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Institute and Faculty of Actuaries

SESSIONAL PAPER

UK Asbestos Working Party Update 2020

Institute and Faculty of Actuaries UK Asbestos Working Party

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Abstract

The Institute and Faculty of Actuaries UK Asbestos Working Party update 2020 sets out the methodology and assumptions used to estimate the potential cost of asbestos-related claims to the UK Employers' Liability Insurance Market. The Working Party has estimated the UK EL Insurance Market cost for the following asbestos-related disease types: mesothelioma, lung cancer, asbestosis and pleural thickening, and pleural plaques. For each disease type the Working Party has constructed a range of scenarios to highlight the uncertainty of these estimates. The Working Party reminds practitioners that use the Working Party scenarios that they should always consider the experience and trends that have occurred since the scenarios were published, adjusting the scenarios to take into account new information.

Keywords: Asbestos; Asbestosis; Mesothelioma

1. Introduction

The ubiquity of asbestos and the danger it poses to human health have had and will continue to have, profound consequences. In the UK alone it is estimated around fifty thousand people have died of mesothelioma and thousands more are likely to die in the future. This paper has been produced to cover one aspect: the financial impact on the UK Insurance Market of UK asbestos-related claims. Whilst this paper focuses on the financial cost of claims it is by no means intended to treat the real human issues lightly. The wider social and human aspects are rightly examined elsewhere.

For the avoidance of doubt, non-UK asbestos issues are outside the scope of the Working Party (although epidemiological studies and deaths/claims experience on asbestos diseases in other countries have been used to inform the UK experience).

1.1. Purpose

Given the age of its estimates and the deviations, the Working Party decided to revise its UK Employers' Liability ("EL") Insurance Market estimates, taking into account the additional years of experience since the last update "UK Asbestos Working Party Update 2009". This paper sets out the Working Party's findings: a detailed discussion of the updated model used by the Health and Safety Executive (HSE)/Health and Safety Laboratory (HSL) and comparison with a simpler Generalised Linear Model (GLM) Age-Birth model, and a re-estimation of the potential cost of asbestos-related claims to the UK EL Insurance Market.

In addition, this paper presents the results of a survey of aggregated asbestos-related claims numbers and costs for a large proportion (estimated to be around 80%) of the UK EL Insurance Market. As well as giving an insight into trends in claim development, this survey has facilitated the estimation of future costs for asbestos-related claims.

The Working Party defines the UK EL Insurance Market as all direct EL (including London Market) insurers, Lloyd's syndicates and captive insurance regardless of whether the entities are now currently solvent or insolvent. It does not include central Government, nor local authorities except to the extent they are covered by commercial insurance.

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The estimates in this paper cover UK asbestos-related claims covered by EL insurance policies written by the UK EL Insurance Market. They do not include asbestos-related claims that may fall to public liability insurance policies, or non-UK asbestos-related insurance claims.

It is possible that the actual cost of UK asbestos-related claims turns out to be outside the range of the estimates contained in this paper. For example, changes in the law or in medical technology could have profound implications. It remains vital to monitor closely actual experience over time against predictions: suggestions on the main areas to monitor and a practitioner's guide to using the information in this paper and the models developed by the Working Party can be found in Sections 12 and 13.

1.2. Previous Work

In this paper the Working Party has included some key background information from its previous papers in 2004, 2008 and 2009 and GIRO presentations to assist readers who are unfamiliar with the field of asbestos-related claims.

In 2004, the UK Asbestos Working Party ("the Working Party") produced a paper entitled "UK Asbestos – The Definitive Guide" ("the 2004 paper" Ref: 1). The paper contained background information and history in respect of asbestos use in the UK, a summary of regulations and legal principles, an Insurance Market survey and estimates of the potential cost to the UK EL Insurance Market of UK asbestos-related claims. The UK EL Insurance Market estimates relied on the population mesothelioma deaths projected by the HSE as set out in their 2003 paper "Mesothelioma Mortality in Great Britain: Estimating the Future Burden" (HSE 2003).

