to provide greater clarity for dutyholders and potentially reduce the burden on business. The recommendations can be delivered mainly by changes to administrative guidance and processes, with the exception of one recommendation which would require exploration of the case for a minor amendment to the Regulations. These are:

1. **Greater clarity around the distinction between licensable, non-licensable and notifiable work with asbestos**

   This can be achieved by reviewing and revising appropriate guidance, particularly the Approved Code of Practice (L143) and other associated guidance, to provide greater clarity for the dutyholder around the different types of work with asbestos.

   The qualitative work confirmed that some dutyholders consider there is confusion about what work needs to be notified, particularly for notifiable non-licensed work, potentially increasing the costs associated with the notification of this type of work.

2. **Information on dutyholders' roles and responsibilities around duty to manage asbestos in non-domestic premises**

   Research identified the largest group of workers at risk from asbestos exposure were building workers involved in maintenance, repair and refurbishment work and workers such as plumbers, electricians and joiners. One of the biggest problems these workers face is that they do not know when and where they may discover asbestos during their work activities. The duty to manage (Regulation 4 'Duty to manage asbestos in non-domestic premises') is designed to specifically address this issue and ensure information is provided before work starts so the risks can be properly managed.

   Dutyholder analysis confirmed that there remained a lack of clarity around dutyholders' roles and responsibilities, particularly how to conduct a management plan. The enforcement data report at Appendix 4 further supports this view as the majority (60%) of Improvement Notices served between 2007 and 2016 were for breaches of CAR, regulation 4.

3. **Practical examples of written plans of work**

   The dutyholder analysis confirms support for clearer guidance including practical examples of written plans of work, particularly for inexperienced contractors. Due to the importance of developing a written plan of work to ensure work with asbestos is carried out safely, dutyholders were unclear as to the amount of information to include in a plan of work and welcome clearer guidance to ensure consistency with the Regulations and associated guidance.

4. Alignment of frequencies for medical examinations for licensable and notifiable work

Dutyholders were unclear why the frequency of medical examinations differs for licensable and notifiable work (ie every 2 and 3 years respectively). There was a belief that exposure to asbestos carried the same risks irrespective of whether the work was licensable or notifiable, and generally, licensed dutyholders arranged medical examinations every two years irrespective of whether the work was licensable or notifiable.

CAR 2012 implements the EU Directive 2009/148/EC which requires licensed asbestos workers to undertake a medical examination. The Directive requires medicals to be carried out before work and then every 3 years until work with asbestos is stopped. In GB, licensing the highest risk asbestos work and creating a permissioning regime overseen by HSE begun in 1983 and so currently, CAR 2012 goes beyond the requirements of the Directive which requires medicals before licensed asbestos workers start work and every 2 years until work with asbestos is stopped. GB includes the self-employed in scope of the Regulations even though the Directive does not. If the self-employed were excluded there would be great danger to all from uncontrolled exposure. Addressing the UK's under-implementation of the Directive resulted in certain types of lower risk work (ie notifiable non-licensed work (NNLW)) attracting the need for a medical before first work and every 3 years thereafter until work with asbestos stops, implemented in CAR 2012.

Aligning the frequency of medicals to every 3 years would bring the Regulations into line with the Directive but can only be achieved by amending CAR 2012. Initial cost/benefit analysis for this proposal over a 20 year appraisal period estimates the savings to be between £4.9m and £5.4m, with the average estimate around £5m. This change would only affect licensed workers as those undertaking NNLW are already only required to have medicals every 3 years.

Medical examinations are currently designed to detect disease early and to allow removal from further harm. This approach has limited value in relation to asbestos, as asbestos-related cancers have a latency effect and do not occur until many years after exposure. The only effective safeguard is to avoid or minimise all exposure to asbestos fibre. Any cases presenting now are associated with past cumulative causative higher exposure levels. Whilst in the past cases of asbestosis, a fibrosis of the lungs, might have benefited from being removed from further exposure, given the better current lower exposures asbestosis will be a thing of the past. Therefore, where medicals may give early diagnosis, this is of no benefit to the asbestos worker. The Directive does not explicitly explain how the requirement for medicals adds to worker protection. Independent expert medical advice confirms that reducing the frequency for licensed work and increasing the screening interval is unlikely to have an adverse effect on the risk of disease progression. The less frequent need for medicals would also lower costs to business and would not lower standards of health protection of workers who carry out the most high risk work.

HSE will explore the health and safety impacts of any changes to the regulations, taking account of medical, epidemiological, and scientific evidence, in consultation with stakeholders. The results of the evaluation will inform any proposals for regulatory change.

Sign-off For Post Implementation Review:

I have read the PIR and I am satisfied that it represents a fair and proportionate assessment of the impact of the policy.

Signed: Date:

Appendix 1: The Costs and Benefits of the Control of Asbestos Regulations 2012

1. This analysis describes the process undertaken to try to quantify and monetise the current costs and benefits of the Control of Asbestos Regulations 2012 (CAR 2012). The Better Regulation Framework Manual requires that, for high level Post Implementation Review such as this, the actual costs and benefits of the regulation are estimated, as far as is possible. This analysis therefore describes the steps taken in an attempt to complete this estimation, the barriers encountered and the results of the work undertaken.
2. This section of the Post Implementation Review follows the format described here:
   a. Approach and existing sources of evidence
   b. Methodology for collecting evidence on costs
   c. Issues encountered and approach taken as a result
   d. Results
   e. Conclusion

a) Approach and existing sources of evidence

3. The Better Regulation Framework Manual indicates that the PIR should assess the extent to which the effects anticipated in the original impact assessment (IA) actually occurred. This proved problematic in this instance, because the individual duties in CAR 2012 have come about in a piecemeal process over approximately 20 years, with some of the duties amended at different points. Most of the regulatory changes were accompanied by IAs, but there is not a definitive IA in place that captures all of the costs together.
4. We have examined the different IAs available and explored whether it would be possible to reconstruct a set of stand-alone estimates, but this proved not to be feasible. This was partly due to way the regulations have evolved, but we also had concerns that the evidence included in some of the IAs (particularly the oldest ones) would not be suitable to understand the current situation and would therefore be of limited usefulness. Some of this relates to changes in the way the businesses involved work and to technological changes, but some of it is about the nature of the cost estimates themselves.
5. We found that many of the costs were not estimated in a way that would be feasible to reassess at this point. An example of this is the 2002 IA produced to accompany the introduction of the Duty to Manage Asbestos.[1] Although this provided a thorough analysis, the evidence collected was not reliable enough to use in this PIR. A high-resource evaluation of the duty to manage asbestos was commissioned by HSE in 2011.[2] One of its objectives was to reassess the assumptions made in the IA about the costs and benefits of the duty. However, the evaluation found that collecting accurate information about costs in a way that could be compared with the IA and isolating the impact of the

[1] This IA is currently not available online, but can be provided on request.
[2] Available at: www.hse.gov.uk/research/rrpdf/rr783.pdf

duty were not possible. This was partly because the way the costs were calculated in the IA (directly relating them to the size of the property involved) was incompatible with what information on costs was available from dutyholders. We have taken this lesson into account in how we have gone about gathering cost information for this PIR.

6. Given these issues, the approach taken in this PIR is to concentrate on what the likely costs and benefits are going forward, and estimate the current and ongoing costs and benefits of complying with the requirements in the Regulations.

7. We note that there was a supporting IA for CAR 2012, but that IA examined a change in specific relation to Notifiable Non-Licensed work (NNLW). Although the whole set of regulations were re-drafted to include the change related to NNLW (rather than using amending legislation), the changes were quite specific and only about NNLW. Thus, the IA only captured the costs of this change and not the costs of the whole set of regulations. These costs were only of the additional requirements, starting from a position where those affected already had some duties. The way we have approached the costs here, which involved looking at the regulations as a whole, does not allow a comparison to assess the accuracy of the costs of the changes in the 2012 IA alone. Considering the scale of the costs and benefits involved here, we decided there was limited usefulness in trying to isolate the impact of those much smaller changes.

8. In addition to previous appraisals and evaluations, the evidence available to us also included administrative data (e.g. on the number of companies licensed to undertake high-risk work with asbestos and how many people they employ), published statistical data, as well as analysis performed by HSE epidemiologists using the HSE Mesothelioma Projections Model and HSE published research on the Costs to Britain of Work-Related Cancer,[3] which allowed us to estimate benefits. It was clear, however, that the main gap in the evidence was the current experience of those working with and managing asbestos, and so the external research undertaken was designed to address that gap.

b) Methodology for collecting evidence on costs

9. The approach to estimating benefits was relatively clear, being based on the use of the HSE Mesothelioma Projections Model and research on the Costs to Britain of Work-Related Cancer. However, it was apparent, based on the evidence from previous analysis (impact assessments and evaluations), that collecting the evidence needed for appropriate costs estimates would be very challenging.

10. One of the decisions taken was that we would use the majority of our resources on estimating the costs of the areas where the impact per dutyholder would be largest, because the ongoing duties under the regulations were most significant. This meant that we expended particularly high effort in collecting evidence for licensed work, and to an extent, NNLW. We still collected information about non-notifiable work and those with the Duty to Manage Asbestos. However, for those groups, we knew that the ongoing requirements for most dutyholders would be less significant and therefore less burdensome. For those with the Duty to Manage Asbestos there would have been larger costs when the duties came into force, but by now those are sunk costs (also, as mentioned earlier, there was a large-scale evaluation of the Duty to Manage Asbestos 5 years ago, closer to the time when the costs were incurred). Total ongoing costs for these two groups are estimated to be significant, but this is mainly due to the very large number of dutyholders.

11. The other initial decision made, based on lessons learnt from previous analysis, was that for licensed and NNLW it made more sense to gather information from those undertaking the work, rather than attempt to do so from those commissioning it. This was mainly because of the variation in the scale of the potential work, which would have made it much harder to extrapolate to the universe of projects requiring that kind of work and also because the price charged to those

[3] See: http://www.hse.gov.uk/research/rrhtm/rr1074.htm

commissioning work would also include some element of profit and other non-regulatory costs such as travel. We opted to gather evidence from firms that actually did the work, as they would have a wider view of what would be typical costs for the projects they did. They would also be able to provide us with estimates for overhead costs such as training and purchase of reusable equipment.

Methodological options considered

12. A number of options were considered for gathering the evidence required for the monetisation of the current costs of CAR 2012. The main possibilities considered are described here and the reason for the chosen method is detailed.

    a. Focus groups – as explained in Appendix 2, this was the method chosen to collect the qualitative evidence from dutyholders about the effectiveness of the Regulations. Such an approach would have been good for ensuring dutyholders understood the relevant costs for the post implementation review analysis and that all answers were on a consistent basis. However, 8 groups were required to ensure representative coverage across the different dutyholders and across the UK. These groups were set up to collect qualitative information about the effectiveness of the regulations, and a lot of territory needed to be covered there. It was not considered feasible by HSE social researchers to also cover costs in those same sessions to an appropriate level of detail. In order to include any questions about costs, all 8 groups would have had to be replicated which would have created a disproportionately large burden on the participating businesses. Also, a focus group/workshop setting was not considered to be the ideal method for trying to get a consensus view on the costs. Ideally, each group would have had to be reconvened a number of times to build a consensus (see option b below).

    b. A consensus-building approach – one method that has been used successfully by HSE in the past to estimate baseline costs uses an approach whereby a consensus is reached by dutyholders who are similar in size and activity. In order for this to work for CAR 2012, the dutyholders would be split as they were for the focus groups / workshops as described in the PIR Report and Appendix 2 but would have to be reconvened at least twice, (the first time for HSE to provide guidance and clarity on which costs we are looking for and how to go about estimating them, at which point the dutyholders go back to their business and estimate the costs of the regulations for their own business and then a second meeting to discuss these costs and try to reach a group consensus). HSE would then have to convene a parallel group who look at the estimates provided by the original group and challenge the estimates where appropriate. On top of the qualitative work this was thought to be a disproportionate burden on business, especially as the outcome of such an approach could not be guaranteed for the asbestos sectors. The consensus-building approach has been successful in the past for sectors where businesses are very similar in activity and size and employ dedicated health and safety managers; however, the asbestos sector has more variation in size, customer base and activities, and so a large number of separate groups would have had to be convened to arrive at a completely robust estimate, creating a large and disproportionate burden on business.

    c. On-line questionnaire – the information on the type of costs required is complex to explain online to dutyholders. If an online questionnaire was used then this would likely result in a lot of misunderstanding and a large range in the answers provided, due to different interpretations about what the question is asking for and what should be included. Such an approach would lead to estimates with very wide ranges and notable outliers.

    d. Telephone interviews – this would require external support due to the high resource level required to set up, complete, document and analyse a large number of telephone interviews. HSE would have to expend some effort in ensuring the external company understood exactly what costs would be required for this PIR, as well as the appropriate follow up questions to responses.

Preferred methodology for evidence gathering

13. For Licensed work, Notifiable Non-Licensed Work (NNLW) and Duty to Manage Asbestos, the method we judged would be most likely to deliver a successful outcome (while being proportionate in the effort it required from dutyholders) was to use the focus groups already set up for the qualitative work in order to introduce the concept of the costs we are interested in, and to request assistance from the participants, who then would answer a questionnaire in their own time. This methodology was selected as it included a combination of the best / most feasible features of the approaches considered, and similar approaches had worked very well in costs research for previous impact assessments looking at complex requirements in high-value sectors.

14. Following introduction and explanation in the focus groups, each participant was emailed a copy of a cost questionnaire for them to complete, with a deadline for completion of a couple of weeks. Several requests for extensions were received which were granted, and a chase up email was sent to all participants around three weeks later. This led to several more queries to which offers of help or to discuss the questionnaires were given. The responses were then collated and average costings estimated for each regulatory duty. These were then sent back to all of the focus group attendees to allow them to challenge the estimates.

15. For Non-notifiable work, it was not possible to convene a focus group. This is known to be a hard-to-reach group, partly because many in this group are self-employed or micro organisations (up to ten employees) and cannot easily spare the time to take part in such research. As such, an on-line survey was used to gather qualitative views from this group, so that they could voluntarily participate their own time. This ensured that a potentially large number of these dutyholders could be reached. People carrying out non-notifiable work with asbestos are not legally required to make contact with HSE, and so, unlike for other groups working with asbestos, HSE has limited contact information for them. The online survey was completed by 94 dutyholders, and led to a number of contacts who agreed to also take part in a telephone interview on costs. An external data collection specialist company, Peak Answers,[4] conducted the telephone interviews, using a question set designed by HSE. A total of 30 phone interviews were conducted. Peak Answers were briefed on the sort of costs that are relevant to the PIR and how to follow up any answers. The participants were sent the questions in advance so that they could prepare, and the interviewers at the external company were fully briefed on the questions to try to zero in on the right costings.

c) Issues encountered and approach taken as a result

16. We faced several problems in our collection of cost data, and there are a number of lessons to be learnt for the future from our use of the chosen approaches.

17. In the case of the approach chosen to gather costs information from the licensed work, NNLW and Duty to Manage Asbestos groups, the biggest problem was that we faced quite serious issues with engagement and participation. Our approach relied on the focus group participants continuing to engage with the process outside of the focus group and filling in questionnaires and providing feedback on estimates. Focus group participants expressed willingness to help during the focus groups, but very few sent back the questionnaire. A total of 55 questionnaires were sent out to the groups for licensed work, NNLW and those who have the Duty to Manage Asbestos, but only 7 were returned (5 by participants in the licensed group and 2 by participants in the Duty to Manage Asbestos group). We expended significant effort in encouraging other participants to return their questionnaires, but with no results.

18. For the licensed work group, as a way to mitigate the consequences of the low response rate, we took the few responses received and estimated averages from them and sent them to all the focus groups participants, so that they could challenge the estimates if they thought they did not feel

[4] See more information on their website at: http://www.peakanswers.co.uk/

reasonable. Only 3 responses to this verification were received, but the ones that were received on the whole, agreed with the estimates.

19. We also made the best use possible of the responses we did get by following up successfully any responses that seemed unusual with the respondents themselves.

20. We considered whether it would be possible to recruit other participants, but the existing ones were part of a small group of relevant businesses and already those who had offered to participate in the research. Furthermore, there was not a great deal of time to be able to try a different approach.

21. When we designed the research programme to be able to obtain information on costs for this PIR, we made a judgment based on proportionality of what it was reasonable to ask of industry. As mentioned above, this was informed by research undertaken for previous impact assessments looking at complex requirements in high-value sectors like onshore and offshore major hazards, where processes not very dissimilar to this one have worked well. The lesson from the way the process worked in practice was that industry did not, on the whole, feel that what we were asking of them in terms of costings was proportionate. Potential ways to resolve this problem in the future would be to provide incentives (possibly monetary) to research participants, and to use sets of questions on costs that are less detailed (potentially asking different groups of respondents about different types of costs), to minimise burden and therefore make participation more likely. More formal piloting of questionnaires would also be useful.

22. Regarding NNLW, as mentioned earlier, no returns were received from the group. Despite several attempts and requests of research participants, we were unable to obtain any information on the cost of only that type of work.

23. However, one of the insights obtained from the focus groups was that there is a lot of overlap between those two types of work. It was clear that a large proportion of the licence holders also undertake NNLW work, and so it is probable that the answers we received, particularly those where estimates were provided per annum or per employee, will include costs that covers all the work they do, both licensed work and NNLW (e.g. training of employees, for which the training required to do licensed work will be more than enough to cover the requirements to do NNLW). Furthermore, the data gathered in HSE's notifications databases indicates that it's mainly licence holders who are also notifying NNLW.

24. Only two questionnaires were received from dutyholders with a Duty to Manage Asbestos, despite repeated attempts to obtain more information. Fewer mitigation actions were taken for this group, as a high-resource evaluation of this set of requirements was already undertaken in 2011.

25. A total of 30 telephone interviews were conducted for the non-notifiable group, and it was found that for half of these respondents, they either did not knowingly work with asbestos and / or they were not aware of any duties under the regulations. This was useful, in that it gave an indication that a sizeable proportion of the construction industry is not currently incurring costs from working with asbestos, which was not unexpected by HSE policy experts. However, the cost information from those respondents who did do non-notifiable work with asbestos turned out to be fairly limited.

26. Given the issues faced, as described above, we did not consider the information we were able to gather, even after a great deal of effort, was robust enough to allow us to make detailed cost estimates. However, since we have been able to produce a solid estimate of the benefits arising from the reduction of exposures that results from current working practices (which are required in the regulations), we felt it was important to provide an estimate of the scale of the costs of those requirements, in order to allow a judgment of whether the benefits justify the costs. We have therefore used the information we were able to gather and, in some cases combining it with advice from sector experts to enable us to fill in the gaps, we have produced a broad estimate of the scale of the costs.

27. This estimate has been arrived at using assumptions that we were confident would not underestimate the costs and, as such, represents an upper bound of what we think compliance with the regulation's requirements might be costing businesses.

28. The total estimate is made up of separate estimates for combined licensed work and NNLW, for non-notifiable work and for the Duty to Manage Asbestos. This is due to the very different nature of the duties for those groups. To calculate those we have gone into some detail (particularly for licensed work + NNLW, where, for transparency, we provide the detailed estimates given to us by dutyholders), which we present here, but we acknowledge that the total result does not have the high level of accuracy that the detailed assumptions might suggest. Therefore, while we report the total calculated costs in the next sections, when reporting these costs in the main PIR report and in the summary section, we will use orders of magnitude.
29. For licensed work and NNLW, we have opted for a combined estimate for the reasons described in paragraph 23. We have used the costs provided for licensed work and, for those requirements that would also apply to NNLW, we have considered whether any per annum or per employee costs provided would also include any NNLW that the firm would do. For costs that were provided on a 'per job' basis, we have applied that cost to the number of NNLW projects. For these, we have opted for the lower end of the range of costs provided -in some cases with some adjustments-, due to the very different nature of the kinds of jobs that would fall in each category (NNLW would include tasks such as drilling holes in asbestos insulating board, removing a single (screwed-in) asbestos insulating board ceiling tile, or removing a door with asbestos insulating board fireproofing, while licensed work will tend to be a lot more substantial). There might be a small number of firms undertaking purely NNLW; however, we were unable to obtain any information to be able to estimate costs specifically for them. We consider that the methodology described above, which will probably overestimate any 'per job' costs for NNLW, should compensate this underestimate.
30. There are good reasons to consider that extrapolating the costs reported will overestimate total costs in the sector. The main is that the businesses that participated in the research were much larger than the average for the sector (those who responded employed an average of 47 workers, while the average for all licensed firms is 5 workers). Many of the costs reported, particularly those that involve management and assurance activities, will be higher than average. This was confirmed by consultation with policy sector experts, who additionally pointed out that some of the costs reported were potentially not directly linked to regulatory requirements.
31. For non-notifiable work and the current costs of the Duty to Manage Asbestos we drew from the limited information provided as much as possible, and complemented it with assumptions informed by existing evidence in IAs and the Duty to Manage Asbestos evaluation, statistical data, ad hoc research (e.g. internet research on the cost of online asbestos awareness courses) and judgment of sector experts. We opted to make generous assumptions in order to ensure we were not underestimating the costs.

d) Results

A note on the appraisal period and adjustments to the costs

32. When estimating benefits of interventions dealing with exposure to asbestos, the latency periods involved mean that the usual appraisal period is 100 years. This is required to allow all the benefits of reduced exposures to manifest. On the advice of our epidemiologists, we take that approach here.
33. This means that we have had to estimate the costs over the same period. We recognise that this introduces even more uncertainty to our costs. We believe is that it is likely that costs per job will tend to reduce in the future, as technological developments mean it will be easier and cheaper to deal with asbestos. We have, however, not introduced this assumption into our calculations, and have kept our unit costs constant over the appraisal period, simply extending the current annual ongoing costs over the future.

34. What we have adjusted our annual costs by, however, is the expected reduction in numbers of jobs required due to the year-on-year decrease in the stock of asbestos-containing materials. The prohibition on supply and use of asbestos mean that, as buildings reach the end of their life and are demolished, and as asbestos-containing materials deteriorate and the asbestos needs to be removed, any replacements will not contain asbestos. This is an assumption that is included in our Mesothelioma Projections Model, and we have applied the same schedule of attrition rates (starting at 1% on year 1 and increasing at a regular rate up to 4% on year 50, remaining stable thereafter) as is used there.

General assumptions

35. Administrative data held by HSE provides information on the numbers of licence holders currently, the annual number of jobs, both licensed and NNLW, as well as the total number of employees working with asbestos in licence holders.

36. The total number of licences as of September 2016 is 434, which include 25 scaffold licences, 16 maintenance licences and 2 supervisory licences. The cost estimates below have not been split by type of licence and so total costs are best reported as an average for all types of licence.

37. Using the last three years to create an average, the estimated number of licensed jobs a year is around 37,500. Using this data, the average number of jobs per licensee is around 86 jobs.

38. Additionally, in the latest year, HSE received approximately 28,400 notifications for NNLW jobs.

39. The number of employees working with asbestos in licensed firms is also a key input to the total costs, for estimates that are reported on a per employee basis. Our latest data indicates some 2,100 employees working with asbestos, an average of approximately 5 per firm.

40. For the purposes of putting a scale on the costs, HSE has assumed that there is 100% compliance with the regulations. However, it is known that this is not the case. Appendix 4 sets out the enforcement data for CAR2012. Notably in this appendix, in 2014/15, HSE prosecuted 18 cases under CAR 2012 (3% of all HSE cases), with conviction achieved in 16 of those cases. HSE also prosecuted 45 offences under CAR 2012, resulting in 34 convictions. If any estimate of actual compliance was to be made, significant assumptions would be required to do this, because HSE does not inspect all jobs involving asbestos. The compliance data is a snap shot in time, but may not be representative across the industry. Therefore we have used the conservative assumption of 100% compliance.

Costs:

Licensed work and NNLW

41. As explained in section (c), the data collected from business was not sufficient to allow us to calculate a robust detailed cost estimate. For transparency, this section sets out in detail how the information received was applied to create a combined cost estimate for licensed work and NNLW, but this is reported in terms of orders of magnitude when concluding on costs.

42. The 5 questionnaires that were returned included responses from companies of various sizes and types. For instance, one reply came from an arms-length body of a local authority, which seems to have had have higher overheads than a private sector operation.

43. The average costs provided in the questionnaires are reported for each regulation below. It is important to note that these regulations are in place to enable the controlled removal of asbestos, which is done on a commercial basis. Therefore, although the regulations put a cost on the licence holders when they are removing asbestos, this is passed onto their clients. So the ultimate cost of the regulations is passed to those who have commissioned the removal of asbestos. This is frequently the owners of rented accommodation, including public sector organisations, private landlords, local authorities and domestic clients.

44. We note, as mentioned earlier, that the companies who responded to our questionnaire reported on average some 10 times the average number of employees (47, when the average is approximately 5), which is one of the reasons we consider it very likely the costs below are overestimates for the sector as a whole.

Regulation 5

45. This regulation requires employers to identify the presence of asbestos and its type and condition before any building, maintenance, demolition or other work, liable to disturb asbestos, begins. It also sets out the requirement to arrange a survey if existing information on the presence of asbestos in the premises is incomplete or appears unreliable.

46. The range of costs provided per job to identify asbestos is from £50 per job (2 hours of work at £25 an hour) up to £140 (4 hours of work at £35 per hour). We will use a best estimate of **£95 per job.** Assuming 37,500 licensed jobs a year, the total cost is **around £3.6million per annum for licensed work**.

47. Considering the nature of the jobs covered under NNLW, sector experts in HSE have advised that the costs of Regulation 5 for those will be much lower than for licensed work. We have estimated 15 minutes per job at £25 an hour. Assuming 28,400 NNLW jobs a year, this leads to costs of **£178 thousand per annum for NNLW**.

Regulation 6

48. This regulation requires employers to carry out a risk assessment to identify the risks of exposure to asbestos. It sets out the requirement to record any significant findings and put in place steps to prevent, or reduce, exposure to employees.

49. The average cost of writing a risk assessment for working with asbestos was estimated to be between £140 (4 hours at £35 an hour) and £210 (6 hours at £35 per hour). The average cost per job is therefore estimated **to be £175**. No disagreement with this estimate arose during verification. Assuming 37,500 jobs a year then the total cost to this sector of this regulation is estimated to have a likely **cost of £6.6 million per annum for licensed work**.

50. Considering the nature of the jobs covered under NNLW, sector experts in HSE have advised that the costs of Regulation 6 for those will be much lower than for licensed work. We have estimated 15 minutes per job at £35 an hour. Assuming 28,400 NNLW jobs a year, this leads to costs of **£249 thousand per annum for NNLW**.

51. Respondents reported there would be other costs associated with regulation 5 and regulation 6 for licensed work, (but no further details of the type of costs were obtained) and these ranged between £140 per job (4 hours at £35 per hour) and £160 per job (4 hours at £40 per hour). The average estimate is therefore **£150 per job**. No disagreement with this estimate arose during the verification exercise. Assuming 37,500 jobs per year then the total cost is **estimated to be £5.6m per annum**. Based on advice from HSE sector experts, we would not expect there to be extra costs for NNLW.

Regulation 7

52. This regulation requires employers to prepare a written plan before work on asbestos is carried out, including details of the work, and the appropriate actions to control risk and prevent harm.

53. The costs of plans of work can be split into cash costs and staff costs. Respondents reported that cash costs are around £350 per job (no breakdown of this estimate was provided). During verification it was offered that cash costs could be more like £450 per job. In the absence of better information, we have taken the average of the two estimates and use an estimate of cost per job pf **around £400**. Assuming 37,500 jobs per annum, the total cost is estimated to **be £15 million for licensed work**.

54. Staff costs range from £120 per job (5 hours per job at £23 per hour) to £250 per job (no breakdown of this estimate was provided). The average staff costs are **therefore £190 per job.** The total costs for 37,500 jobs are estimated to be **around £6.9 million per annum for licensed work**.

55. No issues were noted during the verification of these estimates.

56. Considering the nature of the jobs covered under NNLW, sector experts in HSE have advised that the costs of Regulation 7 for those will be much lower than for licensed work (including because those jobs will be more routine, and businesses are likely to have sample plans available), and cash costs are not expected, only staff costs. We have estimated 15 minutes per job, at £23 an hour. Assuming 28,400 NNLW jobs a year, this leads to costs of **£163,000 per annum for NNLW**.

Regulation 18

57. This regulation requires employers to make sure that areas where asbestos work is being carried out are separated, clearly marked, and restricted to those required to work in the area. It also requires the employer to provide suitable facilities for employees to eat and drink.

58. The cost of identifying and demarcating areas ranges from £20 (1 hour at £20 per hour) to £240 (7 hours at £35 per hour). The best estimate is therefore **£130 per job.** The total costs for 37,500 jobs are estimated to be **£4.9million for licensed work**.

59. Respondents also identified costs of around £1000 per job for barriers and fencing. The total costs for 37,500 jobs are estimated to be £37.5 million for licensed work.

60. No issues were identified during the verification of these estimates.

61. Considering the nature of the jobs covered under NNLW, sector experts in HSE have advised that the costs of Regulation 18 for those will be much lower than for licensed work. The lower end of the range of staff cost for licensed work (1 hour at £20 per hour) was considered to be reasonable for the typical NNLW job, and no additional costs for barriers and fencing were expected. We have therefore estimated 15 minutes per job, at £23 an hour. Assuming 28,400 NNLW jobs a year, this leads to costs of **£163,000 per annum for NNLW**.

Regulation 8

62. This regulation requires employers to obtain a licence from HSE before they can carry out any licensable work with asbestos.

63. The one-off cash cost of a licence is £3,365 as of September 2016.

64. Respondents estimated that the staff costs of applying for the licence for the first time are between £2,000 and £4,000 (100 hours at £40 per hour) with a best estimate **of £3,000.** Very similar estimates were made by respondents for the staff costs of renewing a licence. These were estimated to be between £1,800 (40 hours at £45 per hour) and £4,200 (the higher end was a more complex estimate, including different amounts of time spent on the task by a number of people). The best estimate is therefore **£3,000** every time the licence is renewed**.** No issues were raised with these estimates during the verification process.

65. On average, licences are renewed every 3 years on average, and for simplicity, we will assume that the total number of licence holders will remain constant, and any firm that leaves the market and doesn't renew their licence will be compensated by a new business entering and getting their licence for the first time. We do expect the total number of licences to decrease as the stock of asbestos-containing materials decreases, but this will be accounted for by the adjustment described in paragraph 34.

66. With a total of 434 licences at present, we can assume 145 licences will renew or be issued for the first time every year. Thus, the yearly cash costs of this are **£487 thousand** per annum. Staff costs for the renewal process are estimated to be around **£434 thousand per annum**.

67. As explained in the qualitative report in Appendix 2, the cost of the licence was raised as an issue by some of the focus group respondents. It was suggested the cost of the licence might be high for small companies that undertake licensable work only infrequently.

68. This cost is not applicable to NNLW, as licences are, by definition, not required.

Regulation 9 – Notification of work with asbestos

69. This regulation requires employers to notify the appropriate enforcing authority of proposed work which is either licensable (always notifiable) or NNLW. It also outlines the requirements to notify any material change which might affect the particulars of the original notification (this is particularly important for licensable work).

70. Respondents estimated that the staff costs of a notification are between £20 (1 hour at £20 an hour) and £50 (no breakdown of this estimate was provided). Average staff costs of a notification are therefore estimated **at £35 per notification**. Advice by HSE sector experts is that this is a reasonable cost for NNLW notifications as well. HSE receives 37,500 notifications for licensed work and 28,400 for NNLW. The cost of notifications for licensed work and NNLW is estimated to **be around £2.3m per annum.**

71. No issues were identified with these estimates during the verification process.

Regulation 10 – Information, instruction and training

72. This regulation requires employers to make sure that anyone liable to disturb asbestos during their work, or who supervises such employees, receives the correct level of information, instruction and training to enable them to carry out their work safely and competently and without risk to themselves or others.

73. Respondents estimated the cost of a training needs analysis to be between £75 per employee and £250 per employee. The average cost is therefore estimated **at £160 per employee**. Given that the total number of employees in the industry is 2,072, the total cost is estimated to **be £340,000 per** annum.

74. No issues were noted with this estimate during the verification.

75. Respondents initially estimated cash and staff costs of external and in-house asbestos training on a per annum basis. However, during the verification respondents agreed that the cash and staff costs of training would be better calculated per operative and as a single figure.

76. For external training, this was estimated at **around £360 per operative per annum.** Using the figure of 2,072 operatives in the industry, the total costs per annum are estimated to be **around £750,000.**

77. For in house training, this was estimated at **around £860 per operative per annum.** Using the figure of 2,072 operatives in the industry, the total costs per annum are estimated to be **around £1.8m**.

78. Respondents estimated that the staff costs of employees providing information to other employees about asbestos is between £70 per annum (2 hours at £35 an hour) and £200 per annum (8 hours at £25 per hour). The average of these costs is **£135 per annum**. No comments were received on this cost during the verification process. The total per annum costs are estimated using the total number of licence holders of 434, then the total estimated cost per annum of providing information to other employees **is about £60,000.**

79. The costs of information, instruction and training are considered to cover both licensable work and NNLW, as whatever training is required to be able to undertake the former, will be enough to undertake the latter.

Regulation 11 to 14 – Prevention or reduction of exposure to asbestos, use of control measures, maintenance of control measures and provision and cleaning of protective equipment

80. Regulation 11 – this regulation requires employers to prevent employees being exposed to asbestos or, if this is not possible, to put in place the measures and controls necessary to reduce exposure to as low as reasonably practicable.

81. Regulation 12 - This regulation requires employers to put procedures in place to make sure employees use and apply control measures. It also requires the employees to make full and proper use of those measures.

82. Regulation 13 - This regulation requires employers to carry out regular inspection and maintenance of control measures to make sure they are kept in good efficient working order. It also requires a competent person to test and examine exhaust ventilation and RPE at suitable intervals and for records of examinations and tests to be kept for at least five years.

83. Regulation 14 - This regulation requires employers to provide employees with adequate personal protective clothing appropriate for the work they will be doing. It also sets out the requirement for proper cleaning, maintenance and storage of the clothing.

84. The type of control measures that might be used are dust suppression techniques, extraction equipment, using enclosures, hygiene facilities (showers to decontaminate), using respiratory protective equipment (RPE) and protective clothing. Control measures can also include keeping the workplace clean (the use of 'H' vacuum cleaners) and eating, drinking and smoking in designated areas only.

85. Respondents estimated that the one-off cash costs of control measures is between £1,300 and £5,000. The average one-off cash cost is therefore estimated **to be £3,150**. Respondents estimated that the one off staff costs are estimated to be between £200 and £3,640. The average one-off staff cost is therefore **estimated to be £1,920**. It is assumed that current licence holders will have already incurred these one-off costs and so they are not relevant for current licence holders. New licence holders will enter the market throughout the appraisal period. However, the yearly number is expected to be very small, and so these costs would be negligible in comparison to others in these estimates and will not be included.

86. Respondents estimated that on-going cash costs of control measures are between £950 per annum and £45,000 per annum. This large range was investigated, and it was found the £45,000 estimate has been based on actual expenditure over the year. Due to such a small number of respondents it is not really possible to say whether the range is due to different type of licence holders having different compliance costs, or under estimates. The mid point of the range is used, being an average cost which allows for the fact some of the businesses might have higher costs while some might have much lower ones. The average on-going cash costs of the control measures are **estimated to be** £23,000. There is some uncertainty about this estimate despite the verification process. However, if extrapolated over all 434 licence holders, the total cost per annum of this provision is estimated **to be £10m.** These costs would cover both licensed work and NNLW undertaken by the firm.

87. Respondents estimated that on-going staff costs would be between £2,000 per annum (best estimate) and £4,000 (50 hours a year at £79 per hour). The average on-going staff costs are estimated **to be £3,000 per annum**. No issues were noted with this estimate during the verification. Extrapolated over all current licence holders, this gives total costs per annum of **£1.3m.** These costs would cover both licensed work and NNLW undertaken by the firm.

88. Respondents estimated that the cash costs of inspecting control measures is around **£5,000 per annum** (no breakdown provided). No issues were noted with this estimate during the verification. If extrapolated across all licence holders, the total cost per annum is **estimated to be £2.2m**. These costs would cover both licensed work and NNLW undertaken by the firm.

89. Respondents estimated that the staff costs of inspecting control measures per annum is between £160 (8 hours at £20 per annum) and £46,700 (2,000 hours at various wage rates). Again, this large range was queried but the top end of the range is based on actual hours worked in one business. The range could be due to valid differences in the type of business and the type of work done, but with a small sample it is hard to say for sure. The validation process is designed to remove some of the uncertainty around the range, and no issues were noted with the range during that verification. Therefore, an average staff cost of **£23,400 per annum** is assumed. Extrapolated across all licence holders gives an estimated total cost **of £10.2m.** These costs would cover both licensed work and NNLW undertaken by the firm.

90. Respondents estimated that the cash costs of a competent person examining exhausts is between £200 (best estimate) and £3,000 (best estimate). Average cost per annum is **estimated to be £1,600**. No issues with these estimates were noted during the verification. Extrapolated across all licence holders, total cost estimate is **£700 thousand per annum**. These costs would cover both licensed work and NNLW undertaken by the firm.

91. Estimates of the staff costs of a competent person examining exhausts range between £120 per annum (best estimate) and £3,400 (144 hours at £23 per hour). During the verification the low end of the range was thought to be too low by one respondent but two respondents to the verification agreed with the range. With such a small sample it is difficult to know whether the difference is due to differences in the business and the type of activities they undertake. An average staff cost per annum **of £1,800** is estimated from the range, but there is some uncertainty in the estimate due to the disagreement at verification. Extrapolated across all licence holders, this gives a total cost estimate of **£760,000 per annum.** These costs would cover both licensed work and NNLW undertaken by the firm.

92. Respondents estimated that the cash costs of keeping records of examinations is around **£960 per annum** (£80 a month). Extrapolated over all licence holders gives a cost per **annum of £420,000.** These costs would cover both licensed work and NNLW undertaken by the firm.

93. Respondents estimated that the staff costs of keeping records of examinations is between £80 per annum (4 hours at £20 an hour) and £1,000 (best estimate). No issues with these estimates were noted during the verification. Extrapolated across all licence holders gives total per annum costs **of £230,000**. These costs would cover both licensed work and NNLW undertaken by the firm.

94. Respondents estimated that the cash costs of PPE are between £200 and £4,500 per employee. During the verification this range was challenged by one respondent who thought the low end of the range was too low for the total cost per employee per annum. However, the other two respondents to the verification process agreed with the range. Due to the small sample it is not possible to tell whether the range is due to differences in the licence holders, the reason they have a licence and the activities they do. Therefore an average cost of PPE per employee per year **is £2,400** but there is uncertainty in the estimate due to the disagreements at verification. The estimate was discussed with HSE experts. They explained that PPE for licensed work can be very costly. Licensed workers usually wear 2 disposable tyvex type full hooded overalls per 4 hour shift. So if they do more than 1 shift a day then that is at least 4 overalls per worker per day. These overalls are thrown away. They might also wear rubber boots which might be reusable, gloves, disposable half-masks for set up and dismantling. For enclosure work would have a power assisted full face respirator. The per annum cost of £2,400 was not thought to be unreasonable. Using the number of employees in the industry, the total cost for all employees per annum **is estimated to be £4.9m per annum.** These costs are expected to cover PPE that would be used both for licensed work and NNLW undertaken by the firm.

95. Respondents estimated that the staff costs of PPE are between £850 per annum (1 hour a week at £16 an hour) and £5,500 (32 hours a week at £35 per hour). Average staff costs of PPE are therefore estimated to **be £3,200.** No issues were noted during the verification. Extrapolated across all licence holders gives an estimated total **cost of £1.4m.** These costs are expected to cover PPE that would be used both for licensed work and NNLW undertaken by the firm.

96. Respondents estimated that the cash costs of cleaning PPE are between zero and £15,000 (best estimate). The range was investigated and one respondent said that they don't clean PPE at all and couldn't understand why any dutyholder would. However, this is a regulatory provision and the other respondents saw no issues with the range during the verification and so the average cost of cleaning PPE is estimated to **be £7,500 per annum.** Extrapolated across all 434 licence holders gives an annual cost **of £3.3m.** These costs are expected to cover PPE that would be used both for licensed work and NNLW undertaken by the firm.
97. Respondents estimated that the staff costs of cleaning PPE are around **£160 per annum** (being 8 hours at £20 an hour). No issues were noted with this estimated during the verification and total cost estimates per annum for all licence holders is estimated to **be £70,000.** These costs are expected to cover PPE that would be used both for licensed work and NNLW undertaken by the firm.
98. It is possible that there is some overlap between the costs of control measures and the costs of PPE. If so, this will lead to an over estimate of the costs. The costs are presented in total in terms of orders of magnitude, which captures such uncertainties with these estimates.

Regulation 16, 17 and 23 – Duty to prevent the spread or reduce the spread of asbestos, cleanliness of premises and plant and washing and changing machines

99. Regulation 16 requires employers to prevent or reduce the spread of asbestos anywhere work is being carried out under their control.
100. Regulation 17 requires employers to make sure that work areas, plant and equipment used for asbestos work are kept clean. It also requires the employer to make sure the area is thoroughly cleaned after work is finished.
101. Regulation 23 requires employers to provide suitable and sufficient washing, changing and storage facilities for employees, and sets out the specific requirements for hygiene facilities for licensable work.
102. Respondents estimated that the cost of using work methods that reduce the risk of disturbance are approximately £600 cash costs per annum (no breakdown provided) and £600 staff costs per annum (no breakdown provided). Respondents estimated that the cost of keeping work areas clean are around £100 cash costs and £500 staff costs. No issues were noted with these estimated during the verification. Extrapolating all these costs across the total number of licence holders, the cost impacts are estimated to be **around £780,000**. These costs would cover both licensed work and NNLW undertaken by the firm.
103. Respondents estimated that the cash cost of providing washing and changing facilities to be between £250 and £1,200. Average cost **estimate is £730 per annum**. No issues were identified with this estimate during the verification process. Extrapolating all these costs across the total number of licence holders, the cost impacts are estimated to be **around £310 thousand**. These costs would cover both licensed work and NNLW undertaken by the firm.
104. It is possible that there is some overlap between these costs and those for control measures in paragraphs 80 to 98 above. If so, then this will lead to an over estimate of costs. The costs are presented in total in terms of orders of magnitude, which captures such uncertainties with these estimates.

Regulation 19 and 20 – air monitoring and standards for testing and site clearance certification

105. Regulation 19 requires employers to arrange regular monitoring of airborne asbestos fibres and keep records of the results. It sets out how long the records should be kept and that they should be made available to employees or the regulator as required.
106. Regulation 20 requires employers performing their own air testing to do it in a way that meets the criteria as set out in ISO 17025. It also requires employers to make sure that any person they

engage to perform asbestos air testing and site clearance is competent and accredited by the appropriate accreditation body.

107. Respondents have estimated that the annual cash cost of monitoring the exposure of employees to airborne fibres is **around £450**. Respondents also estimated that the staff cost of monitoring airborne fibres is between around £4,900 and £9,000 per annum. No issues were noted with this range during the verification and so an average cost has been used of **£7,000 per annum**. Extrapolated across all licence holders, the total cost of the monitoring of fibres is estimated to be **around £3.2m**.

108. Respondents estimated that the cash costs of engaging someone to test the air is between £250 per job and £560 per job. The average cash cost is therefore estimated to be around £400 per job. Extrapolated over the industry using the number of licensed jobs of 37,500 the total costs are estimated to be **£15.2m**.

109. Respondents estimated that the staff costs of engaging someone to test the air is around £17 per test. Assuming that the tests are performed on a per job basis too, the total costs per annum are estima**ted to be £640,000**. No issues were noted during the verification.

110. This requirement will be mainly relevant for licensed work, and not for NNLW.

Regulation 21 – standards for analysis

111. This regulation requires employers performing their own analysis of material to check for asbestos in a way that meets the criteria set out in ISO 17025. It also requires employers to make sure any person they engage to perform analysis is accredited to ISO standard by the appropriate body.

112. Respondents have estimated that the total cash costs are between £10 and £25 per job. Average cost estimate is around £18 per job. HSE sector experts advised that this estimate was also reasonable for NNLW. Extrapolated by the number of licensed and NNLW jobs, this gives a total cost **estimate of around £1.2m.** Respondents have also provided staff cost estimates of around £90 per job (4 hours at £23 an hour), which was also deemed a reasonable estimate for NNLW jobs. When extrapolated by the number of licensed and NNLW jobs, this gives a total cost of **£5.9m in total per annum**.

113. No issues were noted during the verification of these estimates.

Regulation 22 – Health records and medical surveillance

114. The regulation requires employers to arrange appropriate medical examinations for any employees who carry out licensable work or notifiable non-licensable work. It also sets out what health records employers must keep and how long.

115. Respondents estimated that the cash costs of maintaining a health record for each employee is between £250 and £300 per annum (no breakdown of the costs were provided). The average estimate **is £280 per employee per annum**. No issues were noted with these estimates at the verification. Extrapolated by the number of employees in the industry, total costs are estimated to be £570 thousand. These costs would cover both licensed work and NNLW undertaken by the firm.

116. Respondents estimated that the staff costs of maintaining a health record for each employee is between £240 per annum (16 hours a year at £15 an hour) and £1,820 per annum (1 hour a week at £35 per hour). Average cost estimate is therefore around **£1,000 per annum per employee.** No issues were noted with these estimates during the limited verification**.** Extrapolating across the number of employees in the industry the average cost **estimates is £2.1m**. These costs would cover both licensed work and NNLW undertaken by the firm.

117. Respondents estimate that the cash cost of a medical examination per employee is between £85 per person and £180 per person. Average cash cost estimate is therefore **around £130 per person**. No issues were noted with these estimates during the verification. Extrapolating across the

number of operatives employed in the industry, total costs per annum are estimated **to be £270 thousand**. These costs would cover both licensed work and NNLW undertaken by the firm.

118. Respondents estimate that the staff cost of a medical examination is between £40 (2 hours at £19 an hour) and £100 (best estimate). The average staff costs of a medical examination are therefore estimated **to be £70 per person** per annum. No issues were noted with these estimates during the verification. Extrapolating based on number of operatives, gives a total cost per annum of **£150 thousand**. These costs would cover both licensed work and NNLW undertaken by the firm.

Regulation 24 – storage, distribution and labelling of raw asbestos and asbestos waste

119. This regulation requires employers to make sure that asbestos and asbestos waste is properly packaged, labelled, stored and transported.