By 2007, evidence was emerging that the correspondence observed in the 2004 paper between the number of UK mesothelioma deaths and insurance claims was breaking down. The Working Party reformed in 2007 to investigate this and to report on general developments since the release of the 2004 paper.

In 2008, the Working Party produced a paper outlining the trends and key issues to consider when estimating UK asbestos-related claims liabilities, entitled "UK Asbestos Working Party Update 2008" ("the 2008 paper" Ref: 2). The next year, the Working Party produced new estimates of the UK EL Insurance Market cost in the paper entitled "UK Asbestos Working Party Update 2009" ("the 2009 paper" Ref: 3). The Working Party's 2009 work estimated that the undiscounted cost of UK mesothelioma-related claims to the UK EL Insurance Market during the period 2009–2050 could be around £10 bn. Including the potential cost of asbestos-related lung-cancer, pleural thickening and asbestosis claims, the total UK EL Insurance Market cost of asbestos-related claims could be around £11 bn. The updated estimate was highly uncertain, and it was possible that the actual outcome could be appreciably more or less than this amount. For example, alternative possible scenarios give a cost of around £5 bn or £35 bn for the same period.

Since producing the 2009 UK EL Insurance Market estimates, the Working Party entered a passive phase:

- Facilitating and collecting summary data of asbestos-related insurance claims to monitor the trends within the insurance industry, as well as data from other sources such as the HSE.
- Reviewing the previous Working Party UK EL Insurance Market estimates against the trends identified.
- Developing the relationship with the HSE, Professor Peto and other experts to discuss the potential for new trend analysis and projections especially around the future number of mesothelioma deaths in the UK.
- Developing relationships with all relevant parties in respect of the compensation process for asbestos-related claims.
- Considering relevant asbestos-related developments.
- Responding to any consultation responses on behalf of the Actuarial Profession.

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- Feeding back to the actuarial community through workshops at GIRO (General Insurance Research Organisation).

Since the 2009 estimates, the HSE (via its specialist modelling arm, the HSL) have been updating their model using the latest mesothelioma deaths data. The HSE estimate, based on the male deaths data up to 2017, has the peak in 2014 at 2,035 male deaths. The year of the peak is 2 years earlier than their 2009 estimates (which is the basis for the Working Party's estimates), and the peak is 3% higher.

Around 2013, Professor Jens Nielsen, Professor María Martínez-Miranda and Professor Bent Nielsen published an estimate of future male mesothelioma deaths without using exposure and/or population data. Their approach was similar to a chain ladder method with a "GLM" to fit the parameters for each Age and Birth year. In late 2015, they updated the model taking into account the most recent deaths up to 2013. These more recent projections estimated the peak of deaths at 2,079 males in 2017.

By 2015, although the experience at an overall level was broadly in-line with the 2009 estimates, the Working Party were beginning to see deviations around some of the assumptions, in particular:

- The number of male mesothelioma deaths was somewhat higher than projected (although it has since fallen so that aggregate deaths over the last 10 years are relatively close to the projections – see Section 6.2.3).
- The propensity for mesothelioma sufferers to make a claim was not increasing as projected. (The UK Asbestos Working Party Update 2009 can be found at Ref: 3).

1.3. Uncertainty

It should be recognised that the estimation of future claim payment amounts on insurance business, particularly UK asbestos, is an inherently uncertain exercise. This uncertainty is exacerbated when estimating long tail liabilities such as those driven by asbestos. An element of subjectivity is inevitably included in any actuarial projection of future liabilities.

As with any form of estimation approach, the results emerging from the estimation process are dependent critically on the integrity of the current data, on the integrity of recent claims progressions and on the applicability of these claims progressions to likely future developments. The Working Party caution, therefore, that it is likely that the eventual outcome will vary, perhaps materially, from the estimates.

It should be noted that the ranges produced in this report do not represent an upper or lower bound on the liability, nor are they intended to represent a range of reasonable best estimates.

1.4. Compliance with Technical Actuarial Standards

The Financial Reporting Council oversees the use of Technical Actuarial Standards ("TAS") by actuaries and requires actuaries to comply with the TASs for various types of actuarial work. The Working Party believes that the work covered in this paper complies in all material respects with the TASs.

2. Executive Summary

The last Working Party estimate of asbestos-related insurance claims is over 10 years old. Over this timeframe more data has been gathered around the key assumptions made in the estimate of asbestos-related UK "EL" insurance claims. Unlike insurers, who will be updating their assumptions regularly based on the latest trends/experience the Working Party estimates are not regularly updated

The Working Party reminds Practitioners that use the Working Party scenarios that they should always consider the experience and trends that have occurred since the scenarios were published, adjusting the scenarios to take into account new information.

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Please note that the Working Party parameterised its mesothelioma scenarios using deaths up to 2018 for the GLM AgeBirth Model and 2017 for the HSE/HSL model. Since this parameterisation the HSE have published new deaths data (deaths in 2019). The Working Party has not reflected this data in their work but have shown the data for reference where appropriate.

2.1. Changes in UK EL Insurance Market Estimate

Developing any estimate of future asbestos-related UK EL insurance claims is inherently uncertain. An element of subjectivity is inevitably included in any actuarial projection of future liabilities, which is also the case for the Working Party's scenarios.

The Working Party's scenarios give a cost of between £3.5 bn and £12.1 bn for the period 2020 to 2060. As with pervious Working Party estimates, mesothelioma-related claims give rise to the vast proportion (over 90%) of the estimated total UK asbestos-related claims cost for the UK EL insurance industry.

A key Working Party objective has been to select a central scenario. Ultimately the Working Party had to choose a central scenario to compare against the 2009 scenario 23. As the Working Party is made up of a number of actuaries there was a lot of discussion around the central scenario. The Working Party's central scenario is based more around the recent experience on deaths/claims, inflation and propensity for a mesothelioma suffer to make an EL insurance claim. The Working Party believes that its central scenario is more representative of the mode (and not the mean) of the distribution of future asbestos-related UK EL insurance claims.

Figure 1 details the key changes from the 2009 (Scenario 23) estimate of £11.3 bn (for the period 2009 to 2050) and the latest central scenario[1] of £4.9 bn (for the period 2020 to 2060).