120. Respondents estimate that the cash cost of ensuring asbestos is properly packed, labelled, stored and transported is between £1,000 and £1,400 per job. During the verification process one respondent suggested the average costs could be lower, but it depends on the nature of the waste. Average costs are therefore calculated as **being £1,200 per job**. Extrapolated over the number of jobs, **total costs per annum are estimated to be £45m for licensed work.** Considering the nature of the jobs covered under NNLW, sector experts in HSE have advised that the per job costs of Regulation 24 for those will be much lower than for licensed work. They will typically require a single bag with labels. We will estimate a cost per job of 10% that of licensed work, £120 per job. Extrapolated over the number of jobs, **total costs per annum are estimated to be £3.4m for licensed work.**

121. Respondents estimate that the staff costs of ensuring asbestos is properly packed, labelled, stored and transported are approximately £2,400 per annum. Extrapolated using total number of licence holders, total costs are estimated **to be £1m.** These costs would cover both licensed work and NNLW undertaken by the firm.

122. Respondents estimate that the cost of any other costs will be between £80 and £3,000. The average estimate is therefore **£1,500 per annum**. Extrapolated using total number of licence holders, total costs are estimated **to be £670,000.** These costs would cover both licensed work and NNLW undertaken by the firm.

123. No issues were identified during the verification process.

Total costs of licensed work and NNLW

124. Presented above is the estimated cost of each regulation, as provided and verified by a limited number of respondents for licensed work, presented firstly as either the per annum cost, the per job cost or the per employee costs. These have then all been converted to total costs for the industry per annum by extrapolating by the number of licence holders, the number of notifications of licensed work (and therefore jobs) and the estimated number of employees in the industry. These costs have also been used to estimate the costs of NNLW.

125. Summing together all the totals gives an estimate of the total cost of licensed work and NNLW of between £150m and £300m with a midpoint of £225m per annum.

126. As described earlier, we consider that the small number of respondents, as well as their large size in comparison to the average for the industry, does not allow us to consider this a robust detailed estimate for licensed work and NNLW as a whole. We consider this provides **an indication of the potential scale of the costs, which we expect to be at most in the low hundreds of millions of pounds per annum**.

127. It is important to note that whatever the costs of the regulations, they allow the licence holders to operate a profitable business. The regulatory costs are part of their business costs and are passed onto their customers. Ultimately then, the cost of the CAR2012 regulations for removal of licensed work falls on a range of stakeholders, from public sector organisations who own public buildings that

need asbestos removed, to domestic clients who need asbestos removed, to other businesses that need asbestos to be removed from their buildings.

Non-notifiable work

128. Examples of what non-notifiable work can include can be found on the HSE website.[5] It can include, for instance, cleaning up small quantities of loose/fine debris containing asbestos-containing material dust (where the work is sporadic and of low intensity, the control limit will not be exceeded and it is short duration work), or drilling of textured decorative coatings for installation of fixtures/fittings.

129. Thirty telephone interviews of a sample of workers from the construction industry, who either volunteered via the survey (see Annex 2) or were recruited over the phone, were conducted by Peak Answers, an external recruitment agency.

130. Of the 30 responses received, half said they had no duties under CAR 2012 and so did not report any costs. The answers were a mix of respondents who said they walked away if asbestos was found to be present and did no further work on the building until the asbestos was removed by a licensed contractor; and respondents who said they were not aware of their regulatory responsibilities.

131. The other half in the sample said they did work with asbestos on occasion and did undertake regulatory duties as a result. The costs provided mainly relate to drafting a risk assessment, training costs and PPE. This was a very hard to reach group and they generally cannot spare the time to answer detailed cost questions. Thus, some of the answers received are likely to present only a partial picture of regulatory costs. Another issue with this group is that compliance appears to be variable, and so part of the reason for the wide range in costs is due to this misunderstanding of compliance obligations (see Appendix 2 for further details).

132. As explained in section (c), the data collected from the interviews was not sufficient to allow us to calculate a robust detailed cost estimate. To calculate a broad estimate we drew from the limited information provided as much as possible, and complemented it with assumptions informed by existing evidence in IAs, statistical data, ad hoc research and judgment of sector experts. We opted to make generous assumptions in order to ensure we were not underestimating the costs. For transparency, this section sets out these calculations in detail, but this is reported in terms of orders of magnitude when concluding on costs.

133. The 50-50 split between those construction companies that work with asbestos and those who do not was felt to be reasonable by HSE sector experts. According to the Business Population Estimates 2015,[6] there are around 956,000 businesses in construction. Using this 50 – 50 split, we will assume that approximately half of these businesses in the construction sector will be undertaking non-notifiable work occasionally, so around 480,000.

134. The main costs identified for this group that would apply across the board were the following:

135. Risk Assessments: Undertaking and writing up risk assessments. The best estimate from the information provided by the telephone interviews was £7 per risk assessment per job. HSE experts confirmed that assessing the risk of asbestos will generally be just one part of the general risk assessment for a construction project and so the cost provided seems reasonable for a cost per project. Additionally, in the vast majority of cases businesses will not have to do a risk assessment from scratch for the sorts of tasks involved here, but would re-use previous ones and/or use HSE's Asbestos Essentials guidance,[7] which provides task sheets for the different types of work.

136. The number of projects that might require an asbestos risk assessment can be estimated from the total number of construction projects a year. Using estimates gathered from the Impact Assessment

[5] See: http://www.hse.gov.uk/asbestos/licensing/non-licensed-work.htm
[6] Available at: https://www.gov.uk/government/statistics/business-population-estimates-2015
[7] See: http://www.hse.gov.uk/asbestos/essentials/

for the Construction (Design and Management) Regulations 2015,[8] this is 250,000 commercial projects and 3.3million domestic projects, totalling 3.5million construction projects. Included within these projects will be the licensed and notifiable non-licensed jobs, totalling 37,500 and 28,400 respectively. Removing these from the number of construction projects a year gives an estimate of just under 3.5m construction projects per year.

137. A further adjustment to this total is required to reflect the fact that a proportion of property in GB will not contain any asbestos-containing materials. The broad assumption has been applied that property built between 1945 and 1983 will be more likely to contain asbestos than in any other period. Obviously, some buildings from this period will not have ever contained asbestos, some may have had all asbestos removed and there could be buildings before and after this period that do contain asbestos. It is thought that this overestimate of buildings that contain asbestos during 1945 – 1983 will be more or less offset by any underestimate from excluding all buildings before and after that period. Using data from the VOA[9] on the stock of council tax properties, the percentage of the 25.2m properties that were built between 1945 and 1983 is 38% and 36% in England and Wales respectively. Public sector housing data for Scotland has come from the Scottish Government,[10] which shows 70% of the 320,000 public sector buildings were built between 1945 and 1983. The weighted average of domestic and public sector properties that were built between 1945 and 1983 in GB is around 37%. Although this average is calculated from council housing and public sector buildings, it is assumed to be a reasonable proxy for all building in GB. Thus, the 3.5m construction projects per annum is adjusted by 37% to 1.3m projects per annum, which reflects the more likely number that might involve the disturbance of asbestos-containing materials.

138. Using the above assumptions the annual cost of risk assessments that involve asbestos are estimated to be around £9.1m.

139. Training: Based on the estimates received, online commercial research and discussion with HSE experts, the cost of an online training course for asbestos awareness is around £25. This will have to be undertaken by all workers who could come into contact with asbestos. It is assumed that all current workers in the industry will have done this initial awareness training course and will only require a refresher when necessary, assumed to be every other year. Those workers who disturb asbestos will have to undertake a more detailed 'working with asbestos' course, estimated by HSE experts to be approximately £300 per course. Similarly, it is assumed that relevant current workers who need to will have done this detailed course already, and will be simply refreshing it.

140. It is estimated that there are 2.2 million workers[11] in the construction sector who could come across asbestos in their work. Each year approximately half, or 1.1 million of these will undergo refresher training, estimated to take 2 hours of time. At an estimated cost of time of £20[12] an hour the annual cost of this refresher training is estimated to be £44m.

141. New entrants to the workforce each year have been estimated using tenure date from the Annual Population Survey (APS). Tenure data for the construction industry from 2005 to 2015 shows that the average number of workers during this period, who had been in their current job less than 12 months, is around 320,000. Some of these moves will have been from another construction job during the 12 month period, and so the figure overestimates the number of workers who are completely new to the construction industry and so requiring asbestos training. However, the estimate provides a top limit on the number of new workers in construction in any year who might be requiring asbestos training. This estimate, in turn, enables us to estimate a top end of the range for training costs, which is in line with the conservative approach we have taken when making assumptions in this cost – benefit analysis, in order to avoid underestimating the scale of the costs.

[8] See: http://www.legislation.gov.uk/uksi/2015/51/impacts

[9] Valuation Office Agency Data on council tax properties. Available at: https://www.gov.uk/government/statistics/council-tax-stock-of-properties-2016

[10] Scottish Government, see http://www.gov.scot/Topics/Statistics/Browse/Housing-Regeneration/HSfS/StockPublicSector

[11] Data taken from the Annual Population Survey, 2015.

[12] Data from the Annual Survey of Hours and Earnings 2015, table 4.5 a gives the average gross hourly wage rate in construction of £16.65. This is grossed up by 20% to reflect the full costs of employing the person, such as tax and NI contributions and overheads.

Using the assumptions set out in paragraph 139, and the estimate of 320,000 new workers per annum, we assume that 50% of these new workers will only do an online awareness-raising course while the other 50% will do the full day course. The total cost of this training is estimated to be £4.0m for awareness raising and £48m for the full course per annum.

142. **Total costs of training per annum are estimated to be around £96m.**

143. Control measures: Based on discussion with HSE experts and responses from the questionnaires, it is understood that control measures for the sorts of tasks analysed here will mostly comprise Respiratory Protective Equipment and dust sheets / baggage. Market research has revealed that the cost of a full asbestos protection kit is £47.40. Assuming that control measures are required for each of the construction projects that are likely to require a risk assessment, which is 1.3m per annum (see paragraph 136) and that because the work is likely to be small scale, only 1 worker per project will be involved and so wearing the PPE, **the total costs per annum of control measures are estimated to be £61.5m**.

144. Summing together all the totals gives an estimate of the total cost of non-notifiable work with asbestos of approximately £165m per annum.

145. We consider that the quality of the data received from respondents, as well as the lack of validation by industry of the additional assumptions made for these calculations, does not allow us to consider this a robust detailed estimate for non-notifiable work with asbestos. We consider this provides **an indication the potential scale of the costs, which we expect to be at most in the low hundreds of millions of pounds per annum**.

Duty to Manage Asbestos

146. As explained in section (c), the data collected from the 2 questionnaires returned for this group was not sufficient to allow us to calculate a robust detailed cost estimate. To calculate a broad estimate we drew from the limited information provided as much as possible, and complemented it with assumptions informed by existing evidence in IAs and the 2011 evaluation, statistical data, ad hoc research and judgment of sector experts. We opted to make generous assumptions in order to ensure we were not underestimating the costs. For transparency, this section sets out these calculations in detail, but this is reported in terms of orders of magnitude when concluding on costs.

147. The Duty to Manage Asbestos includes a number of requirements that will already have been fulfilled when the regulations came into force. Dutyholders are required to find out if there is asbestos in the premises, its location and what condition it is in. If there is asbestos present, they must make a record of the location and condition of the asbestos, assess the risk from it, and prepare a plan that sets out in detail how they are going to manage the risk from this material. They must also set up a system for providing information on the location and condition of the material to anyone who is liable to work on or disturb it.

148. For all buildings containing asbestos, this would all have been done when the duty came in more than 10 years ago. And since there is a ban on the use of asbestos, no buildings that are new since that time will contain asbestos. We therefore do not expect there would currently be substantial costs arising from these duties. Some buildings which were assumed with good reason not to contain asbestos at the time might be discovered to contain it, and in that case the duties described above would apply, but we expect this would be a small number relative to the costs relating to ongoing duties.

149. The requirements that will be generating ongoing costs are those to keep up to date the record of the location and condition of the asbestos in the premises and to verify every 12 months the information in the management plan. This will involve updating the record if any work is done that alters the condition of the asbestos and to annually check that it is in the condition that it was the last time it was checked (in most cases, this will involve a simple visual check to see if asbestos-containing materials have deteriorated or been damaged or disturbed in any way).

150. We have made estimates of the costs of the latter for the different groups to whom this duty applies (the duty applies to all non-domestic buildings, and to the common areas of domestic buildings). Due to their differing nature and what we know of how the duty to manage asbestos is made operational, we have made separate estimates.

151. The groups we are considering are:

- Under those who manage non-domestic buildings: schools, Local Authorities (which manage a large estate of public buildings), hospitals, and businesses.
- Under those who manage common areas of domestic buildings, management companies or others which manage dwellings comprising two or more household spaces.

152. For several of the estimates, the numbers of buildings have been adjusted by the proportion of buildings estimated to contain asbestos, estimated as 37% in paragraph 136.

Schools

153. There are approximately 28 thousand schools in GB.[13] Using the estimate of 37% of buildings likely to contain asbestos leads to an estimate of approximately 11 thousand schools with asbestos. We are aware that the responsibility for managing asbestos most often falls on the head teacher, and we will assume that they spend 1 day a year on asbestos management. This includes time spent checking the condition of existing asbestos (themselves or a caretaker), as well as time spent updating plans and records. If we assume 220 working days a year and an average annual head teacher salary of £62,500[14] (and so an average of £340 per day, this gives us **annual costs of £3.5m a year for schools**.

Local Authorities

154. There are 380 Local Authorities (LAs) in GB.[15] According to the 2011 evaluation, 98% of LA respondents stated asbestos was present in the buildings they manage[16] (this makes sense, considering LAs manage large estates, mainly more than 100 properties, according to the evaluation). We will therefore assume that 100% of LAs are incurring costs from managing asbestos.

155. Based both on the evaluation, which found LAs were very likely to have in-house maintenance departments,[17] and on information gathered during our qualitative research, we will assume LAs will have, on average, 2 full-time members of staff tasked with managing asbestos across their estate. Assuming a yearly cost of a health and safety officer of approximately £44 thousand,[18] this leads to a **total annual estimated cost for LAs of £33m**.

Hospitals

156. There are approximately 460 hospitals in GB,[19] 37% of which have been assumed to contain asbestos (a total of 172). Considering the size of their estate in comparison to LAs, we have assumed that managing asbestos will take up approximately 10% of the time of a health and safety officer (this is likely to be an overestimate, as in most cases the ongoing management is not going

[13] Source: Estimates for England: https://www.gov.uk/government/publications/number-of-schools-teachers-and-students-in-england/number-of-schools-teachers-and-students-in-england , for Wales: http://gov.wales/docs/statistics/2016/160727-school-census-results-2016-en.pdf ; for Scotland: http://www.gov.scot/Topics/Statistics/Browse/School-Education/TrendSchoolEstate.

[14] Source: Annual Survey of Hours and Earnings (ASHE) 2015, top 10% earners in SOC code 23 (Teaching and educational professionals) uprated by 19.8% to account for non-wage costs.

[15] HSE Local Authority Unit estimate

[16] See section 4.2.

[17] See section 3.2.7.

[18] Source: Annual Survey of Hours and Earnings (ASHE) 2015, SOC code 3567, uprated by 19.8% to account for non-wage costs.

[19] Source: The number of trusts has been taken from a combination of data published by the Health and Social Care Information Centre, available at: http://www.hscic.gov.uk/ ; the Information Services Division (ISD) Scotland, available at: http://www.isdscotland.org/ ;and NHS Wales, available at: . http://www.wales.nhs.uk/. Information on number of private hospitals has been provided by HSE's sector specialists.

to require that much time, but we have opted here and in the estimates below to be conservative, to ensure costs are not underestimated). Assuming the costs described in paragraph 155, this leads to a **total annual estimated cost for hospitals of £750,000.**

Industrial / commercial buildings

157. To estimate the costs of the duty to manage asbestos in industrial / commercial buildings, we have made separate estimates for different sizes of businesses in terms of numbers employed. We are using the numbers employed as a proxy for the size of the estate those businesses may own.

158. For the 9,300 companies employing 250+ workers,[20] we will assume that, similarly to LAs, it is likely that at least some of their buildings will contain asbestos. We will assume that, on average, the management of asbestos will take up 10% of the time of a health and safety officer (this estimate is likely to be an overestimate, as it will likely only really describe those large businesses with numerous and geographically dispersed estates, e.g. a large chain of supermarkets. Most will have a much more focused and easy-to-manage profile). Assuming the costs described in paragraph 155, this leads to a **total annual estimated cost for companies with 250+ employees of £41m.**

159. There are approximately 52 thousand companies employing from 10 to 249 workers. Using the estimate of 37% of buildings likely to contain asbestos, we will estimate approximately 20,000 of them will be managing asbestos. We will assume this will on average take approximately a day of a health and safety officer (again, this is likely to be an overestimate, particularly because as we get to the smaller sizes of businesses, compliance with the duty to manage asbestos requirements is likely to decrease), with costs as described in paragraph 155. This leads to a **total annual estimated cost for companies with 10-249 employees of £3m.**

160. The number of companies employing 9 people or fewer is 5.2 million. This includes approximately 4.7m[21] self-employed, some 20% of whom are home-workers,[22] and therefore do not have a duty to manage asbestos. This leaves 4.3m businesses, of which we assume 37% (or 1.6m) have asbestos on their property. We will assume the duties regarding asbestos are undertaken by a health and safety officer, with the costs as described in paragraph 155. All of this will mainly be done as part of general maintenance of the property. These businesses are likely to have a very small estate, where any changes to the condition of any asbestos present would be easily visible. We will assume an average of 1 hour per company at around £22 an hour, to fulfil these requirements, considering this might be an overestimate, as there is likely to be a much lower level of compliance in this segment. Based on these assumptions, the **total annual estimated cost for companies with 9 or fewer employees is £35m.**

Common areas of domestic buildings

161. Domestic buildings which are likely to have common areas are those dwellings which include 2 or more household spaces. There are some 22 thousand such buildings in GB,[23] 37% of which are estimated to contain asbestos. These will mostly be managed by either a management company or a housing association. Based on advice from HSE sector experts, we will assume fulfilling asbestos management duties will take 4 hours a year of a health and safety officer, with costs as described in paragraph 155 (there is likely to be a high degree of compliance in this group). These assumptions lead to a **total annual estimated cost for common areas of domestic buildings of £720,000.**

Summary for Duty to Manage Asbestos

162. Summing together all the totals gives an estimate of the total ongoing costs for the Duty to Manage Asbestos of approximately £120m per annum.

[20] Source: Business Population Estimates 2015
[21] Source: ONS http://www.ons.gov.uk/employmentandlabourmarket/peopleinwork/employmentandemployeetypes/bulletins/uklabourmarket/february2016
[22] Source: ONS Annual Population Survey 2010
[23] Source: Census 2011. Table KS401EW for England and Wales and table KS401SC for Scotland.

163. We consider that the very small number of respondents from respondents, as well as the lack of validation by industry of the additional assumptions made for these calculations, does not allow us to consider this a robust detailed estimate for non-notifiable work with asbestos. We consider this provides **an indication the potential scale of the costs, which we expect to be at most in the low hundreds of millions of pounds per annum**.

Total Costs

164. If we were to sum the costs detailed above for licensed work and NNLW, non-notifiable work and the Duty to Manage Asbestos, the estimates imply a total annual compliance cost under CAR 2012 of approximately £495m. However, due to the limitations in the data, discussed in detail in section (c) and throughout the descriptions of the costs above, we do not believe that the evidence we have been able to gather can support a robust detailed estimate. Rather, as discussed, we believe that these estimates only reflect the scale of the costs.

165. We will therefore use **an estimate of annual ongoing costs of complying with the requirements of CAR 2012 of several hundreds of millions of pounds**.

166. To provide an estimate over the period 2016-2115, we have discounted the detailed annual costs following the guidance in Annex 6 of the HM Treasury Green Book, as well as adjustment for the expected decrease in the stock of asbestos-containing materials, as described in paragraph 34. This results in a present value of those costs of £10.3bn. We will therefore use **an estimate of costs of high single billions of pounds over the period 2016-2115**. We note that without the adjustment for the decrease in the stocks of asbestos-containing material, the present value of the costs would be approximately 50% higher.

167. As mentioned during the analysis, these costs are likely to be an overestimate. For the licensed costs, the businesses which participated in the research were on the larger end of the spectrum, which we expect has made the costs higher than would be typical in the sector. These estimates were then applied to NNLW, which will typically tend to incur fewer costs. Estimating the costs of non-notifiable work and the Duty to Manage Asbestos, we opted to go for 'generous' estimates, as we had less information from the bespoke research and wanted to ensure we were not underestimating the costs.

Benefits:

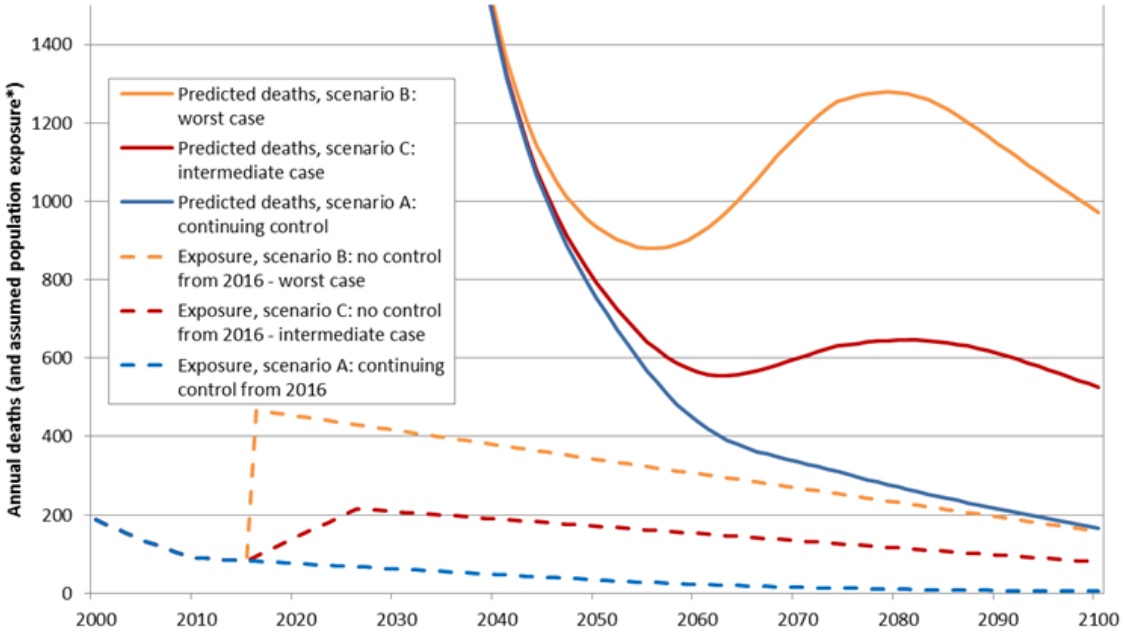
168. After consultation with HSE epidemiologists, we established the most appropriate scenarios we could use to estimate the benefits arising from the actions required in the regulations (which are the actions costed in the previous section). We would compare a scenario (A) where individuals and businesses continued to take the actions indicated in the regulations (with the improvements suggested in this PIR, which would not have a significant impact on health and safety) with another scenario (B) where individuals and businesses stopped taking all of those actions.

169. In scenario B, practices in working with and managing asbestos would return to what they were in 1980, and therefore so would the level of exposures, with some adjustments. The adjustments are because scenario B would not include a return to the use of asbestos, as direct-acting EU prohibitions are in place (which is why CAR 2012 does not include prohibitions on supply and use of asbestos). Therefore, the increased exposures in scenario B should be adjusted to account for the year-on-year decrease of the stock of asbestos-containing materials in the UK, as buildings containing asbestos are demolished and any new ones do not contain any (scenario A should also include this year-on-year decrease).

170. Using the Mesothelioma Projections Model, which is based on our National Statistics on mesothelioma and estimates the impact of changes in exposure on deaths from mesothelioma and lung cancer, HSE epidemiologists created different scenarios reflecting the conditions described in the previous paragraphs.

171. A graph showing predicted deaths and exposures in scenarios A and B (as well as an intermediate scenario C, which is described in paragraphs 178 and 179) is included below. The blue lines ('continuing control') represent scenario A, while the yellow lines ('worst case') represent scenario B.

Figure 1 – Predicted annual deaths and exposures from the different scenarios



**Relative changes in annual population asbestos exposure are used to predict subsequent mesothelioma mortality in the HSE model; the absolute scaling of the exposure profile is arbitrary in this chart .*

Source: HSE Mesothelioma Projections Model

172. Scenario B (without the risk-control actions prescribed in the regulations) results in some 50,500 additional cancer deaths compared to scenario A (with the risk-control actions prescribed in the regulations) in the period 2016 - 2115. Of those, 40,800 are from cases of mesothelioma, while 9,700 are from cases of lung cancer. As can be seen in the graph, because of the latency periods involved, it is only in the mid-2040s that the additional deaths start to occur (the blue and yellow non-dotted lines begin to really diverge).

173. HSE has recently published estimates of the costs to society of work-related cancer,[24] which include costs to business and government/taxpayers, as well as costs to the individuals affected, both in terms of financial costs and the impact of quality of life and loss of life. This research also includes appraisal values, including for the average costs to society of a fatal case of work-related cancer. This is estimated to be approximately £1.3m per case.

174. We applied this appraisal value to a yearly profile of the number of additional cases of cancer expected in each of the years from 2016 to 2115 (this was an output of the model provided by HSE epidemiologists). We then discounted those values. We note that because 93% of the appraisal value is composed of "human costs" (the costs arising from the impact on the individual's quality of life and their loss of that life), we used a 1.5% discount rate[25] for periods 0-30, and then proportionately adjusted it for later periods following the guidance in Annex 6 of the HM Treasury Green Book.

[24] HSE (2016). The Costs to Britain of Work-related Cancer. HSE Research Report RR1074. Available at: http://www.hse.gov.uk/research/rrhtm/rr1074.htm

[25] The HM Treasury Green book advises the use of a 3.5% discount rate, reflecting the social time preference rate (STPR). A rate of 1.5% is conventionally used for health impacts in UK government analyses to account for the fact that we would expect the value of health to rise at the rate of real incomes, which we assume to be 2% in the long-term. This is discussed further in Glover and Henderson (2010), paragraph 2.15, available at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/216003/dh_120108.pdf)

175. This results in **estimated benefits to society of preventing those cases of cancer of £28.8bn**.

176. It should be noted that the increased exposures in scenario B would also lead to non-cancer asbestos-related conditions which are not included in the Mesothelioma Projections Model. This would lead to additional benefits from not stopping taking the actions indicated in the regulations. However, the monetised impact of those benefits would be relatively minor compared to that of preventing fatal cases of cancer.

177. We acknowledge that scenario B is not a very plausible one for a real situation in which the regulations were removed. It is likely that some or many individuals working with asbestos would continue to take the precautions indicated in CAR 2012 or other precautions (as we state in the body of the PIR report, we are not able to claim all of the reduction in exposures since 1980 was due to the regulations), and therefore exposures would not increase as much as estimated. However, this is the appropriate scenario to contrast with the costs calculated in this PIR, which are simply the ongoing costs of taking the prescribed actions in the regulations, as it simply represents the impact of stopping taking those actions.

178. For illustrative purposes, HSE epidemiologists have also created what we feel is a more realistic scenario C for a world in which the regulations were removed (which can also be seen in Figure 1 above, in the red lines), where businesses and individuals working with and managing asbestos gradually change their practices and stop taking some of the actions required in the regulations over the first 10 years, with exposures reaching half of what they were in 1980 on year 10 and remaining level thereafter (all with adjustments for the reducing stock of asbestos-containing materials).

179. Scenario C, when compared to scenario A, leads to approximately 19,300 additional deaths over the 2016-2115 period. The cost to society of those additional deaths is estimated (applying the same methodology described above) at £10.6bn. We stress that this figure cannot be compared to the costs calculated earlier, as in this scenario businesses and individuals would continue to take many of the actions generating those costs.

e) Conclusion

180. Annual **costs** per annum for complying with the requirements in the regulations are estimated to be several hundreds of millions of pounds at most. This results in a present value estimate of costs of **high single billions of pounds at most** over the period 2016 – 2115.

181. Per annum benefits over the same period vary, but their present value is of £28.8bn.

182. As we have described in this document, there is a high level of uncertainty surrounding our cost estimates, which has not allowed us to report a detailed cost estimate. However, we consider that there is enough difference between the benefits of the levels of exposure that are associated with the risk control measures indicated in CAR 2012 and the scale of the potential maximum costs of complying with the regulations. This allows us to conclude that the evidence supports a judgment that the benefits of CAR 2012 outweigh the costs and will continue to do so for the foreseeable future, so long as exposures continue to be controlled.

Appendix 2: Research report on dutyholder evidence

This research was commissioned as part of the post-implementation review (PIR) of the Control of Asbestos Regulations 2012. It was conducted by psychologists and human factors specialists in the Health and Safety Laboratory, which is part of the Health and Safety Executive's Science Division. A series of workshops, focus groups and an online survey were commissioned by HSE seeking insight and evidence from those whose day-to-day business activities pose an inherent risk of exposure to asbestos of both their employees and themselves. This report, an appendix of the Government command paper and PIR report, presents the full analysis of that evidence gathered from dutyholders. The full research report is available at **www.hse.gov.uk/research/rrhtm/rr1106.htm** and the reference number is RR1106.

Appendix 3: Epidemiological data report and conclusions

Asbestos use, regulation and disease in Britain: historical context and potential impact of recent regulatory changes on long-term health outcomes

History of asbestos use and evidence about adverse impact on heath

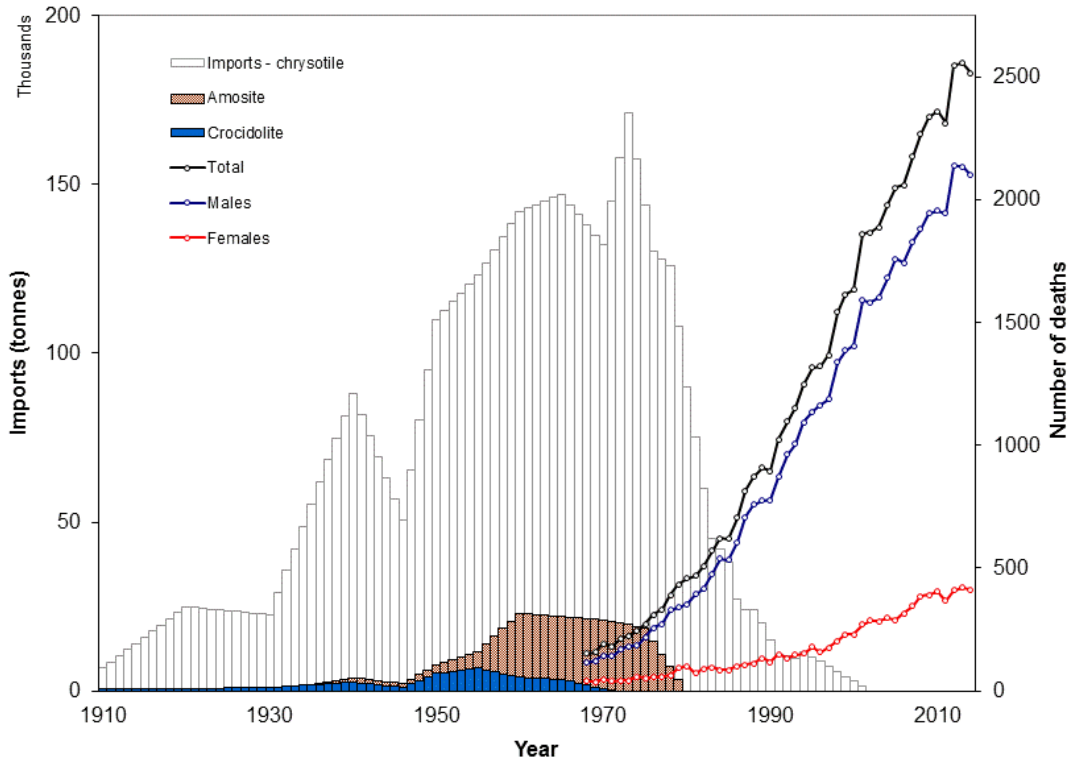
1. Inhalation of asbestos fibres can cause a range of lung diseases, the three most important of which are mesothelioma, lung cancer and asbestosis. However, asbestos can also cause cancer of the larynx and ovary, as well as non-malignant respiratory effects including diffuse pleural thickening and pleural plaques. All of these are so-called long latency diseases which become manifested many years after initial exposure to asbestos. The evidence about these ill health effects gradually became apparent during the long history of asbestos use, particularly during the twentieth century.
2. Italy was the world's primary supplier of asbestos during the late 1800s and the centre for the development of the industrial use of asbestos in modern times.[1] Early asbestos products included fabrics and string, and insulation for boilers and gaskets for steam engines. In the early 1900s fireproof construction products began to be mass-produced. Around this time the large deposits of white asbestos (chrysotile) discovered in Canada and Russia, and blue and brown amphibole-type asbestos (crocidolite and amosite) from South Africa began to be exploited as the world wide asbestos products manufacturing industry grew rapidly.[2] After WWII demand for asbestos-containing building products grew rapidly in Europe due to extensive building reconstruction programmes. Such products were widely used due to their fire resistance and as well as being strong and light. Britain and other Western and Northern European countries had been developing asbestos products industries during the early twentieth century and it was from populations working or living close to these industries that signs of the health impact of asbestos began to emerge.
3. Concerns that asbestos was causing pulmonary fibrosis (asbestosis) among factory workers grew during the earlier 1900s and this led to the first regulations to control exposures in 1931 in Britain.[3] Suspicions that asbestos exposures in workers could cause the cancer mesothelioma were aroused in Britain during the 1930s but not conclusively confirmed until 1960 when a study by Wagner demonstrated the link among those working in or living close to the South African crocidolite mines.[4,5] The link between asbestos exposure and lung cancer had been demonstrated five years earlier in a study of British asbestos workers,[6] though many had accepted the link in the previous decade.[7] Findings of early epidemiological studies of mesothelioma in the USA and Britain published in 1964 prompted many further studies in European and North American worker populations, including asbestos miners in Canada and Italy, insulation and dockyard workers, and workers employed in asbestos-cement, textiles and friction products manufacture in various countries including Britain.
4. It became clear that crocidolite was a particularly potent cause of mesothelioma and its use was discontinued in Britain by 1970 coinciding with the introduction of the Asbestos Regulations 1969 which extended to all workers exposed to asbestos, not just those employed within the asbestos products manufacturing industry. However, it was not yet clear that amosite was similarly dangerous as crocidolite and its use continued for another ten years in Britain until a voluntary ban on its use

from 1980.[8] A formal ban on the use of all types of asbestos is now in place and extends to all European Member States.

Asbestos use and consequences within Britain

5. Britain imported around 7 million tonnes of asbestos during the twentieth century,[1] the majority of which was chrysotile, but substantial quantities of crocidolite and amosite were also imported from South Africa.[9] Annual imports of the three main asbestos types during this period are shown in Figure 1 below. The chart also shows annual deaths from mesothelioma which have increased more than 10-fold since consistent recording began in the late 1960s.

Figure 1: Annual asbestos imports and mesothelioma deaths in Great Britain, 1910-2014



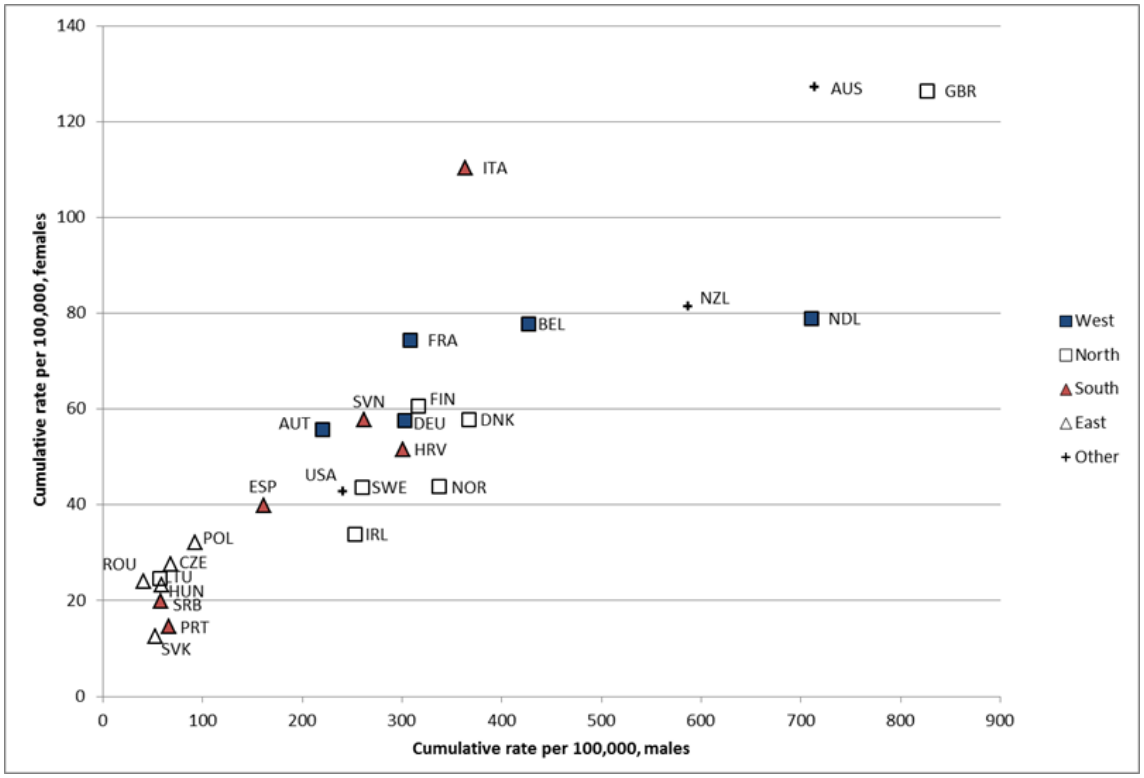
6. The current burden of asbestos-related disease in Britain is substantial and expected to remain so for many years to come despite large reductions in asbestos exposures since the period of peak use. There are currently around 2500 mesothelioma deaths each year in Britain and there are likely to be a similar number of lung cancers attributed to asbestos. Nearly 1000 new cases of asbestosis and over 400 cases of diffuse pleural thickening were assessed for Industrial Injuries Disablement Benefit (IIDB) in 2014, and in addition there were several hundred cases of pleural plaques identified by chest physicians in The Health and Occupation Reporting (THOR) scheme. The latter is likely to be a substantial underestimate of the incidence of pleural plaques which, although usually symptomless, are an indicator of past asbestos exposures.

7. Virtually all of the mesotheliomas that have occurred in Britain over the past half-century are a consequence of asbestos exposure,[10] either via direct handling of asbestos-containing materials (ACMs) at work, or secondary exposures at work and elsewhere that occurred as a consequence of such handling or the disturbance of ACMs. This close relationship with asbestos means that, of the cancers that can be caused by asbestos, mesothelioma is the easiest to study. It is almost always fatal, and often within twelve months of symptom onset, which means that annual incidence is approximately equal to annual mortality. The mesothelioma exposure-response relationship is such

that the risk of eventually developing the disease in later life increases according to the extent of exposure (i.e. the amount of fibres inhaled), but it is generally accepted that there is no exposure threshold below which the risk is zero.[11] Controlling asbestos exposures to minimise the risk of mesothelioma is likely to largely prevent other forms of asbestos-related disease.

8. Mesothelioma mortality is currently higher in Britain than in any other country, although rates in Australia are almost as high.[12] Current cumulative mesothelioma mortality to age 85 for men and women in various European countries is shown in Figure 2. Data are from the WHO Mortality Database for the period 2008-2012, the most recent five year period for which data was available for most countries.[13] Countries with on average at least five mesothelioma deaths per year in each sex are shown and rates for certain non-European countries (Australia, New Zealand and the United States) are also included for comparison since these countries have also seen a high level of mesothelioma mortality.

Figure 2: Cumulative death rates per 100,000 to age 85 in males vs females in the European region and selected other countries, 2008-2012



9. Although patterns over time in asbestos consumption within countries do correlate with subsequent patterns of mesothelioma incidence within countries, there is little correlation between total consumption and overall mesothelioma incidence across countries. This is likely to be because the amounts of different asbestos fibres types used are of crucial importance given large differences in their potential to cause mesothelioma.[11] A number of strands of evidence point to the major role that the extensive use of amosite asbestos played in the particularly high mesothelioma incidence now seen in Britain.

10. During the 1950s and early 1960s around a third of amosite exports from South Africa went to Britain and by the 1960s Britain was importing over 20,000 tons per year – a similar amount to the USA and more than twice as much as the rest of Europe combined – levels that were sustained until the mid-1970s.[14] A population based study of mesothelioma cases in Britain found that work as a carpenter during the 1960s and 1970s was associated with a particularly high risk of mesothelioma: of the 30 mesotheliomas in men born since 1950 in the study, 10 had been carpenters and were likely to have had extensive exposure when cutting and installing amosite-containing insulation

board (AIB) that was used extensively in Britain prior to 1980.[15] (In contrast, the risk to former carpenters in a recent French study was not increased to the same extent as in Britain and France used far less amosite.) A recent related study also confirms the major contribution of amosite to mesothelioma incidence in Britain.[10] In this study, 75% of the asbestos fibres counted in the lungs of mesothelioma cases and control subjects were amosite, and there was a striking correlation between mesothelioma risk and amphibole asbestos lung burden.

11. A comparison of per capita imports of the three main asbestos types and age-specific mesothelioma mortality rates in men born in the early 1950s for Britain versus the USA is also particularly suggestive of the role of amosite: death rates at ages 45-49, 50-54 and 55-59 for this birth cohort of men are at least three times higher in Britain than the USA. The key period of exposure for these men was the 1970s, at which time per capita imports of crocidolite and chrysotile were lower in the UK than the US, but per capita imports of amosite were at least 7 times higher.[12]

Sources of mesothelioma risk in the British population

12. The British mesothelioma register has included all death certificates mentioning the term "mesothelioma" since its inception during 1967, so it provides a reasonably consistent series of mesothelioma mortality over a long time period. Although individual mesothelioma death certificates do not contain any direct information about the source of exposures, analyses of the last occupation of the deceased – which is routinely recorded on all death certificates below age 75 years – have provided insight into key sources of asbestos exposure in Britain.[16] These analyses have consistently highlighted various occupations that are recorded on male mesothelioma death certificates much more frequently than expected (had occupational asbestos exposures not played a role), including: carpenters and joiners; plumbers and heating/ventilation engineers, electricians, pipe fitters, metal plate workers/shipwrights/riveters, sheet metal workers, energy plant operatives, and various other construction-related jobs. These findings clearly highlight the importance of certain well known exposed industries such as shipbuilding, but also the importance of exposures in the building industry.

13. In the mid-1990s there were still fewer than 1000 mesothelioma deaths per year in Britain, but the first projections of the future mesothelioma burden published at that time suggested that this number would increase 3-fold before peaking around year 2020.[17] This brought renewed focus on the sources of mesothelioma risk in the British population, particularly among building maintenance workers, and prompted more detailed epidemiological research – the British mesothelioma case-control study.[15] The study confirmed the high burden of disease among former building workers and showed that the occupational analyses of mesothelioma death certificates tend to underestimate the proportion of male mesothelioma deaths that are attributable to this source. An estimated 46% of currently occurring mesotheliomas among men born in the 1940s were attributed to such exposures, and 17% attributed to carpentry work alone. A key factor in causing the higher risks now seen in these former workers appears to be the extensive use of insulation board containing brown asbestos (amosite) within buildings for fire protection purposes.

14. Occupational analyses of female mesothelioma deaths are more difficult to interpret because of the lower proportion caused directly by occupational exposures. Since occupations are recorded on death certificates as a matter of course (for deaths below age 75) there are inevitably various occupations that are recorded in appreciable numbers on female mesothelioma death certificates. However, most of these occupations are recorded with the frequency expected if in fact there was no difference in risk between occupational groups. This suggests that where exposure to asbestos did occur at work, it was no more likely in any particular occupational group. The case-control study also confirms these observations. Although not attributable to direct handling of asbestos at work, most mesotheliomas among women were nevertheless caused by asbestos. Some of these 'unexplained' cases could be part of a background incidence of mesothelioma that is thought to account for about 50 to 100 deaths per year. However, many are likely to have been due to exposures that would have occurred during the peak period of use when asbestos was being

actively installed into many British buildings and when there would have been widespread potential for unwitting exposures.

15. These population-based studies have drawn attention to the large burden of mesothelioma caused by exposures outside what was previously considered to constitute the 'asbestos industry' (which was the subject of most of the early epidemiology studies described above). The introduction of the Asbestos Regulations 1969 coincided with the establishment of an epidemiological study of the long-term health outcomes of British 'asbestos workers'.[18] These workers were initially recruited from the asbestos manufacturing industry, then later a large number of asbestos removal workers who began work during the 1980s following the introduction of the Asbestos Licensing Regulations were also recruited. Analyses based on long term follow-up of these particular workers demonstrate a reduction in the risk of asbestos-related disease among those who first worked with asbestos after 1970. However, it is also striking that of the 50,000 mesotheliomas that have occurred in Britain since the late 1960s, only about 2% were among this group of asbestos workers. In other words, most of the mesotheliomas were caused by asbestos exposures that occurred outside the asbestos industry. This further highlights the important role played by asbestos exposures among 'end-uses' of asbestos products in the building industry.

Assessment of the potential health impact of regulation to control asbestos exposures in Britain

Introduction

16. Assessing the long-term health benefits of past initiatives to control asbestos exposure is challenging for a number of reasons. Firstly, the long-latency of asbestos-related diseases means that there is a long delay between any improvements in exposure control and consequent reduction in the rate of disease occurrence. Since mesothelioma is essentially only caused by asbestos, national trends in mortality can be used to infer how asbestos exposures in general – i.e. averaged over the whole population – must have changed over time. These data provide strong evidence that asbestos exposures were (on average) far lower from the 1980s onwards than during the previous three decades, and it is now clear that the phasing out of new installation of amphibole-containing products by around 1980, due to the voluntary ban on amosite (crocidolite use had ceased ten years earlier), was a key driver in substantially lowering exposures from that time. However, overall mesothelioma patterns tell us nothing about how exposures may have changed since then, and in any case, it would be very difficult to make a direct link between any general trend and specific control initiatives to further reduce exposures, such as: the introduction of the asbestos licensing regime, revised regulations in 1987, and initiatives to raise awareness among general building maintenance workers during the 1990s – culminating in the introduction of the Duty to Manage asbestos regulation in 2004.