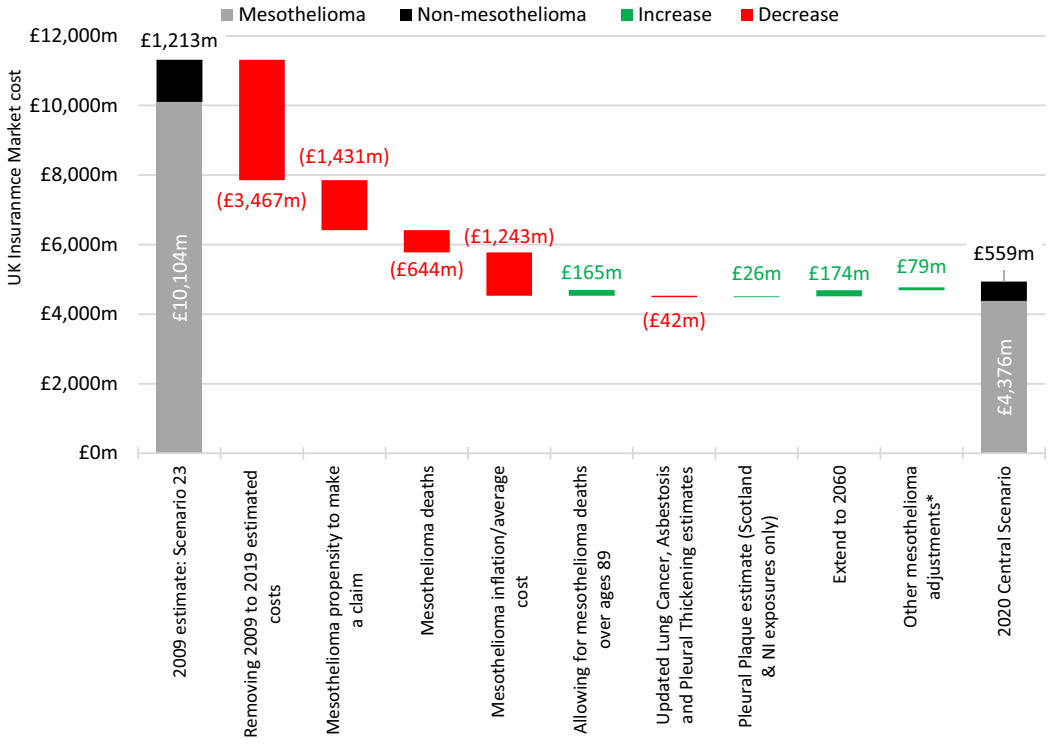


Figure 1. Key movements in central estimate.
*Includes NI and Female percentage changes.

[1]Scenario 5 for mesothelioma and the B2 scenarios for non-mesothelioma.

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The rationale behind the key movements in the central estimate is detailed below.

2.1.1. Reduced GB male mesothelioma deaths

Although the peak of deaths is higher than estimated in the 2009 Working Party GB male mesothelioma deaths model, the run-off in the tail is faster. This is a result of the combination of changes by the HSE/HSL and the Working Party to the non-clearance model parameters, namely:

1. The HSE/HSL updated the parameters within the model including an allowance for a latency cap on the k factor (this age cap occurs at an earlier latency than in the 2009 Working Party's adjustments to the HSE parameters); and
2. The removal of the background deaths from the projections as these are highly unlikely to result in an EL insurance claim, which is consistent with market practice.

The detail on the changes to the HSE model and the additional adjustments can be found in Section 6.3.6.

2.1.2. Reduced propensity of a mesothelioma sufferer to make an EL insurance claim

The Working Party has used a static propensity of a mesothelioma sufferer to make an insurance claim by age, which reduces the claims in the tail of the projection, compared to the 2009 estimates where an increasing propensity by age band was used.

This is based on the evidence from the Compensation Recovery Unit (CRU) which shows a reducing propensity by age over the last 6 years. See Section 7 for more details on the analysis and assumptions on estimating mesothelioma claimants.

2.1.3. Reduced average cost of mesothelioma claims

There have been a number of changes to the assumptions used within the mesothelioma average claimant cost model, resulting in a lower overall inflation than assumed in the 2009 Scenario 23. These changes are discussed in more detail in Section 8.4.

The average mesothelioma claimant cost has increased due to changes in the Ogden discount rate (from 2.5% in 2009 to the current rate of at −0.25% in England and Wales) and for the allowance for Ogden multipliers at successive intervals to increase due to life expectancy according to the ONS's 2018-based national population projections. However, these increases are more than off-set by the following assumptions:

- **Court inflation:** More recent Judicial College Guidelines for the assessment of damages in personal injury cases suggest that court inflation is in-line with RPI. The Working Party looked at a long-term average and selected future Court inflation to be +0.4% greater than RPI (compared to +2% greater than RPI in 2009).
- **Wage/pensions inflation:** The central assumption for wage inflation was set at 3.0% per annum, which is +0.5% above RPI, (compared to +1.5% greater than RPI in 2009).
- **Move from RPI to CPI**: For heads of damages relating to: (i) Costs payable through CRU (including PWCA), (ii) Bereavement awards, (iii) Funeral expenses and (iv) Miscellaneous expenses, the Working Party decided to adopt CPI as the inflation index for these costs. Based on discussions with claim handlers, it was felt that CPI was a more appropriate index instead of RPI.

Section 8 details the Working Party's work on estimating the mesothelioma average claimant cost, including areas of uncertainty and considerations for Practitioners.