17. A further challenge is that there is a lack of information from other sources about how asbestos exposures changed in the past. Most exposures prior to 1980 were a result of new use of asbestos – either in producing new asbestos materials or, more significantly, the use or installation of such products in the building industry. Annual asbestos imports – which essentially describe 'asbestos consumption' (i.e. the amount of new use) – thus also provide general information about how overall population exposures must have changed in this period of peak use, and these corroborate the inferences about exposure from national mesothelioma mortality data. However, it is more difficult to assess the contribution of exposures arising from the stock of asbestos materials in buildings, and it is this source of exposure which is of key interest from 1980 onwards following the cessation of the use of new asbestos products.

18. While there is a substantial body of evidence about typical short-term airborne exposures that can result from specific activities with asbestos-containing materials which remain in many buildings, there is a lack of information about how widespread and frequent these activities were, and how they changed over time, in order to provide a representative picture of population exposure that could be used to predict future disease incidence.

19. In light of these difficulties we apply the HSE mesothelioma model used to project future annual mesothelioma deaths[19,20] to a number of different general scenarios for overall average annual population exposure from 1980. We justify the scenario we think most likely to have actually occurred by appeal to other sources of empirical data where possible, and in qualitative terms by presenting other supporting information about changes in exposure control that took place. We then compare the long term predictions of this scenario with those of plausible counterfactual scenarios that could have resulted from a less stringent control regime. We present these comparisons to illustrate the potential scale of health benefits that overall regulatory changes – which in reality encompass a range of specific control requirements – since the 1980s may have had. We do not make any definite claims that specific changes prevented a given number of deaths.

General approach to modelling the effect of asbestos exposure on mesothelioma deaths in the British population

20. The obvious correlation between the striking increase in national mesothelioma mortality, which lags by a few decades a similar magnitude increase in national asbestos consumption during the twentieth century, suggests that the timing of changes in past asbestos use was a key factor in explaining the subsequent pattern of mesothelioma incidence. This was the motivation for the development of statistical models to estimate annual mesothelioma deaths and project the future burden of disease.

21. The strong increase in mesothelioma incidence in the population with increasing age reflects the effect of disease latency rather than the effect of age *per se*.[21] The pattern of age-specific mesothelioma death rates over time in the British population is thus a reflection of both disease latency and the timing of past asbestos exposure. Overall, rates are much higher in older age because the disease takes many years to develop following exposure. The continuing increase in male rates at age 75 years and above also reflects the fact that this generation of men had the greatest potential for asbestos exposures in younger working life during the period of peak asbestos use in the 1950s, 1960s and 1970s. In contrast, rates below age 65 have now been falling for some time. The most recent deaths in this age group are among the generation who started working life during the 1970s or later when asbestos exposures were being much more tightly controlled.

22. The current statistical model developed by HSE which addresses these features of the data is described below.[19,20] The model is used here as a basis for estimating the scale the long-term health consequences of different scenarios for how asbestos exposures may have changed since the 1980s in more recent times in order to illustrate the potential benefits of asbestos control.

Description of the HSE mesothelioma projections model

23. In situations – typically worker cohorts – where the timing of asbestos exposure and subsequent mortality of individuals is known with reasonable precision, the relationship between mesothelioma incidence and time since exposure can be modelled using the approach proposed by Peto[22] in which a person's additional mesothelioma risk, *R*, caused by each brief exposure to asbestos is proportional to the increase in cumulative exposure, *D*, multiplied by a power (typically around 2 or 3) of time, *t*, since the exposure lagged by 10 years:

$$R \propto D \times (t - 10)^k$$

24. Since the predicted risk after a given time is directly proportional to the exposure *D*, this model can also be applied at the population level to death rates within each birth cohort by replacing an individual's asbestos exposure *D* in a given period by the corresponding average collective dose.

25. This forms the basis of the current mesothelioma model. The model assumes that the average asbestos exposure to the population of Britain in each year can be summarised as a single value, and that exposure in any year is also dependent on age, with the pattern of age-specific exposure fixed over time. The mesothelioma death rate for men aged A in year T can then be estimated as the sum of the risks – as in the equation above – due to exposure in all previous years of their lifetime, excluding the most recent 10 years. For each of these individual years, the contribution to the predicted death rate is calculated as the product of the appropriate age-specific exposure factor, the overall population exposure index for that year and the lagged time interval to year T raised to the power k. The predicted number of mesothelioma deaths at age A in year T is given by the sum of these risk contributions multiplied by the total population aged A in year T (i.e. the person-years for age A and year T), rescaled so that the total fitted number of mesothelioma deaths over the period for which observed deaths are available is equal to the total observed number. The model also incorporates terms to account for the clearance of asbestos fibres from the lung and a 'diagnostic trend' towards more complete recording of deaths over time.

26. The model can be represented mathematically as follows:

$$F_{A,T} = \frac{\left[\sum_{l=0}^{A+1} W_{A-l} D_{T-l}\{l+1-10\}^{k} \times c\right] \times d_T \times P_{A,T}}{\sum_{A,T}\left\{\left[\sum_{l=0}^{A+1} W_{A-l} D_{T-l}\{l+1-10\}^{k} \times c\right] \times d_T \times P_{A,T}\right\}} \times (M-B) + B_{A,T}$$

where,

$F_{A,T}$ = number of deaths at age A in year T;

W_A = age-specific exposure potential at age A;

D_T = overall population exposure in year T;

k = exponent of time representing the increase of risk with increase of time since exposure;

$P_{A,T}$ = person-years at risk for age A in year T;

M = total observed mesothelioma deaths in observation period

c = term to represent clearance of asbestos fibres from the lungs, $c = (1/2)^{l/H}$, so that H is the clearance half-life in years;

d_T = term to estimate a linear trend in diagnosis, i.e. the proportion of mesothelioma deaths in year T that are recorded;

{ } = zero when negative;

The summations indexed by l represent the cumulative effect at age A of the exposures at earlier ages;

l indexes years lagged from the risk year.

B = total background cases in the observation period, equal to the sum of $B_{A,T}$, the background cases at age A and year T. A constant background rate is fitted and assumed proportional to $(A\text{-}10)^k$.

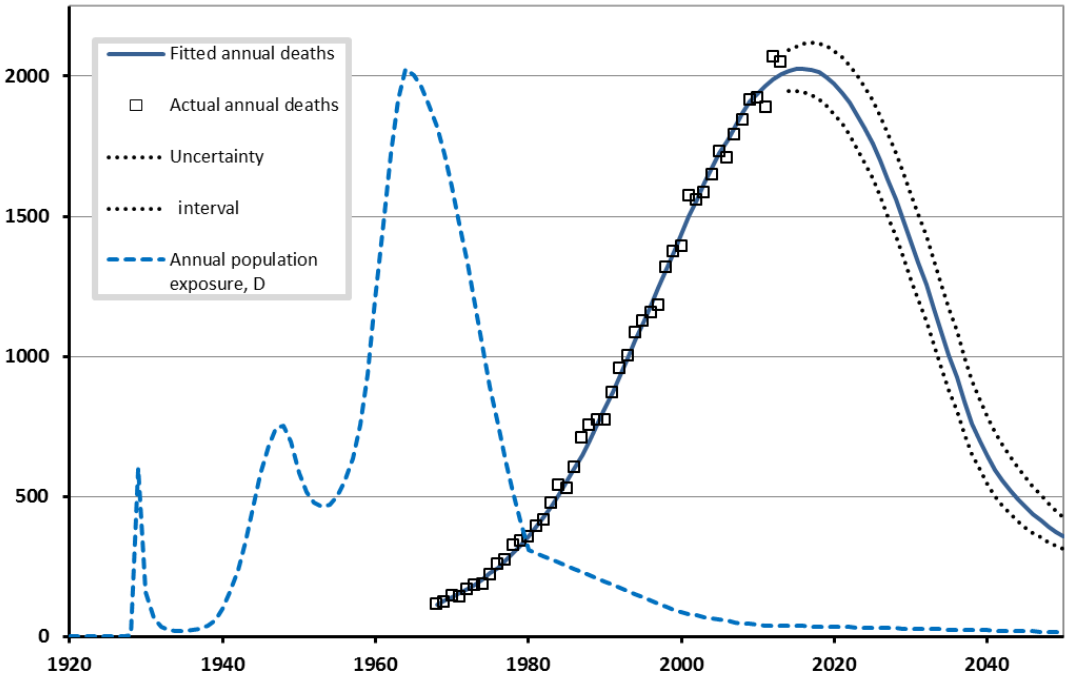
27. The age-specific exposure potential W_A was defined by assigning nine parameters to the age groups 0–4, 5–15, 16–19, 20–29, 30–39, 40–49, 50–59, 60–64 and 65+ years. The overall population exposure distribution D_T was parameterised by defining growth and decline rates for years in multiples of 10 before and after the maximum exposure year (in which exposure growth/decline is zero), with growth rates for years intermediate between the 10-yearly values were determined by linear interpolation.

28. In reality the average population exposure arises from a complicated distribution of exposures accrued by workers, and others, across a wide range of settings. In the past this will have included traditional exposed industrial settings such as shipbuilding, asbestos product manufacturing, and asbestos lagging and construction activities. Following the cessation of new use of asbestos, this will have shifted to comprise asbestos removal workers and building maintenance workers. Within these groups there will have been considerable variation in the number of workers exposed and the extent of their exposure on any given day. The model does not tell us anything about these complicated underlying distributions. Rather, the exposure metric D just expresses the mean effective carcinogenic dose of asbestos to the population delivered in a given year. Summarising the exposure in this way is justifiable given that the dose-response relationship is likely to be linear, or approximately so, so that the mean dose of a group (or population as a whole) will reliably predict the mean risk among that group (or population).

Fitting the model to currently available mesothelioma mortality and population data

29. The most recent update of the statistical model was based on GB mesothelioma deaths during the period 1968-2013 at ages 20-89 years. The results of the model fitted data for males are shown in Figure 3 below. The model predicts that the current level of annual mesothelioma mortality – around 2000 deaths per year – will continue until about 2020 before starting to decline.

Figure 3: Observed and predicted annual mesothelioma mortality, with annual population exposure, males aged 20-89



Other model parameters

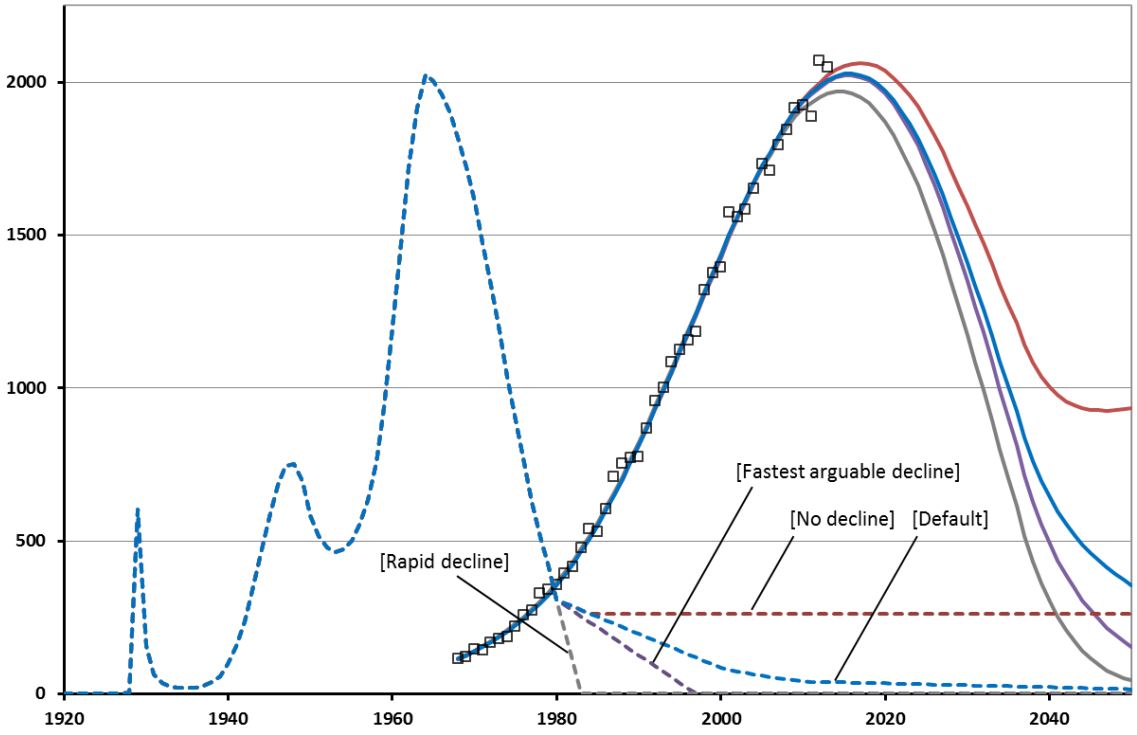
k=2.47; Peak exposure year = 1964; No lung clearance; Background rate = 1.1 per million per year; Diagnostic trend = 1% per year; Age specific exposure potential, W_A = 0.19, 1, 1.65, 1.27, 0.08, 0.6 for ages 16-19, 20-29, 30-39, 40-49, 50-59, 60-64, zero otherwise.

30. The profile of annual population exposure D implied by the model is shown by the blue dotted line in Figure 3. The model provides strong evidence that annual exposure peaked during the 1960s and then reduced rapidly during the 1970s. However, a consequence of the latency between exposure and mortality is that the strength of inferences that can be drawn about D falls rapidly beyond 1980 and from the mid-1980s the value of D is essentially undetermined. Thus, a wide range of scenarios for the profile of D from the early 1980s onwards is possible without adversely affecting the fit of the model. Some of these have a large impact on predicted future annual deaths, particularly beyond year 2030.

31. The exposure profile presented in the Figure 3 showing a linear reduction in D between 1980 and 2000 followed by a more gradual decline thereafter shows what we think is most likely to have been the case between 1980 and the present time and what might reasonably be expected to occur to year 2050. This represents our default scenario.

32. Figure 4 presents three possible scenarios for D, most of which are consistent with the observations of mesothelioma mortality to 2013. Dotted lines represent the population exposure D and solid lines of the same colour represent the consequences in terms of predicted annual mesothelioma deaths to 2050.

Figure 4: Observed and predicted annual mesothelioma mortality for various possible annual population exposure profiles from 1980, males aged 20-89



33. Two scenarios illustrating more a rapid decline in population exposure during 1980s than the default scenario are included. In the rapid decline scenario, exposure continues to reduce at the rate of decline inferred for the 1970s so that exposure is zero by 1983. However, this is in fact inconsistent with the observed data: the fit of the model is significantly worse than for the default scenario and annual deaths in 2012 and 2013 are substantially underestimated. This suggests that asbestos exposure must have continued well into the 1980s. The fastest arguable decline scenario represents the steepest linear decline in exposure that can be assumed from 1980 without a statistically significant worsening of model fit. The no decline scenario represents a levelling off of the exposure D at the highest level possible for the earliest year after 1980 without a statistically significant worsening of model fit. This model clearly predicts much higher numbers of mesothelioma deaths in the long-term which, following an initial decline after year 2020, eventually start to increase again during the 2040s due to gradual changes in population demographics.

34. We compare the long-term predictions of the model for difference exposure scenarios to illustrate the potential health impact of regulation to reduce asbestos exposures by considering counterfactual scenarios which might arguably have occurred had different regulatory strategies been adopted from 1980.

35. These comparisons are based on a consideration of population exposure between 1980 and 2050 and consequent predicted mesothelioma morality to year 2100. We adjust the mortality predictions to include mesothelioma deaths among women and deaths due to asbestos-related lung cancer.

Basis for the default scenario

36. The default scenario was determined by assuming a linear decline in the value of D between 1980 and 2000, with the value for year 2000 estimated using other data sources, and further assuming that exposure beyond 2000 would decline in proportion to size of the remaining stock of asbestos-containing buildings during the period 2000-2050. These calculations were first derived for the Regulatory Impact Assessment carried out for the introduction of the Duty to Manage asbestos regulation in 2004.[23]

Estimating the value of D in year 2000

37. The index of population exposure used in the mesothelioma projections model is scaled arbitrarily: it is the shape of the exposure profile over time that is used to predict subsequent patterns in mesothelioma mortality rather than the absolute value of D in any given year. Estimating the absolute scale of D from other data sources therefore requires calibration of the predictions of the mesothelioma model against predictions based on these other sources.

38. The particular approach adopted to estimate the value of D in 2000 was first to consider evidence about the distribution of exposure levels for key subgroups of the working and wider population of Britain on any given day in order to then estimate the overall average concentration of the population at that given point in time (i.e. in year 2000), using the standard metric for airborne asbestos concentrations (f/ml). Next, published information about the exposure-response model for mesothelioma (expressed in terms of cumulative exposure using the same metric) was used to estimate the long-term mesothelioma mortality that would be expected for continued exposure at this average level. Then, the value of the exposure index D in the mesothelioma projections model was set to predict this same level of future deaths. This process led to an estimated value of D in year 2000 of 4.2% of the peak value in 1964.

39. In the absence of any explicit duty to manage asbestos remaining in buildings values of D beyond year 2000 were estimated to reduce from the level in 2000 in proportion to the assumed rate of demolition of existing buildings with a high probability of containing asbestos materials. This was derived by applying a demolition rate of 1% of current stock per year in 2000, rising gradually to reach 2% after twenty-five years, and then accelerating to reach 4% by year 2050. These assumptions lead to an overall average demolition rate of just over 2% each year, and imply numbers of annual demolition jobs which are consistent with current annual asbestos notifications for licensed work.

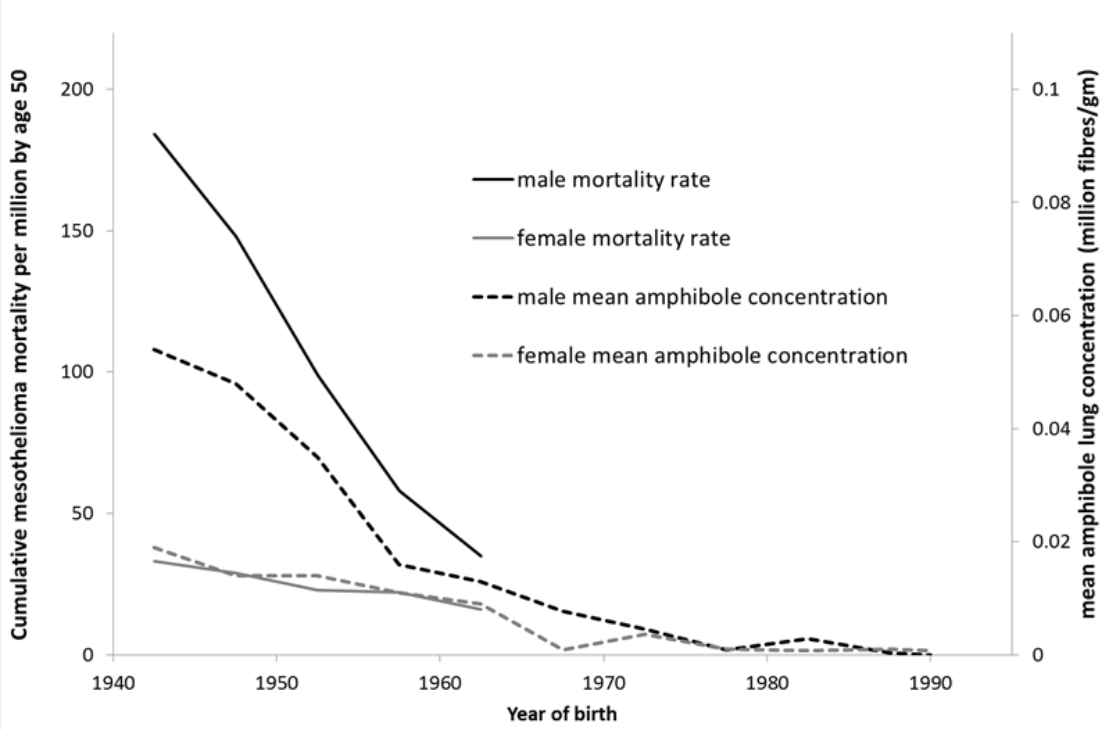
Justification of the default scenario using other data sources

40. The reduction in exposure during the period 1980-2000 – driven by the estimate of D for 2000 of 4.2% – is a key feature of the default scenario, particularly in the context of the ‘no decline’ scenario, which is statistically consistent with observations of mesothelioma mortality to date but which predicts much higher levels of future mortality. However, the calculations to estimate the value of D in year 2000 encompass uncertainties which are difficult to quantify but are likely to be considerable. In the light of this, and in view of the paucity of any new data of the requisite type, it is not clear that revisiting the calculations – for example, to re-evaluate the 2000 value, or to attempt to update the estimation procedure for a more recent time point – would lead to estimates that are materially more precise. We thus assess the plausibility of the default scenario using another source of evidence about population asbestos exposure which has since become available, namely estimates of the asbestos lung content of the general population from ongoing research linked to the mesothelioma case-control study.[10]

41. Figure 5 shows estimates of the average amphibole asbestos lung burden of the British population by period of birth, separately for men and women. Cumulative mesothelioma mortality to age 50 is also shown for the birth periods for which this is calculable from national data available to date (i.e. 1965 or earlier). A strong correlation between the average lung burdens and mesothelioma mortality is evident; downward trends in both lung burden and resulting mesothelioma morality are apparent

for successive birth cohorts from 1940 to 1965. A continuation of these downward trends is also suggested by the mean asbestos lung burdens for more recent birth cohorts.