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2.1.4. Non-mesothelioma claims

Overall, the increase in non-mesothelioma claim costs results from an increase in the projected volumes of these claims, due to:

1. the greater number of claims reported to date than expected in the 2009 estimates; and
2. a slightly slower decay in the expected reporting frequency of these claims than had been selected in 2009.

The increase in claim numbers offsets the reduction in the Working Party's average cost. This is principally because the 2009 Working Party projections of future non-mesothelioma claim numbers included nil claims, but the average cost was based on non-nil claims. As a result, the selected starting average cost of non-mesothelioma claims was overestimated (See Section 3.3.6 for more details).

In the 2009 Working Party projections no projection was made for pleural plaque claims, whereas in this estimate a projection has been made for pleural plaque claims from Scotland and Northern Ireland.

The assumptions used in estimating the UK EL Insurance Market cost from non-mesothelioma diseases can be found in Section 9.2.

2.2. Key Areas of Uncertainty

There is still considerable uncertainty around the estimation of UK asbestos-related claims covered by EL insurance policies.

The Working Party has listed below the key areas of uncertainty; Practitioners should consider when producing their own estimate.

2.2.1. Future mesothelioma deaths

The most recent GB male mesothelioma deaths, UK EL insurance claims from the Working Party's latest survey, Industrial Injuries Disablement Benefit ("IIDB") and CRU data would suggest that peak of mesothelioma deaths/claims has occurred (see Figure 71 for more details). In fact, the last 3 years of GB male mesothelioma deaths (2017 to 2019), have all be lower than the deaths in the previous year. Up to 2018, there had never been more than one year when the deaths were lower when compared to the previous year.

However, there is still uncertainty regarding how mesothelioma deaths/claims will run-off. This is because there is limited data:

1. on the underlying population exposed to asbestos and the levels of their exposure; and
2. on which to parameterise the HSE/HSL non-clearance model for post 1970 exposure and deaths at older ages 85–89 and 90+.

The Working Party has therefore constructed scenarios using alternative parameter sets for the GB male mesothelioma deaths models it has used.

To provide understanding of the uncertainty in the HSE/HSL non-clearance model parameters the Working Party has considered variations around the exposure after 1970 and incident rate at ages 85+, where there is limited to no historical data to parameterise the model. Section 6.3 contains more details on the HSE/HSL non-clearance model, including the parameters used by the Working Party.

The Working Party has also produced scenarios using a simple alternative model, developed by María Martínez-Miranda, Bent Nielsen and Jens Nielsen, to consider the impact of a different model structure that does not directly use population or exposure data. The model is a generalised

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linear model ("GLM") around the parameters of birth year and age. To provide some measure of the uncertainty around the parameters used by the GLM Age-Birth model the Working Party has constructed two sets of alternative parameterisations. These alternative parameter sets provide an understanding of the uncertainty in the model parameters, where there is limited to no historical data to parameterise the model, around the age-related coefficients for ages 85+ and birth year-related coefficients for years 1965 and onwards. Please see Section 6.4 for more details on the Age-Birth GLM model.

2.2.2. Propensity of a mesothelioma sufferer to make an EL insurance claim

It is clear from the data provided by the CRU that there is a reducing propensity for a mesothelioma sufferer to make a claim as the age of the sufferer increases. In more recent years it appears that the propensity for a mesothelioma sufferer to make an EL insurance claim at a given age has also been slightly reducing.

It is important to remember that between 2004 and 2009 Working Party papers, the propensity for a mesothelioma sufferer to make a claim increased dramatically due, the Working Party believes, to a number of factors including the adoption by the NHS of the National Mesothelioma Framework. The factors are discussed in Section 3.3.1.1.

The Working Party has developed three alternative scenarios around the propensity for a mesothelioma sufferer to make a claim, including a jump scenario where there is a step change in the propensity to claim over a short period similar to the increase in propensity to claim experienced between 2004 and 2009 Working Party. The propensity for a mesothelioma sufferer to make a claim is discussed further in Section 7.5.