Figure 5: National mesothelioma mortality and average amphibole asbestos lung burdens* in Britain by period of birth (million fibres/gm longer than 5 microns)

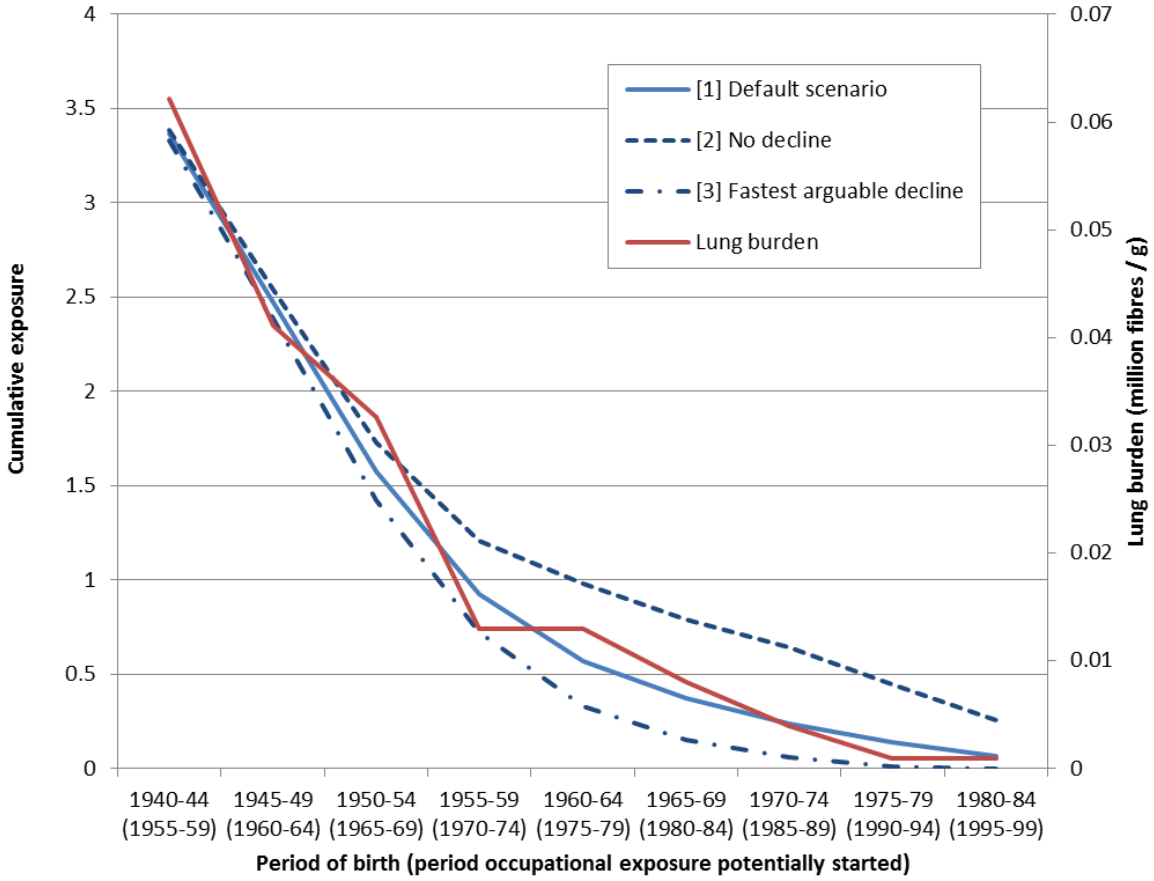


* Subjects born 1940-64 are predominantly resected lung cancer patients, while those born 1965-92 are all pneumothorax patients. Lung burden estimates are adjusted to allow for the fact that a proportion of lung cancers are caused by asbestos.

42. Amphibole asbestos lung burden is reflection of cumulative exposure to asbestos – i.e. it reflects mainly the duration and the average intensity (i.e. the airborne concentration) of exposure, assuming that there will be minimal clearance of bio-persistent amphibole fibres from the lung over time. Since lung samples in the lung burden study were obtained during a fairly short time window (of a few years) but reflect a much wider range of ages, the period of birth comparisons shown in Figure 5 above are affected by the amount of time available for those born in successive birth periods (i.e. of different ages) to be exposed, as well as changes in the average exposure intensity over time. For example, for those born in 1950s will, on average have started work by the early 1970s and had the potential for around 40 years of exposure by the time the lung samples were collected, whereas those born in the 1970s will have had the potential for only around 20 years exposure on average at working ages. The exposure metric in the mesothelioma projections model, on the other hand, reflects the average intensity of population exposure. We therefore calculate from this the implied cumulative exposure for successive birth cohorts within the population, assuming that exposures continued up to the point when the lung burden samples were collected. This was done for the various exposure scenarios of interest – i.e. those shown in Figure 4 – to assess which produces the closest agreement with the lung burden data.

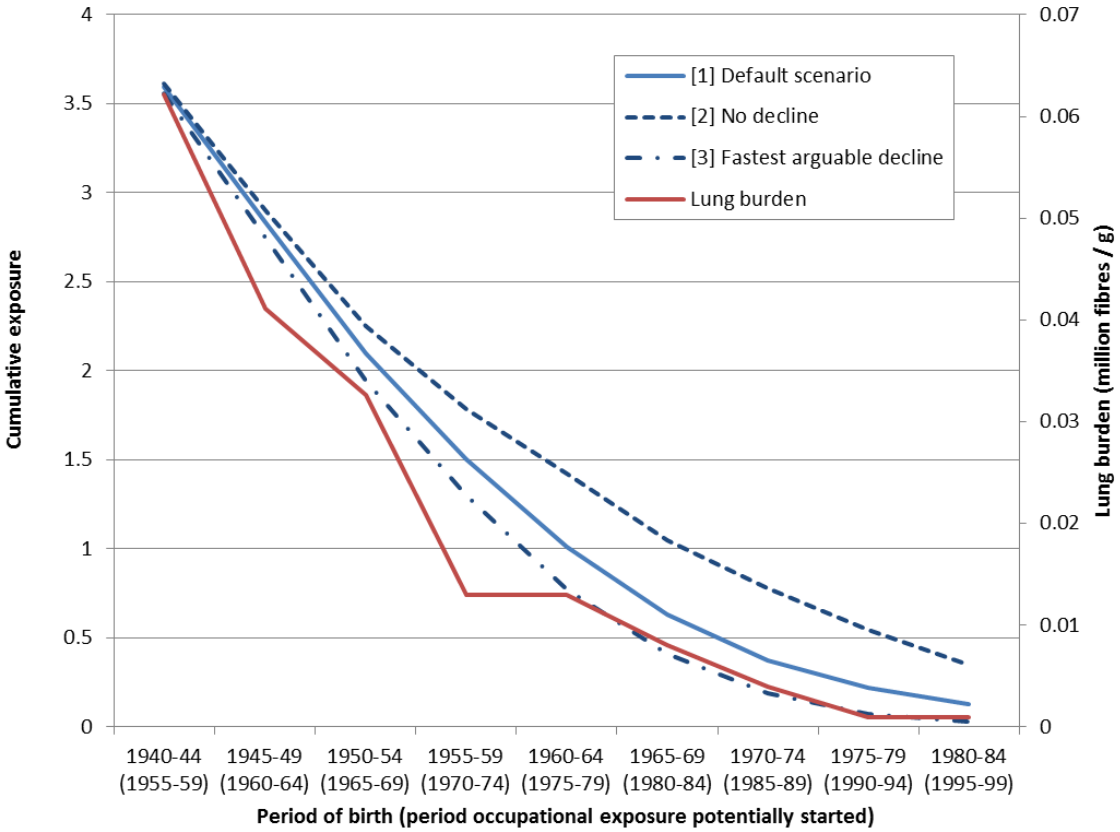
43. Figure 6A reproduces the lung burden results (red line) and also shows average cumulative exposures implied by three of the exposure scenarios presented previously in Figure 4. The Default scenario matches the lung burden results more closely than the “no decline” scenario (which implies higher cumulative exposures) and the “Fastest arguable decline” scenario (which implies lower cumulative exposures).

Figure 6A: Average population lung burdens of amphibole asbestos by period of birth and implied cumulative exposures under three scenarios



44. The mesothelioma projections, and the cumulative exposures calculated in Figure 6A, assume that the age-specific exposure potential (factor W_A in the model) remains fixed for all time with relative values of 0, 0.19, 1.0, 1.65 and 1.27 at ages 5-15, 16-19, 20-29, 30-39, and 40-49 years respectively. Estimation of these parameters is influenced mainly by exposures prior to 1980 when consumption rather than releases from the stock of existing asbestos materials in buildings was the dominant source. However, it might be argued that those below working age have a greater potential for exposures from the stock of existing materials than implied by these values, and if so this would tend to decrease the rate of decline of the cumulative exposure curves shown in Figure 6A. To illustrate this effect the calculations underpinning Figure 6A were re-run after arbitrarily assuming alternative relative exposure potential values of 0.25 and 0.5 at ages 5-15 and 16-19. The results are shown in Figure 6B. Here the scenario of a faster decline in exposure post 1980 produces cumulative exposures that most closely match the lung burden values.

Figure 6B: Average population lung burdens of amphibole asbestos by period of birth and implied cumulative exposures with higher exposure potential below working age

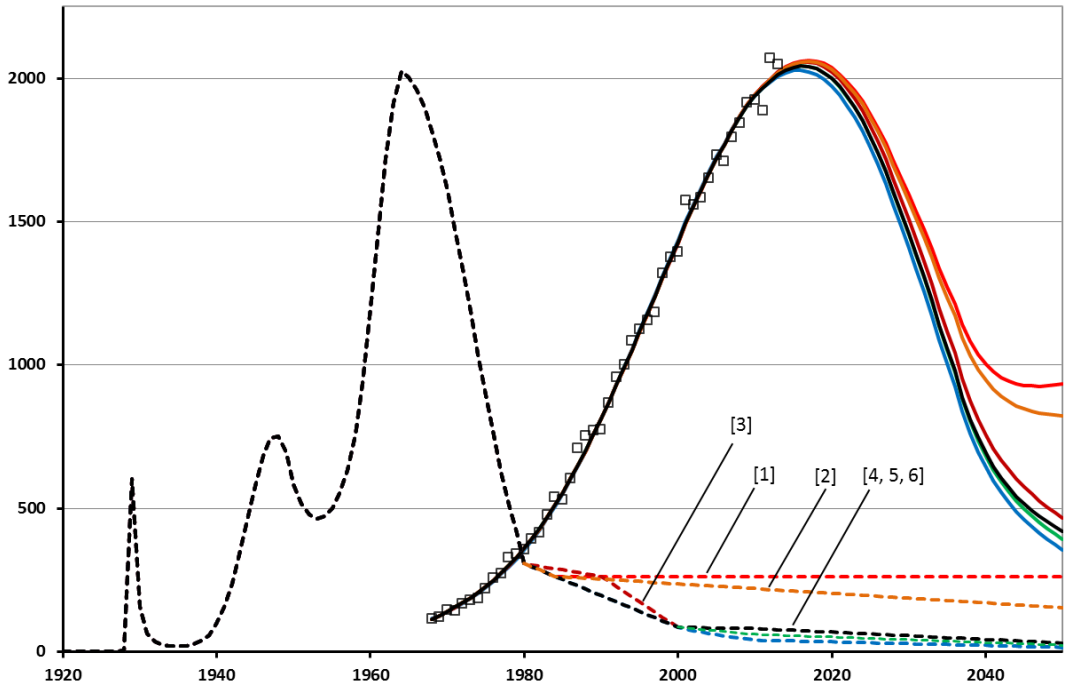


45. These calculations suggest that the “no decline” scenario is implausible and rather tend to support a reduction in exposure since 1980 that was at least as steep as the default scenario.

Scenarios to be compared to assess the potential impact of regulatory changes 1980-2015

46. The scenarios for the profile of population exposure, D, used to illustrate the potential long term health impact of regulation from the 1980s are shown in Figure 7 below.

Figure 7: Observed and predicted annual mesothelioma mortality under six alternative scenarios for annual population exposure from 1980, males aged 20-89



47. Scenarios 1 and 2 represent the worst cases for the population exposure that may have occurred had efforts to control asbestos not been made progressively more stringent from the 1980s onwards.

Scenario 1: Exposure remained level from 1984 (earliest possible levelling off of exposure which does not adversely affect the fit of the model).

48. This represents the extreme worst case scenario. The rapid decline in exposure during the 1970s vs a contrasting levelling off of exposure after this can be justified qualitatively in terms of the reduction of new installation of amphibole containing materials (which caused particularly high and widespread exposures among construction workers) during the 1970s which virtually ceased by 1980. However, a lack of stringent requirements for the control of work with the stock of asbestos containing materials in buildings is then assumed to lead to exposure at a constant level from the early 1980s onwards.

Scenario 2: Linear decline from 1980 to half the 1980 level by 2050.

49. The plausibility of scenario 1 can reasonably be doubted given the continually growing concerns about asbestos in the 1970s. It is likely that at least some level of control would have been implemented, and a general reduction in exposure driven by the gradual depletion of the stock of asbestos containing materials in buildings – as in the default scenario described in the previous section – is likely. Thus scenario 2 represents a more plausible worst case for less stringent control. Here the exposure reduces gradually from the relatively high level of the early 1980s to half that level by 2050.

Scenario 3: Slower linear decline 1980-90; faster linear decline to 2000; 'no Duty to Manage' exposure from 2000.

50. This represents a variation of the default scenario (scenario 4 here) discussed in the previous section in which exposure reduces more gradually during the 1980s and then more steeply during the 1990s to reach the value of 4.2% of the peak exposure in year 2000. This scenario is presented as a possible alternative to the default scenario, since efforts to control exposure post 1980 were arguably directed mainly at the relatively small asbestos removal industry rather than the wider group of building maintenance workers, and improvements in control among the latter are more likely to have occurred during the 1990s in the lead up to more formal arrangements culminating in the introduction of the Duty to Manage.

Scenarios 5 and 6: Linear decline from 1980 to 2000; 75% or 50% of the default scenario (i.e. in the absence of the Duty to Manage) from 2010

51. These Scenarios 5 and 6 are focussed on the exposure situation following the implementation of the Duty to Manage (DTM) regulation. One major factor that relates to the impact of this regulation is the level of compliance. The scope of the duty (which does not cover most domestic premises) also means that full compliance could not be expected to reduce exposure to zero beyond, say, 2010. For consistency with the calculations in the Regulatory Impact Assessment we assume that high compliance with the duty would reduce exposures to 50% of the "no DTM" exposure (scenario 4). This situation is presented in scenario 6, and scenario 5 assumes an exposure mid-way between the "no-DTM" and "high compliance" scenarios.

52. Table 1 presents predicted deaths from asbestos-related cancer over the 100-year period from 2001-2100 based on the mesothelioma projections model under the six scenarios presented in Figure 7, and allowing for additional deaths among women and due to asbestos-related lung cancer.

53. Predicted deaths are given for two cases, firstly assuming that the exposure for each scenario continues beyond the present time to year 2050, and secondly, considering only the predictions for exposures up until the present time. The second of these approaches is arguably most relevant to assessing the impact to date of changes in exposure influenced by past regulatory activity. The right hand part of Table 1 presents the differences in the long term mortality predicted when comparing the different scenarios. For example, the total predicted deaths during 2001-2100 for the default scenario [4] (considering only exposures to 2015) is 172,100. The equivalent figure for scenario [2] (the "plausible worst case") is 194,900. The difference between these two scenarios can be interpreted as the deaths prevented had scenario [4] taken place rather than scenario [2], and equates to 22,800 deaths. If scenario [3] is a more realistic description of exposures that took place during the 1980s and 1990s than scenario [4], the number of deaths prevented is reduced to 18,700 (i.e. [3] vs [4]).

Table 1: Predicted deaths from asbestos-related cancer during 2001-2100 for various exposure scenarios during the period 1980-2050

	Predicted deaths* 2001-2100 if exposure continues to:		*Difference in predicted mortality (for exposure to 2015) vs scenario…*				
Scenario	**2050**	**2015**	*[1]*	*[2]*	*[3]*	*[4]*	*[5]*
[1] Exposure level from 1984 (earliest possible levelling off)	267800	200400	-	-	-	-	-
[2] Linear decline from 1980 to half 1980 level by 2050	234800	194900	*5500*	-	-	-	-
[3] Slower linear decline 1980-90; faster linear decline to 2000; 'no DTM' exposure from 2000	189100	176200	*24200*	*18700*	-	-	-
[4] Linear decline from 1980; 'no DTM' exposure from 2000	185000	172100	*28300*	*22800*	*4100*	-	-
[5] Linear decline from 1980; 75% of 'no DTM' exposure from 2010	180400	170700	*29700*	*24200*	*5500*	*1400*	-
[6] Linear decline from 1980; 50% of 'no DTM' exposure from 2010	175600	169200	*31200*	*25700*	*7000*	*3000*	*1600*

* Includes mesothelioma and asbestos-related lung cancer among men and women of all ages.

54. Key comparisons which illustrate the potential scale of deaths prevented by the introduction of the DTM are for scenario [6] vs [4] (i.e. high compliance with DTM vs no DTM) which predicts 3000 prevented deaths, and [5] vs [4] (i.e. exposure mid-way between high compliance and no DTM vs the no DTM scenario) which predicts 1400 prevented deaths. If the exposure reductions based on scenarios [5] and [6] were continued to year 2050, these values rise substantially to 9400 and 4600 deaths prevented respectively.

55. In order to assess the overall health benefit of asbestos exposure reduction since the early 1980s to date we compare scenario [2] (plausible worst case) with scenario [6] (high compliance with the DTM) (for the case in which exposure continues as described by these scenarios only until 2015). On this basis, scenario [6] predicts 25,700 fewer deaths from mesothelioma and lung cancer in the 100 years between 2001 and 2100 than scenario [2].

Assessment of the potential impact of removing asbestos control requirements from 2016

56. The basis for assessing the future benefits of continued control of asbestos by continuing the current regulations is illustrated in Figure 8. We compare the predicted deaths over the 100 year period 2016-2115 under three different exposure scenarios. Dotted lines in Figure 8 show the assumed population asbestos exposure profile for each scenario, and solid lines of equivalent colour show the resulting predicted cancer deaths.

57. Scenario A describes the situation of continued regulatory control under the existing requirements and uses the same exposure profile as scenario [6] in the previous section, extended to year 2100.

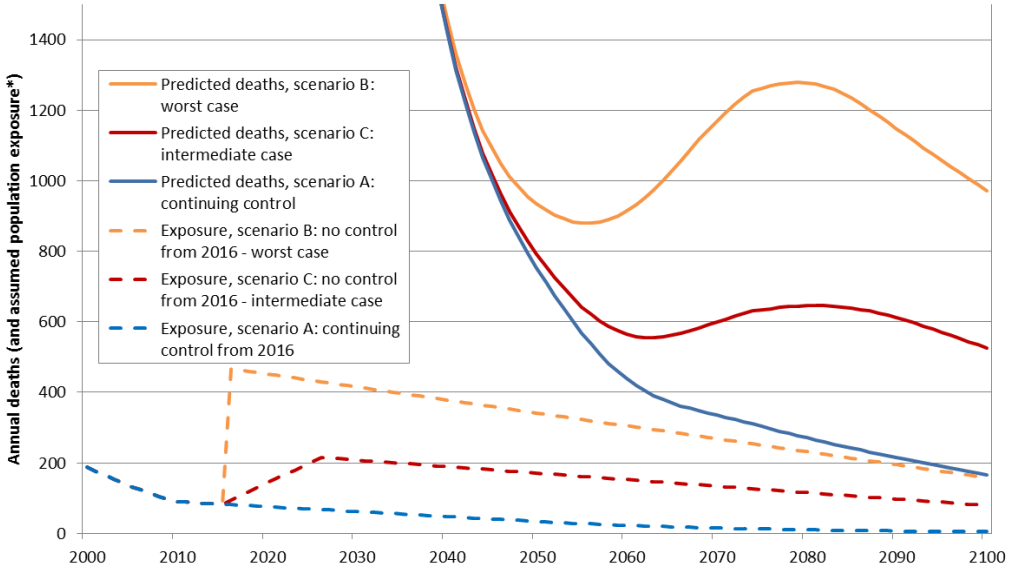
58. Scenario B describes a rapid increase in exposure from 2016 onwards assumed to occur if all asbestos control requirements were discontinued from this point. Here the exposure profile from 2016 onwards is the same as in scenario [2] in the previous section – i.e. the plausible worst case for less stringent control – again extended to year 2100.

59. Scenario B is likely to represent a worst case situation and so we also assess an intermediate case – scenario C – in which exposure increases to half the level of scenario B by 2026 (i.e. 10 years after the discontinuation of any requirement to control asbestos).

60. Scenario B (without the regulations) results in some 50,500 additional cancer deaths compared to scenario A (with the regulations) in the period 2016 - 2115. Of those, 40,800 are from cases of mesothelioma, while 9,700 are from cases of lung cancer.

61. Scenario C (intermediate case without the regulations) results in some 19,300 additional cancer deaths compared to scenario A (with the regulations) in the period 2016 - 2115. Of those, 15,900 are from cases of mesothelioma, while 3,400 are from cases of lung cancer.

Figure 8: Predicted annual cancer deaths for three scenarios for population asbestos exposure from 2016



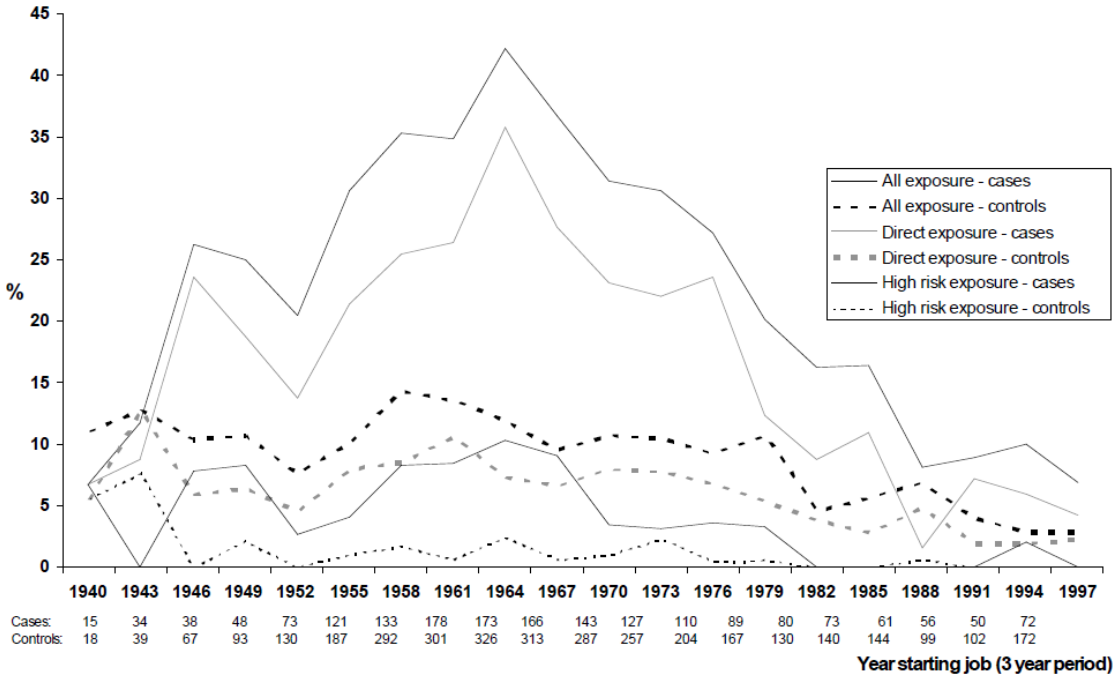
**Relative changes in annual population asbestos exposure are used to predict subsequent mesothelioma mortality in the HSE model; the absolute scaling of the exposure profile is arbitrary in this chart .*

Further supporting evidence for a reduction in exposures since 1980

62. The evidence discussed above, which broadly supports the plausibility of our default scenario for a continued reduction in exposure from 1980s, can be supplemented by a number of other strands of evidence which are highlighted briefly below.

63. Information about reported asbestos exposure is available from individuals with mesothelioma and control subjects interviewed within the British mesothelioma case-control study.[15] Figure 9 shows the proportions of male mesothelioma cases and controls beginning a new job in each three-year period since 1940 who reported asbestos exposure in that job. (Jobs of more than 5 years duration are excluded to ensure that reported exposure is representative of the period when the job started.) Cases report substantially more exposure in most time periods, and while this may be somewhat biased by case status, the data for both cases and controls suggest that the frequency of exposure fell sharply during the 1970s, but also continued to decline after 1980.

Figure 9: Proportion of all male mesothelioma cases and controls reporting asbestos exposure by year started job in the British mesothelioma case-control study



64. Table 2 shows the regulatory history in Britain relevant to work with asbestos which is characterised by a progressive tightening of control requirements. Key changes since 1980 include the introduction of licensing for work with higher risk materials, including sprayed insulation and Asbestos Insulation Board (AIB).