Although the last 6 years of data is now showing a reduction in the propensity, Practitioners should think carefully about whether this may change in the future (including changes due to different generational behaviours or legal developments) and how they weight between different propensity outcomes.

2.2.3. Future changes in average claim costs

There are a number of uncertainties around the future costs of both mesothelioma and non-mesothelioma claims that Practitioners should consider when considering future changes in average claim costs, such as:

- Medical advances leading to new treatments or even a cure for mesothelioma. Along with the cost of these treatments, they could provide an improvement in longevity for mesothelioma sufferers (and other asbestos-related diseases) leading to, amongst other things, a reduction in the award for future lost income and, depending on the quality of life bestowed, additional care costs.
- Changes in the take-up of current medical treatments (like Immunotherapy see Section 8.5.2 for more details);
- Legal developments – Claims have been significantly affected by legal and judicial changes over the last 12 years and may continue to be so in the future. These can have an immediate impact on liabilities, but they can also lead to secondary consequences that might not be foreseen at the time of enactment. Section 6.2 discusses the key legal developments in the area over the last 20 years;
- New guidance on costs from the Judicial Studies Board Guidelines on general damages and Ogden multipliers on future loss of income and dependency;
- Inflation shocks (one off inflation shocks and long-term impacts);
- Economic impacts affecting CPI, RPI and Earnings;

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- Short-, medium-, and long-term views around CPI/RPI/Earnings. Please note that the both the mesothelioma and non-mesothelioma cost scenarios developed by the Working Party has used a flat inflation input assumptions all future years. Practitioners should consider the short-, medium-, and long-term rates of RPI and CPI especially given the recent increase in RPI from April 2021.
- Changes in share arising from, say, the insolvency of a major insurer and the consequent loss of contribution recoveries;
- The proportion of claimants who are alive when the claim settles;
- The proportion of claimants from Scotland, given the higher awards due to "loss of society" damages; and
- Legal Costs (both claimant and defence/claims handling).

2.2.3.1. Changes in nil rates. The Working Party projections for mesothelioma claims implicitly exclude nil claims (specifically the selected propensity rates are derived from data excluding withdrawn claims). The selected numbers and average costs used in the Working Party projections for non-mesothelioma claims include nil claims.

The historical trends on nil rates have been reasonably stable across the UK EL Insurance Market for each non-mesothelioma disease type.

However, claim recording practices vary between insurers and sometimes over time for a particular insurer. For example, the creation of ELTO in 2011 led to an increase in enquiries. Some insurers adopted a filtering process so that claims would not be logged unless there was positive evidence of coverage, whereas others logged all enquiries. The latter approach would have led to an increase in reported claims and a corresponding increase in the ultimate nil rate. If a Practitioner analyses their average costs on an including nil basis, they should also consider the stability of the nil rate for each disease type. In this regard some legal changes, such as rulings on de minimis levels of culpable exposure, affect the nil rate rather than the average cost of non-nil claims.

2.2.3.2. Non-mesothelioma claim numbers. The Working Party has taken a more high-level approach to estimating the UK EL Insurance Market cost from each non-mesothelioma disease for the following reasons:

1. No publicly available epidemiological models exist for non-mesothelioma diseases to build a projection of claim numbers;
2. They have shorter average latency periods than mesothelioma;
3. Non-mesothelioma asbestos claims make up a much smaller proportion of the total asbestos reserves of either the UK EL Insurance Market estimate or individual insurers' reserves, compared to mesothelioma claims; and
4. There is limited to no data that will allow us to measure the propensity to make a claim for these disease types, which also makes it difficult to separate out epidemiological and non-epidemiological impacts to the number of claims. Looking at the Working Party's latest survey on the reporting of Asbestosis/Pleural Thickening claims the level has been reasonably stable for several years. Given that these claims should have an average latency period which is shorter than mesothelioma, this stable experience is in contradiction to the peaking of mesothelioma deaths/claims. This suggests that there are non-epidemiological impacts affecting the reporting of Asbestosis/Pleural Thickening claims. This makes the selection of run-off patterns more judgemental.