65. Limits for the concentration of airborne asbestos fibres were first introduced soon after the Asbestos Regulations 1969 came into force. The various limits that have applied since then are shown in Table 3. Limits were initially intended as a guide to determine whether the 1969 regulations were being implemented and this led to a number of hygiene surveys by HSE during the 1970s which were focussed on the asbestos manufacturing industry. Later, the focus of control was on lowering exposures as low as reasonable practicable among the wider group of asbestos removal workers. Rather than setting a safe or acceptable level of exposure, control limits thus became a trigger for certain additional control measures (such as the use or PPE) over and above measures to minimise the release of fibres at source. Table 3 shows that the control limits themselves have been progressively lowered, the current limit of 0.1 f/ml being one twentieth of the 2 f/ml limit that applied in 1970.

Table 2: Asbestos –related regulatory history since 1931

Regulation History	**Main Area of focus**
Asbestos Industry Regulations 1931	Workers manufacturing asbestos products
Asbestos industry (asbestosis) scheme 1931	Compensation for disablement and death for workers in selected areas of work with asbestos for more than 8 hours per week
The Asbestos Industry (Asbestosis) Amendment Scheme, 1946.	Introduced employer contribution to compensation if worked >5 years on process.
The Factories Act 1961	Extended the 1931 regulations to other workers (eg boilermakers, shipyard workers and plumbers).
Asbestos Regulations 1969	Employers and employees who work with asbestos or any article containing asbestos
Asbestos (Licensing) Regulations 1983	Contractors who work with asbestos insulation require a license from HSE

Regulation History	Main Area of focus
Control of Asbestos at Work Regulations 1987	Applied to all work which is liable to expose employees to asbestos and before starting work to identify the type of asbestos, provide information, instruction and training, ensure adequate control measures and prevent the spread of debris. Also to reduce exposure to ALARP.
Control of Asbestos in the Air Regulations 1990	Limited the discharge to air from asbestos factories and other environmental pollution.
The Control of Asbestos at Work (Amendment) Regulations 1992	Introduced the need for a plan of work and include the EU Carcinogens Directive and required to substitute with less hazardous substance
Control of Asbestos at Work (Amendment) Regulations 1998	Extend the application to all employees exposed to asbestos and required employers to keep records of risk assessments and plan of work etc.
Control of Asbestos at Work (Amendment) Regulations 2002	Introduced a specific duty to manage asbestos in premises to control exposure to workers and others.
Control of Asbestos Regulations 2006	Merged The Control of Asbestos at Work Regulations 2002; The Asbestos (Licensing) Regulations 1983; and The Asbestos (Prohibitions) Regulations 1992 into one set of asbestos regulations.
Control of Asbestos Regulations 2012	Updated to deal with the issue on Sporadic and low intensity exposure.

Table 3: Exposure limits / control limits for asbestos since 1970

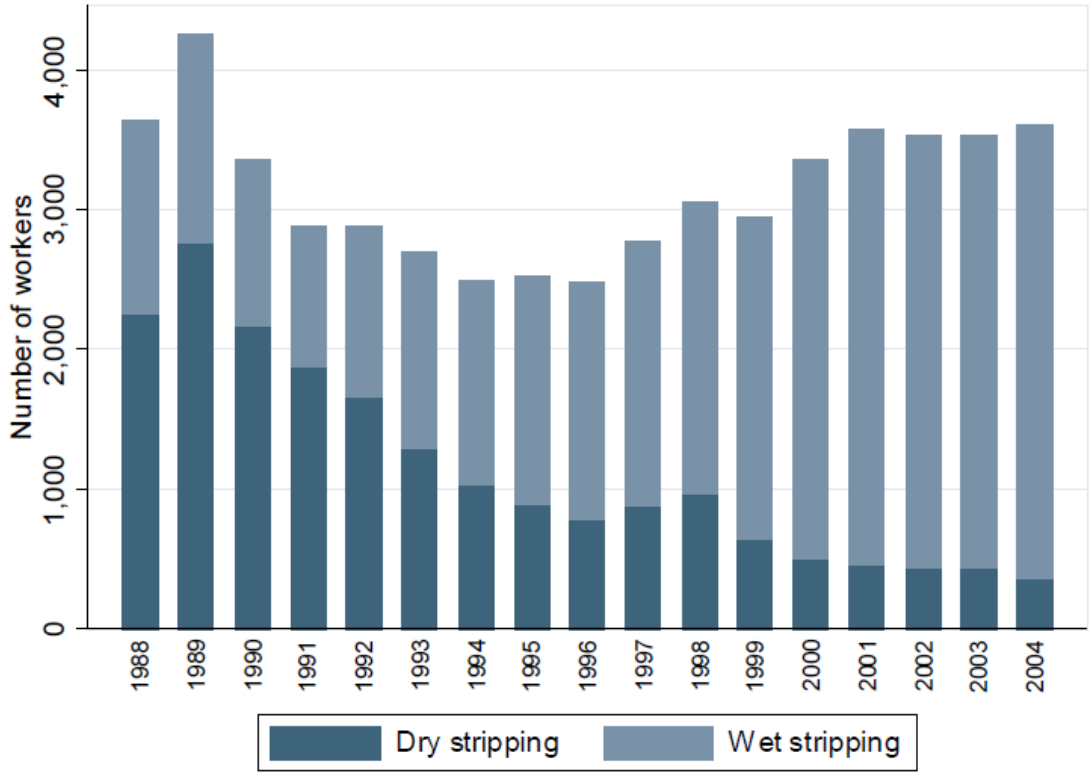
Date implemented	Legislation (Guidance)	Chrysotile f/ml		Amosite f/ml		Crocidolite f/ml	
		4 hrs	***10 mins***	**4 hrs**	***10 mins***	**4 hrs**	***10 mins***
1969	Asbestos Regulations 1969 (Limits in Technical Data Note 13)						
1970	(Department of Employment Technical Data Note 13 "Hygiene standards for airborne dust concentrations for use with the Asbestos Regulations 1969".)	2.0	*12.0*	2.0	*12.0*	2.0	*12.0*
1976 (*from 12/76*)	(EH10: 1976 "Asbestos hygiene standards and measurement of airborne dust concentrations".)	2.0	*12.0*	2.0	*12.0*	Not stated	*0.2*
1983 (*from 01.01.83*)	(EH10: 1983 (rev April 1983) "Asbestos control limits and measurement of airborne dust concentrations".)	1.0		0.5		0.2	
1984 (*from 01.08.84*)	(EH10: 1984 (rev July 1984) "Asbestos control limits, measurement of airborne dust concentrations and assessment of control measures".)	0.5		0.2		0.2	
1987 (*from 01.03.88*)	Control of Asbestos at Work Regulations 1987	0.5	*1.5*	0.2	*0.6*	0.2	*0.6*
1988 (*from 01.03.88*)	(EH10: 1988 (rev Feb 1988) "Asbestos exposure limits and measurement of airborne dust concentrations".)	0.5	*1.5*	0.2	*0.6*	0.2	*0.6*
1992 (*from 01.01.93*)	Control of Asbestos at Work (Amendment) Regulations 1992	0.5	*1.5*	0.2	*0.6*	0.2	*0.6*

Date implemented	Legislation (Guidance)	Chrysotile f/ml		Amosite f/ml		Crocidolite f/ml	
		4 hrs	***10 mins***	**4 hrs**	***10 mins***	**4 hrs**	***10 mins***
1995	(EH10: 1995 (rev 1995) "Asbestos: exposure limits and measurement of airborne dust concentrations".)	0.5	*1.5*	0.2	*0.6*	0.2	*0.6*
1998 (*from 01.02.99*)	Control of Asbestos at Work (Amendment) Regulations 1998	0.3	*0.9*	0.2	*0.6*	0.2	*0.6*
2001	(EH10: 2001 "Asbestos: exposure limits and measurement of airborne dust concentrations".)	0.3	*0.9*	0.2	*0.6*	0.2	*0.6*
2002 (*from 21.11.02*)	Control of Asbestos at Work Regulations 2002	0.3	*0.9*	0.2	*0.6*	0.2	*0.6*
2006 (*from 13.11.06*)	Control of Asbestos Regulations 2006	0.1	*0.6*	0.1	*0.6*	0.1	*0.6*

66. Other changes during this period which were part of a more general progressive tightening of the control regime, and which we think are likely to have contributed to reductions in exposures overall, include the following:

    1. An increase in the availability of guidance about control requirements and good practice for work with asbestos. For example, the Asbestos Licensing regulations and Control of Asbestos at Work Regulations were accompanied by ACOPs to set out improved and expected standards of work, and since then a wide range of guidance has been refined, clarified and targeted for different work task and worker groups as knowledge of the practicalities of best controlling fibre release in different situations has increased.
    2. One specific important example of changing work practices was the trend from dry to wet stripping of asbestos materials during the 1980s and 1990s, which is supported by evidence from the HSE asbestos workers survey. Figure 10 shows the number of asbestos removal workers who mainly carried out wet or dry stripping, as reported when surveyed each year between 1988 and 2004 during the course of their statutory medicals for work with asbestos. There is a clear trend towards wet stripping over time, with a majority of workers reporting that they mainly carry out wet stripping from the mid-1990s onwards.
    3. There have been progressive improvements in various control strategies, including enclosure of asbestos removal work, clearance procedures following removal, as well as PPE use and effectiveness.
    4. There has also been a progression towards more stringent requirements for, and increased availability of, appropriate training, and the accreditation of laboratories.

Figure 10: Asbestos removal workers reporting wet or dry stripping, 1988-2004



67. In addition to the regulatory changes since the 1980s, there is also likely to have been a gradual change in the prevalence of different ACMs remaining in buildings over time. Substantial quantities of the very highest risk ACM – in particular, sprayed asbestos insulation and asbestos coatings – have now been removed. Workers removing or disturbing asbestos in more recent times are thus relatively more likely to come into contact with materials such as AIB, textured decorative coatings and floor tiles, than these particularly hazardous materials.

68. Many of the changes described above have directly relevance to the relatively small cohort of workers carrying out licensed asbestos removal work. However, we think it is reasonable to expect that these factors influenced exposures among the much wider group of building workers who typically worked with asbestos less frequently well before the formal Duty to Manage asbestos in buildings was implemented.

69. There is, for example, evidence that amount of activity to survey asbestos materials encountered in building increased rapidly during the 1990s as part of increased recognition of the need for careful management of asbestos within buildings. *Methods for the Determination of Hazardous Substances No. 100 (MDHS 100: Surveying, sampling and assessment of asbestos-containing materials)* was published in July 2001 but reflects the evidence and experience gained over a long period prior to this date in terms of effective identification and control of asbestos in buildings.

70. The 1990s saw increased efforts to promote a greater awareness of the risks of asbestos within the construction industry, particularly among those that may be unaware that building materials they encounter may contain asbestos. These included producing targeted guidance for specific occupational groups within the construction industry as well as promoting better awareness of asbestos among employers and trade associations. More recently, national campaigns to promote better awareness among individual tradespeople and building maintenance workers have been carried out include the ‘Don’t take the gamble’ and ‘Hidden Killer’ campaigns.

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Appendix 4: Enforcement data – Control of Asbestos Regulations

Post Implementation Review (PIR) of the Control of Asbestos Regulations (CAR) 2006 and 2012

Enforcement data – Notices, prosecutions and penalties 2007-2016

Enforcement of CAR

Asbestos regulations are enforced by HSE, Local Authorities (LAs) and the Office of Rail and Road (ORR). LAs are the principle enforcing authority in retailing, wholesale distribution, warehousing, hotel and catering premises, offices, and the consumer and leisure industries. ORR is responsible for railway stations and depots and other rail premises.

If there is extensive building or construction activity in premises normally enforced by LAs or ORR, HSE may become the enforcing authority for the duration of the construction work.[1]

HSE approach to enforcement

HSE considers that appropriate use of enforcement powers is important, both to secure compliance with health and safety law and to ensure that dutyholders are held to account for significant failures.

HSE uses a risk-based approach when deciding which dutyholders to proactively inspect, taking into account factors such as size, type of activities, industry sector, and the associated death, injury and ill-health rates.

HSE carry out a programme of work to secure a national minimum commitment to the inspection of licensed work with asbestos insulation, asbestos coating and asbestos insulating board (AIB). In particular, HSE continue to give inspection priority to work where:

- uncontrolled dry stripping is planned;
- work is proposed in hot environments;
- where the use of power tools is planned.

HSE also give priority to:

- new licence holders;
- licensees whose licences expire within next 4-6 months and have not been inspected in the previous 12 months;
- licensees who have been sent a warning letter by the Asbestos Licensing Unit (ALU) or whose performance has been unsatisfactory.

HSE targets 20% of visits to sites where notifications of work with AIB have been received. HSE also continues to work alongside LAs to ensure dutyholder compliance with the regulation to safely manage

[1] Further information is available at HSE's asbestos enforcement page http://www.hse.gov.uk/asbestos/enforcement.htm

asbestos and have a range of enforcement methods to secure compliance with the law and to ensure a proportionate response to any breaches.[2]

HSE notices

An **improvement notice** (IN) specifies remedial action and gives the dutyholder a date by which they must complete the action. It can be served when an inspector is of the opinion that there is a breach of the law.

A **prohibition notice** (PN) tells the dutyholder to stop an activity immediately.[3] It can be served when an inspector is of the opinion that there is a risk of serious personal injury associated with a particular work activity or process or, if a serious deficiency in measures is identified, to prevent or mitigate the effects of major hazards. There does not need to be a breach of the law.[4]

HSE prosecutions

Failure to comply with either type of notice is a criminal offence and can result in prosecution. Both prosecution and, where appropriate, cautions, are important ways to hold those responsible to account for breaches of the law. Where it is appropriate to do, these measures can be taken in addition to issuing an improvement or prohibition notice.

Prosecution is an essential part of enforcement, ensuring that where there has been a serious breach of the law, dutyholders are held to account. This includes bringing alleged offenders before the courts in England and Wales or recommending prosecution to the Crown Office and Procurator Fiscal Service (COPFS) in Scotland.

Over the last five years, the number of cases prosecuted by HSE, local authorities and COPFS has increased slightly. Offences prosecuted count individual offences of separate health and safety legislation.

In the latest year available (2014/15),[5] HSE:

- prosecuted 650 cases, with at least one conviction achieved in 606 cases, a conviction rate of 93%;
- prosecuted 1,058 offences, resulting in 905 convictions, a conviction rate of 86%;
- prosecutions led to fines totalling £16.5 million, an average penalty of £18,198 per offence.

For CAR, in 2014/15 HSE:

- prosecuted 18 cases (3% of all HSE cases), with at least one conviction achieved in 16 cases, a conviction rate of 89%;
- prosecuted 45 offences (4% of all HSE offences), resulting in 34 convictions, a conviction rate of 76%;
- prosecutions led to fines totalling £265,205 (2% of all HSE fines), an average penalty of £7,800 per offence.

[2] Further information is available at HSE's Enforcement Management Model (EMM) page http://www.hse.gov.uk/foi/internalops/ocs/100-199/130_5/index.htm
[3] It can also be deferred for safety reasons.
[4] A Crown notice is issued under the same circumstances that would justify a statutory prohibition or improvement notice, but is only served on duty holders in Crown organisations such as government departments, the Forestry Commission or the Prison Service.
[5] http://www.hse.gov.uk/statistics/prosecutions.htm

Penalties

Breaches of CAR are offences under section 33 of the Health and Safety at Work Act etc. (HSWA) 1974. A summary of the maximum fines and periods of imprisonment that may be imposed for an offence under section 33 can be found in the table of penalties at http://www.hse.gov.uk/enforce/enforcementguide/court/sentencing-examples.htm. These are the maximum penalties available to the courts and do not indicate the size of penalty that should be imposed on a defendant in any particular case, as there is no concept of a tariff in health and safety cases.

Prosecution costs

In addition to penalties, the court may order a convicted defendant to pay what it considers to be 'just and reasonable' costs to the prosecutor. It is HSE policy to seek to recover the full costs of any investigation and prosecution which have been 'just and reasonably' incurred from convicted defendants. The award of costs is at the discretion of the court and may be less than the total amount sought by the prosecution. The court must look at the whole sum (fine and costs) that it is minded to order and consider the impact on the defendant. If the total exceeds the sum the defendant can reasonably be ordered to pay, the court will use its discretion to achieve an acceptable total. Any compensation order will take priority over the fine.

HSE records

HSE publishes details of notices, prosecutions and fines relating to dutyholders who breached CAR in the last 5 years on their website.[6] HSE also retains details of the breaches on its internal Corporate Operational INformation (COIN) system from April 2007. CAR 2006 was replaced by CAR 2012, coming into force on 6 April 2012, updating and replacing the previous 2006 regulations. CAR 2012 contains new requirements for certain types of non-licensable work with asbestos on notification of work; designating areas where you are working on asbestos; medical surveillance and record keeping.

However, all breaches relate to part 2 (general requirements) of CAR and the order and titles of these sections remains identical in the 2006 and 2012 regulations. HSE COIN data provides details of each case, including:

- the name of the inspector assigned to the case
- the name of the dutyholder
- their company name and address
- their type of industry
- what section of CAR was breached (if available)
- a description of the breach
- what type of notice was issued (if applicable)
- the date of the hearing (if applicable)
- the fine amount (if applicable)

[6] http://www.hse.gov.uk/prosecutions/default.asp

HSE CAR notices (April 2007-March 2016)

There were 22 sections of CAR that were breached resulting in notices being issued to dutyholders in the period April 2007-March 2016. These related to regulations:

- 4 Duty to manage asbestos in non-domestic premises
- 5 Identification of the presence of asbestos
- 6 Assessment of work which exposes employees to asbestos
- 7 Plans of work
- 8 Licensing of work with asbestos
- 9 Notification of work with asbestos
- 10 Information, instruction and training
- 11 Prevention or reduction of exposure to asbestos
- 12 Use of control measures etc.
- 13 Maintenance of control measures etc.
- 14 Provision and cleaning of protective clothing
- 15 Arrangements to deal with accidents, incidents and emergencies
- 16 Duty to prevent or reduce the spread of asbestos
- 17 Cleanliness of premises and plant
- 18 Designated Areas
- 19 Air monitoring
- 20 Standards for air testing and site clearance certification
- 21 Standards for analysis
- 22 Health records and medical surveillance
- 23 Washing and changing facilities
- 24 Storage, distribution and labelling of raw asbestos and asbestos waste
- 27 Labelling of products containing asbestos[7]

There were 4,633 CAR breaches in this period. 2,695 CAR breaches related to improvement notices (INs).[8] 1,938 CAR breaches related to prohibition notices (PNs).[9] 1,587 INs and 1,068 PNs were issued to dutyholders.

The Standard Industrial Classification (SIC) code is used to classify business establishments and other standard units by the type of economic activity in which they are engaged.

SIC code 41200 – Construction of Buildings – was the most common dutyholder code for CAR breaches relating to INs (11%, N=182). SIC code 41200 – Construction of Buildings – was also the most common dutyholder code for CAR breaches relating to PNs (26%, N=273).

[7] Applicable to INs only (1 notice).
[8] 13 INs were Crown notices and 1 was a Food and Environment Protection Act (FEPA) notice.
[9] 3 PNs were deferred (including 1 Crown notice). The remaining PNs were immediate (which included 2 other Crown notices).

SIC code 43999 – Specialised Construction Not Scaffold – was the second most common dutyholder code for CAR breaches relating to PNs (11%, N=122).

As of 29 July 2016, there were 450 companies holding an asbestos licence.[10] Between 2007 and 2016, 6 companies had their asbestos licences revoked for breaches of CAR (and/or HSWA).

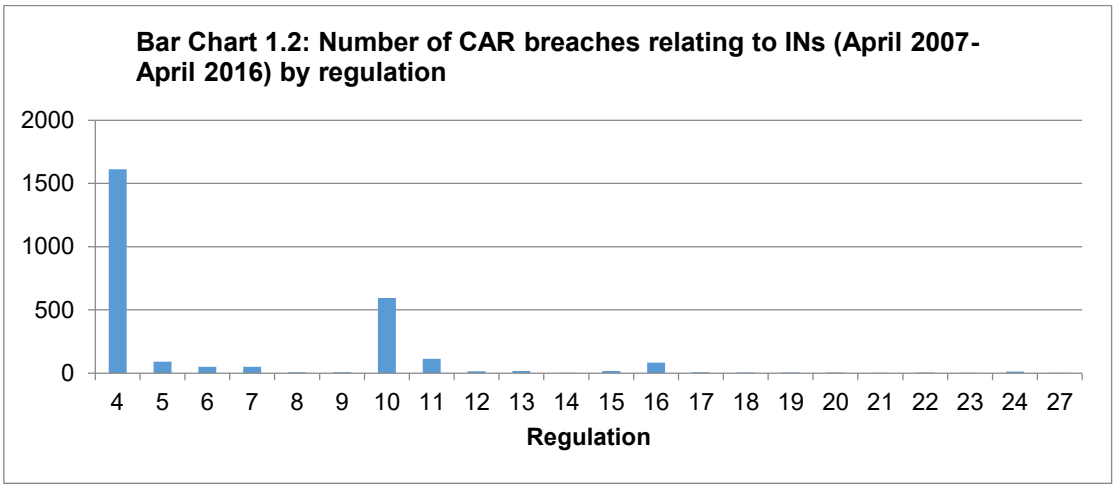
1. CAR breaches relating to improvement notices (INs)

Table 1.1 below shows the number of CAR breaches relating to INs (April 2007-March 2016) by regulation and reporting year:

Table 1.1: Number of CAR breaches relating to INs (April 2007-March 2016) by regulation and reporting year

Regulation	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	27	Total
2007-08	91	1	2	4	0	0	25	8	2	2	1	1	3	0	0	0	0	0	0	0	2	0	**142**
2008-09	261	4	1	2	0	0	31	6	0	2	1	2	3	0	0	0	0	0	0	0	0	0	**313**
2009-10	236	9	3	5	1	1	57	17	5	2	0	3	11	2	0	1	0	0	1	1	0	0	**355**
2010-11	345	8	4	4	1	1	91	15	1	3	0	2	16	3	0	0	0	0	2	1	1	0	**498**
2011-12	267	14	7	9	3	0	109	9	0	0	0	0	2	2	4	0	0	0	0	0	2	0	**428**
2012-13	140	10	8	6	0	3	77	21	0	0	0	2	17	0	0	4	3	1	1	0	0	0	**293**
2013-14	92	17	9	9	1	1	86	9	2	1	0	1	6	0	0	0	0	0	0	0	0	0	**234**
2014-15	92	9	12	7	0	0	61	15	5	6	0	6	14	0	0	0	0	0	0	0	6	1	**234**
2015-16	89	18	3	4	1	1	58	12	0	0	0	0	11	0	0	0	0	0	0	0	1	0	**198**
Total	**1613**	**90**	**49**	**50**	**7**	**7**	**595**	**112**	**15**	**16**	**2**	**17**	**83**	**7**	**4**	**5**	**3**	**1**	**4**	**2**	**12**	**1**	**2695**

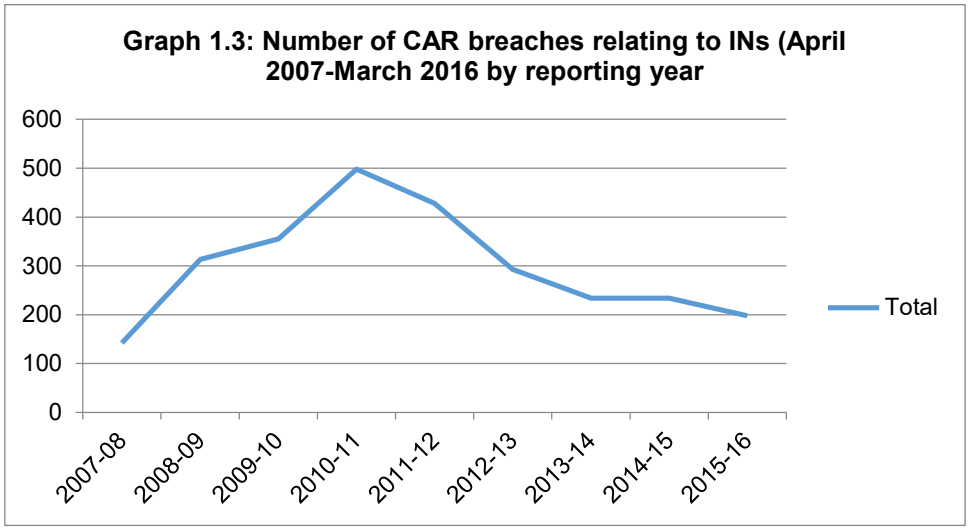
Bar chart 1.2 below shows the number of CAR breaches relating to INs (April 2007-March 2016) by regulation:



In the relevant period, regulation 4 (Duty to manage asbestos in non-domestic premises) represented the most common breach relating to INs (60%, N=1,613). Regulation 10 (Information, instruction and training) represented the second most common breach relating to INs (22%, N=595).

[10] Current asbestos license holders are published on HSE's site http://webcommunities.hse.gov.uk/connect.ti/asbestos.licensing/view?objectId=8516&exp=e1

Graph 1.3 below shows the number of CAR breaches relating to INs (April 2007-March 2016) by each reporting year:



There were the lowest numbers of CAR breaches in 2007-08 (142) and the highest number of CAR breaches in 2010-11 (498).

2. CAR breaches relating to prohibition notices (PNs)

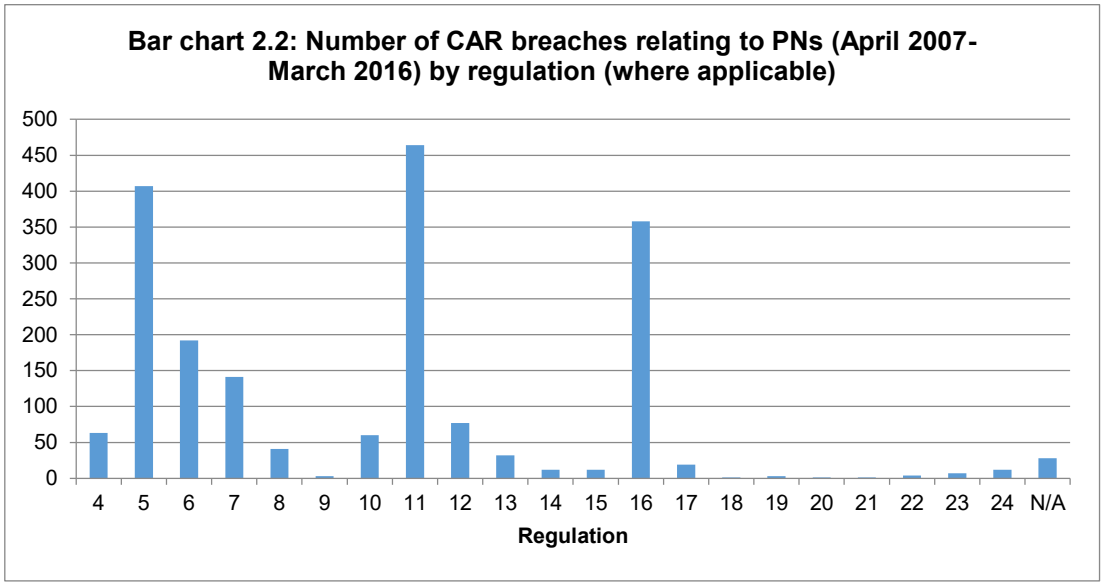
Table 2.1 below shows the number of CAR breaches relating to PNs (April 2007-March 2016) by regulation (where applicable[11]) and reporting year:

Table 2.1: Number of CAR breaches relating to PNs (April 2007-March 2016) by regulation (where applicable) and reporting year

Regulation	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	N/A	Total
2007-08	1	27	8	11	6	0	5	34	11	5	3	4	19	2	0	0	0	0	1	0	2	13	**152**
2008-09	7	11	16	24	5	0	7	58	16	6	1	0	39	1	1	0	1	0	0	2	2	4	**201**
2009-10	12	23	27	23	6	2	2	65	14	5	0	3	42	4	0	0	0	0	1	1	3	3	**236**
2010-11	14	57	19	26	7	0	14	78	10	8	0	3	64	4	0	1	0	1	2	1	1	1	**311**
2011-12	4	59	17	10	5	1	2	55	8	5	3	0	45	2	0	1	0	0	0	1	1	2	**221**
2012-13	7	36	22	14	3	0	7	38	8	0	1	0	32	1	0	1	0	0	0	1	1	0	**172**
2013-14	5	68	27	13	1	0	9	47	5	2	1	0	36	1	0	0	0	0	0	0	1	2	**218**
2014-15	4	66	29	11	3	0	8	54	3	1	3	2	52	3	0	0	0	0	0	1	0	0	**240**
2015-16	9	60	27	9	5	0	6	35	2	0	0	0	29	1	0	0	0	0	0	0	1	3	**187**
Total	**63**	**407**	**192**	**141**	**41**	**3**	**60**	**464**	**77**	**32**	**12**	**12**	**358**	**19**	**1**	**3**	**1**	**1**	**4**	**7**	**12**	**28**	**1938**

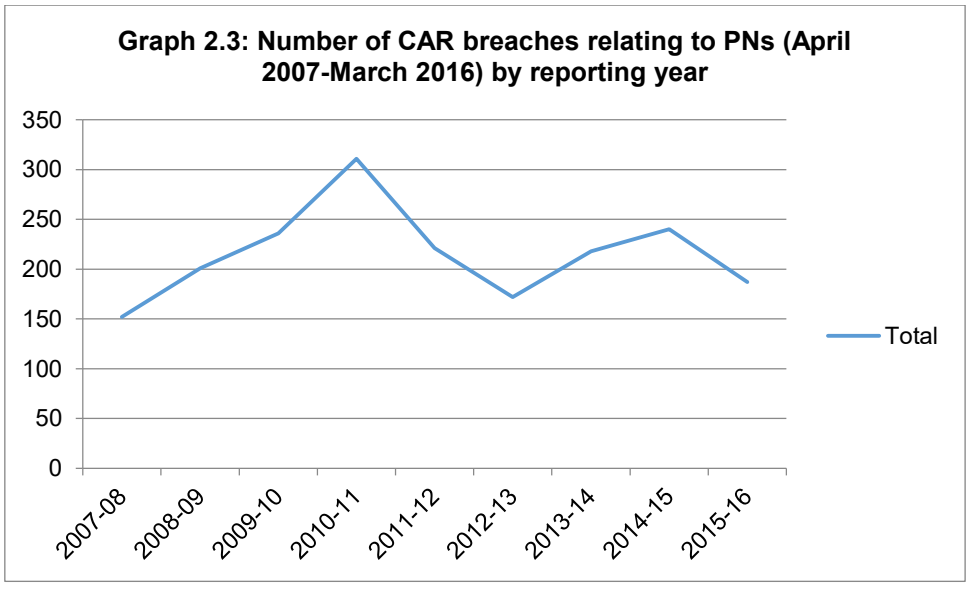
[11] Of the 1938 CAR breaches, full details were not available or applicable for 28 cases (due to missing, duplicate or incorrect data entries).

Bar chart 2.2 below shows the number of CAR breaches relating to PNs (April 2007-March 2016) by each regulation (where available or applicable):



In the relevant period, regulation 11 (Identification of the presence of asbestos) represented the most common breach relating to PNs (24%, N=464). Regulation 5 (Prevention or reduction of exposure to asbestos) represented the second most common breach relating to PNs (21%, N=407). Regulation 16 (Duty to prevent or reduce the spread of asbestos) represented the third most common breach relating to PNs (18%, N=358).

Graph 2.3 below shows the number of CAR breaches relating to PNs (April 2007-March 2016) by each reporting year:



There were the lowest numbers of CAR breaches in 2007-08 (152) and the highest number of CAR breaches in 2010-11 (311).

3. CAR breaches resulting in successful prosecutions (April 2007-March 2016)

There were 14 sections of CAR that were breached resulting in successful prosecutions in the period April 2007-March 2016. These related to regulations:

- 4 Duty to manage asbestos in non-domestic premises
- 5 Identification of the presence of asbestos
- 6 Assessment of work which exposes employees to asbestos
- 7 Plans of work
- 8 Licensing of work with asbestos
- 9 Notification of work with asbestos
- 10 Information, instruction and training
- 11 Prevention or reduction of exposure to asbestos
- 13 Maintenance of control measures etc.
- 16 Duty to prevent or reduce the spread of asbestos
- 17 Cleanliness of premises and plant
- 18 Designated Areas
- 23 Washing and changing facilities
- 24 Storage, distribution and labelling of raw asbestos and asbestos waste

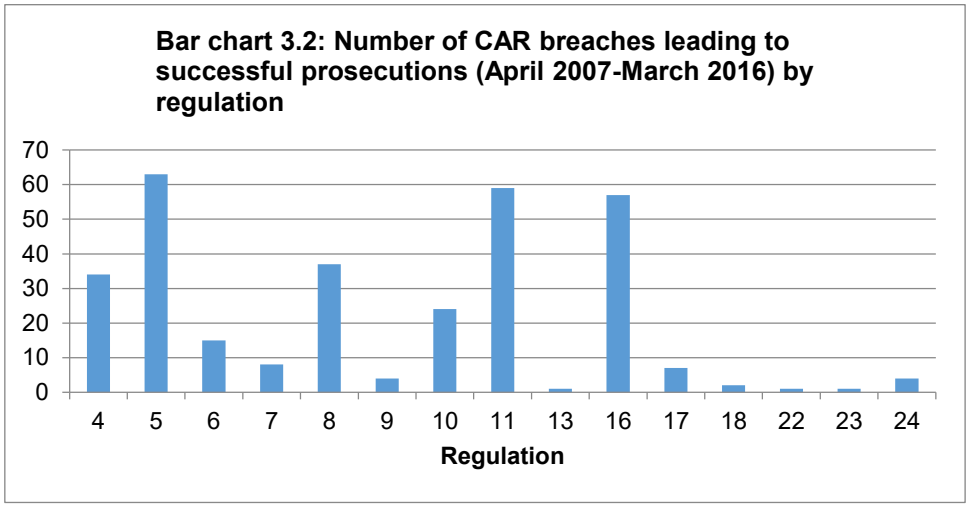
There were 317 CAR breaches leading to successful prosecutions in this period. 142 dutyholders were prosecuted. SIC code 41200 – Construction of Buildings – was the most common code for dutyholders successfully prosecuted (23%, N=33).

Table 3.1 below shows the number of CAR breaches leading to successful prosecutions by regulation and reporting year:

Table 3.1: Number of CAR breaches leading to successful prosecutions (April 2007-March 2016) by regulation and reporting year

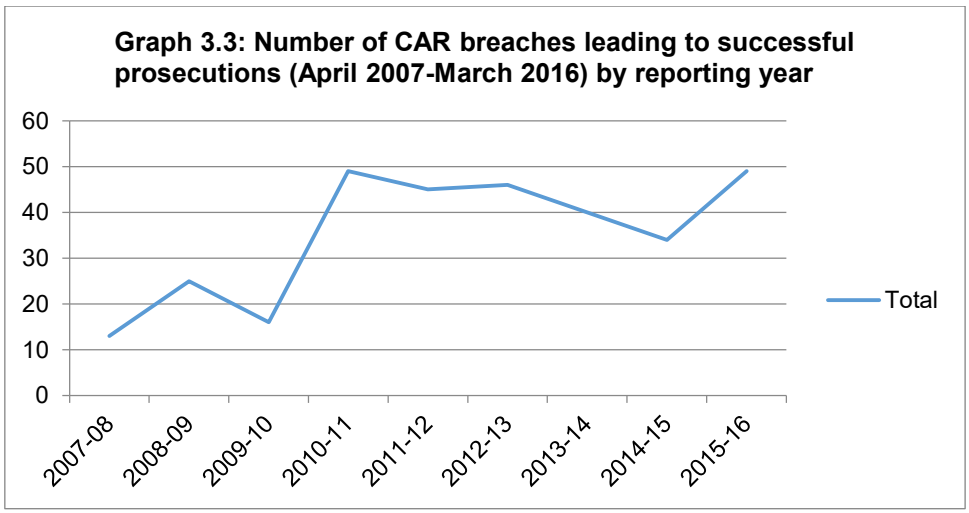
Regulation	4	5	6	7	8	9	10	11	13	16	17	18	22	23	24	Total
2007-08	1	0	1	2	1	0	1	2	1	2	1	1	0	0	0	**13**
2008-09	2	3	1	0	5	1	1	5	0	3	1	1	1	0	1	**25**
2009-10	6	2	0	1	1	0	1	3	0	2	0	0	0	0	0	**16**
2010-11	4	11	2	1	5	1	7	9	0	8	0	0	0	0	1	**49**
2011-12	2	10	2	1	6	0	4	10	0	9	0	0	0	0	1	**45**
2012-13	8	9	3	0	5	0	2	9	0	9	1	0	0	0	0	**46**
2013-14	4	8	1	1	5	1	4	6	0	7	1	0	0	1	1	**40**
2014-15	5	7	3	2	4	1	1	5	0	5	1	0	0	0	0	**34**
2015-16	2	13	2	0	5	0	3	10	0	12	2	0	0	0	0	**49**
Total	**34**	**63**	**15**	**8**	**37**	**4**	**24**	**59**	**1**	**57**	**7**	**2**	**1**	**1**	**4**	**317**

Bar chart 3.2 below shows the number of CAR breaches leading to successful prosecutions by regulation:



In the relevant reporting period, regulation 5 (Identification of the presence of asbestos) represented the most common breach leading to successful prosecutions (20%, N=63). Regulation 11 (Prevention or reduction of exposure to asbestos) represented the second most common breach leading to successful prosecutions (19%, N=59). Regulation 16 (Duty to prevent or reduce the spread of asbestos) represented the third most common breach leading to successful prosecutions (18%, N=57).

Graph 3.3 below shows the number of CAR breaches leading to successful prosecutions by reporting year:



There were the lowest number of CAR breaches leading to successful prosecutions in 2007-08 (13) and the highest number in 2010-11 and 2015-16 (49 in each reporting year).

Of the 317 CAR breaches leading to successful prosecutions, there were:

- 2 conditional discharges[12]
- 8 suspended community/prison sentences[13]
- 7 no separate penalties[14]
- 290 fines
- 10 other penalties[15]

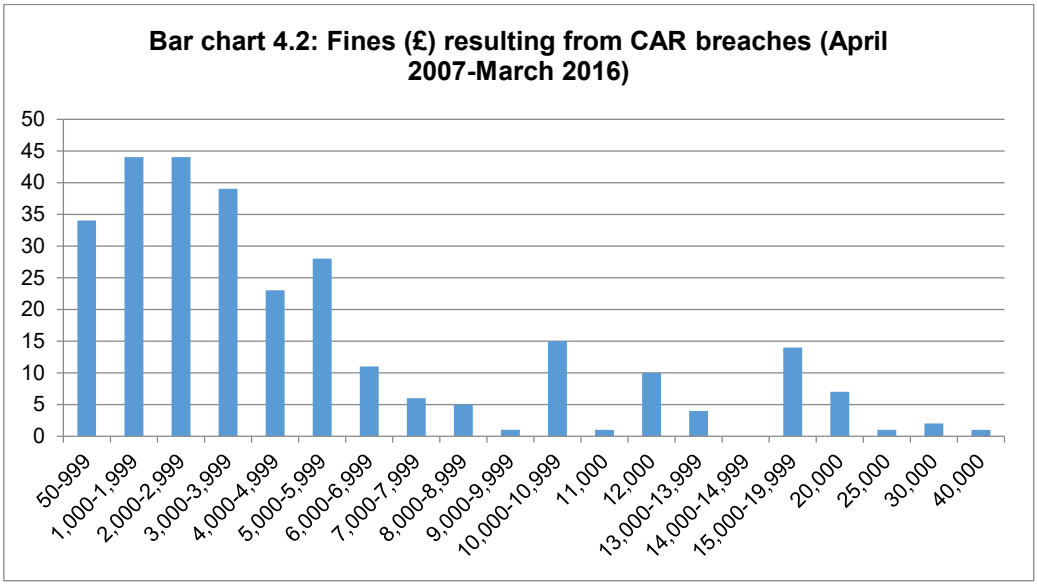
Fines

132 dutyholders were fined in the period April 2007-March 2016. The fines totalled £1,513,368 in value ranging from £50 to £40,000 fines. The average fine was £5,219 and the most common range of fine was £1,000-£1,999 and £2,000-£2,999 (44 cases for each range).

Table 4.1 and bar chart 4.2 below shows the breakdown of fines according to amount (£):

Table 4.1: Fines (£) resulting from CAR breaches (April 2007-March 2016)

Amount (£)	**50-999**	**1,000-1,999**	**2,000-2,999**	**3,000-3,999**	**4,000-4,999**	**5,000-5,999**	**6,000-6,999**	**7,000-7,999**	**8,000-8,999**	**9,000-9,999**	**Total**
Number	34	44	44	39	23	28	11	6	5	1	**235**
Amount (£)	**10,000-10,999**	**11,000**	**12,000**	**13,000-13,999**	**14,000-14,999**	**15,000-19,999**	**20,000**	**25,000**	**30,000**	**40,000**	**Total**
Number	15	1	10	4	0	14	7	1	2	1	**55**
											Grand total
											290



[12] The dutyholder is released and the offence registered on their criminal record. No further action is taken unless they commit a further offence within a time decided by the court (no more than three years).

[13] A 'suspended' prison sentence is carried out in the community. If the dutyholder breaks the conditions of their sentence they can be sent to prison.

[14] Where the dutyholder has been convicted of more than one offence, a magistrates' court is entitled to impose a penalty for one offence and make an order of 'no separate penalty' for the remaining offences, if it is thought that an adequate sentence has already been imposed.

[15] Classified in COIN as 'community/fine', 'compensation/fine' or 'fine/other'.

HSE believed that many of the maximum penalties available for health and safety offences were too low. The Government supported our view and increased many of the maximum fines available to the lower courts as well as making imprisonment more widely available for both lower and higher courts.[16]

For offences committed between the 16th January 2009 and before the 12th March 2015, the offence carries a maximum fine on conviction in the magistrates' court of £20,000 or imprisonment for a term not exceeding 6 months or both. The maximum penalty in the Crown Court is an unlimited fine or imprisonment not exceeding two years or both.

For offences committed on and after the 12th March 2015 the maximum penalty in the magistrates' court is an unlimited fine or imprisonment for a term not exceeding 6 months or both. In the Crown Court, the maximum penalty is an unlimited fine or imprisonment not exceeding two years or both.[17]

[16] http://www.hse.gov.uk/enforce/enforce.htm
[17] http://www.hse.gov.uk/enforce/enforcementguide/court/sentencing-penalties.htm

Appendix 5: Implementation in other Member States

The Control of Asbestos Regulations 2012 fully implements EU Directive 2009/148/EC on the protection of workers from the risks related to exposure of asbestos at work.

Using the Senior Labour Inspectors Committee - Knowledge Sharing System (SLIC KSS), HSE sent a questionnaire (attached below) to member state labour inspectorates to ascertain whether or not the objectives of their national regulatory regimes adopted a similar approach to the UK. The questionnaire, copied below, considered the specific aspects of the regulatory framework that dutyholders were questioned on. All of the member states who responded were in accordance with the approach implemented in Great Britain. It was notable that one member state went beyond the requirements of the Directive in requiring annual employee medical examinations.

In a recent separate exercise, the 2016 Netherlands EU Presidency conducted a survey asking all member states how the Directive has been implemented to ensure work involving exposure to asbestos is conducted safely. The results of the survey, presented at the 70th committee conference of EU Senior Labour Inspectors, confirmed that all EU member states and Switzerland have a governmental regime in place to regulate safe work with asbestos. The Directive workplace exposure limit value is 0.1 fibre/cm^3 as an eight-hour time-weighted average. The UK, Netherlands and France have opted to adopt more stringent and conservative exposure limits. Additionally, some member states have chosen to specify values to be observed when undertaking various other specific aspects of work involving asbestos. These include limits: which must be achieved before a site may be reoccupied and for small jobs.

SLIC KSS Questionnaire:

Title:

How has your government implemented Directive 2009/148/EC on the protection of workers from the risks related to exposure of asbestos at work?

Reason why information is needed and intended use of information:

In compliance with Directive Article 22, the UK is conducting a post implementation review of its national legislation which protects workers from exposure to asbestos. In the UK, this legislation is implemented by the Control of Asbestos Regulations (2012). The report required by the UK government must contain details of how other EU member states have implemented the directive.

Detailed text:

Asbestos is a particularly dangerous agent which may cause serious diseases and which is found in a large number of circumstances at work. Many workers are therefore exposed to a potential health risk. Scientific knowledge is such that a level cannot be established below which risks to health cease to exist. It is necessary to provide for the establishment of specific harmonised procedures regarding the protection of workers with respect to asbestos. The UK Health and Safety Executive is interested in how the requirements of the Directive have been implemented by other member states. We are particularly interested if any of the legislation you have implemented has established a requirement for employers to:

1. Identify the presence of asbestos prior to commencing building or maintenance or demolition work. **Y/N ?**
2. If the presence of asbestos is confirmed, carry out an assessment to identify the risks of exposure. **Y/N ?**
3. Prepare a written plan before any work involving asbestos is carried out. **Y/N ?**
4. Comply with an established statutory permissioning regime in which those undertaking high risk work with asbestos, must to obtain from the regulator a licence which demonstrates their competence to control exposure of their employees and others to asbestos. **Y/N ?**
5. Notify the regulatory/authority of an intention to carry out work with asbestos where the exposure to asbestos is forseeably likely to be high. **Y/N ?**
6. Provide the appropriate level of information, instruction and training to their employees. **Y/N ?**
7. Prevent or reduce exposure to asbestos by implementing the appropriate control measures including:
    a. provision of work equipment and personal protective clothing **Y/N ?**
    b. proper maintenance, cleaning and storage of work equipment and protective clothing **Y/N ?**
    c. provision of washing and changing facilities **Y/N ?**
    d. Proper storage, packaging, labelling and transportation of waste **Y/N ?**
    8. Prevent the spread of asbestos by erection of enclosures and having in place workplace hygiene regimes. **Y/N ?**
9. Restrict access by others to the work area by physical means and by display of appropriate signage. **Y/N ?**
10. Carry out regular workplace air monitoring and keep records of the results. **Y/N ?**
11. Arrange appropriate employee medical examinations and keep health records (in the case of employees whose work deliberately brings them into contact with asbestos). **Y/N ?**
12. In the case of those in control of commercial (non-domestic) premises, to keep and make available documentation of the presence and location of asbestos-containing materials. **Y/N ?**

We would also be interested to hear from member states who have directly copied out the Directive and also if member states could provide us with a weblink (if available) to their legislation in regard to controlling the risks of exposure to asbestos.

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