Interpreting the divergence between the expected "epidemiological" and the actual reporting patterns as a short-term feature of the last few years, the Working Party has constructed projections based on judgementally scaling the estimated mesothelioma deaths using the

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HSE/HSL non-clearance model. This scaling is time dependent, generally with the ratio of non-mesothelioma claims to mesothelioma deaths decreasing over time to allow for the difference in average latency. This scaling is also intended to implicitly allow for the propensity to claim.

Consistent with previous Working Party estimates, the selected numbers and average costs include nil claims. The historical trends on nil rates have been reasonably stable for each disease type. Therefore, it has been assumed that this experience will continue. As stated in the previous section, Practitioners should think carefully about whether this may change in the future.

The assumptions used in estimating the UK EL Insurance Market cost from non-mesothelioma diseases can be found in Section 9.2.

2.3. Areas Not Covered in this Paper

2.3.1. Discounting

Whilst discounting asbestos reserves is common (depending on regulatory reporting requirements), the Working Party's estimates are on an undiscounted basis.

The Working Party does not believe that estimating suitable rates of investment income over the periods required is within its scope of work.

When discounting reserves, the purpose will play an important part. The discount rate adopted for GAAP reserving may differ from that stipulated for SII technical provisions.

2.3.2. Ogden discount rate

The Working Party does not believe that estimating future Ogden discount rates is within the scope of its work. As such the Working Party's estimates assume that the Ogden discount rate remains at minus 0.25% in future years.

The England and Wales Ogden discount rate has been used as the majority of mesothelioma claims and deaths arise in these parts of the UK.

Scenario tests have been produced to illustrate the impact of higher and lower discount rates; these can be found in Section 8.4.1.3, Table 47. Given that the average age of a mesothelioma sufferer is around 75, changes in the Ogden discount rate on UK asbestos-related claims are less than on other claim types such as UK motor claims.

Practitioners can select different rates in the model to estimate the impact for their own purposes.

2.3.3. Immunotherapy

Given the limited data and small proportion of claims that have settled with an agreed settlement on immunotherapy treatment, the Working Party has made no allowance for the cost of immunotherapy treatments. For the avoidance of doubt, no assessment has been made of the potential impact of changes in the proportion of claims that include an agreed settlement on immunotherapy treatment).

The Working Party will continue to collect data around immunotherapy through its market survey and recommends that Practitioners should consider the trends seen around immunotherapy when deciding on their own expectations of future mesothelioma average costs.

More details on immunotherapy costs can be found in Section 8.5.2.

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2.3.4. COVID-19

The outbreak of COVID-19 during 2020 has had a global impact on the insurance industry, impacting the frequency and severity of claims across many classes of business. The market approach to allowing for these potential impacts when estimating claims reserves is continuously evolving, with consideration being given to potential changes in the political and legal environment which might impact claims experience.

The Working Party has not made any explicit allowance for the impact of the COVID-19 pandemic, nor any secondary impacts that may occur due to the UK Government's (and other governments) responses to the COVID-19 pandemic and associated lockdowns.

The Working Party has listed below some of the key areas that the actuaries should consider when estimating the impact that the COVID-19 pandemic may have on UK EL asbestos-related claims.

It is particularly important that actuaries continue to consult with claim teams to understand the impact the pandemic is having on claim reporting and on both internal and external claim management.

2.3.4.1. Short-term reporting patterns. If a current asbestos-related sufferer of a disease such as mesothelioma dies of COVID-19, and if the mesothelioma is deemed to be a material contributor to their death, then the defendant remains liable in full. On the other hand, it is considered unlikely that the disease will lead to a claims spike in reported disease claims through the acceleration of identification of previously undiagnosed cases. This means that COVID-19 of itself is unlikely to lead to a material direct change in short term claim volumes.

However, with (i) the "lockdown" of the population, (ii) the healthcare system prioritising the treatment of COVID-19 and (ii) possible workflow constraints within the claim reporting process, there could be a significant indirect delay in diagnosis and reporting of asbestos-related diseases. It is likely that any such delay would result in a subsequent acceleration of claim reporting once infection rates have subsided.

The Working Party believes that any short-term changes in reporting patterns should therefore be treated with caution.

The HSE have stated in their assessment of the impact of COVID-19 on the 2019 deaths registered in 2020 and 2021 that, "The provisional figure for mesothelioma deaths in 2019 will be updated to take account of any deaths registered beyond March 2021 at the time of subsequent statistical releases. Although a disproportionate increase in the number of late registrations beyond March 2021 cannot be ruled out, this analysis suggests this is not likely to have a large impact on the provisional figure for 2019 published here." (See HSE document referenced in Bibliography Ref: 4)

2.3.4.2. Longer term claim volumes. COVID-19 has a more severe impact on sectors of the population suffering, or at increased risk of suffering, asbestos-related disease:

- older males, who are more likely to have been exposed to asbestos at work
- people with lung conditions and other co-morbidities.

It is therefore likely that an increased share of the sufferer and potential sufferer population will die of COVID-19 rather than of asbestos-related disease.

This will affect longer term asbestos-related claim reporting, although it should be noted that even in the more extreme scenarios for the future progress of the disease, the likely percentage impact is small.

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2.3.4.3. Average claim costs. As discussed above, if a current sufferer of a disease dies of COVID-19, and if the disease is deemed to be a material contributor to their death, then the defendant is liable in full. This also applies to conditions such as asbestosis and therefore may lead to an increase in wrongful death claims with an associated increase in average costs.

The UK Government's and the NHS' response to the COVID-19 may have additional inflationary impacts on the costs associated with asbestos-related claims, which are not covered by the Working Party's scenarios.

3. Look Back at Previous Papers

This paper builds on the Working Party's work since its establishment in 2003, including the papers published in previous years. Therefore, it is useful to have an understanding of the estimates and assumptions made in the 2004 and 2009 papers and the investigation work detailed in the 2008 paper.

3.1. The 2004 Paper (Ref: 1)

The 2004 Working Party estimated that the future cost to the UK EL insurance industry of UK sourced asbestos-related claims, at that time, was £4–10 bn. Approximately, 70% of that estimate was in respect of mesothelioma claims. The mesothelioma estimates were based on the HSE's 2003 projection of the future number of mesothelioma deaths.

These projections are highly sensitive to a number of key parameters. In particular, how the disease continues to develop at older ages, with over half of all projected claims being in respect of those aged over 80 by the year 2020. The Working Party noted that given the lack of actual experience from that age group, the future number of mesothelioma deaths could easily be considerably higher or lower than the HSE's projections. In addition, to using the HSE projections, the Working Party collected data through an anonymous survey of all major insurers, representing the then majority of the UK market. Based on the results of this survey, the Working Party derived assumptions for the number of future claims for diseases other than mesothelioma and for the average claim sizes for all disease types. Based on these assumptions the Working Party derived their estimates for the future cost of asbestos claims to the UK EL insurance industry. A high-level summary of the derivation of these estimates is provided in the sub-sections below.

Alongside the estimation of the future cost of asbestos-related claims to the UK EL insurance market, he 2004 paper, which is available at the Institute and Faculty of Actuaries' ("IFoA") UK Asbestos practice area, covered the following:

- Background information about what asbestos is and the diseases it can cause
- A brief history of asbestos usage in the UK and the associated development of UK asbestos-related health and safety legislation
- A summary of the various insurance-related protocols for apportioning liability in asbestos cases that existed up to the time of writing the paper
- Details of key asbestos-related litigation and legislation
- Details of the worldwide use of asbestos and the regulations in place around the world, including a summary of the then current compensation position around Western Europe
- A summary of the previous projections of UK mesothelioma deaths and the data available on asbestos claims
- The results of the Working Party's survey of the UK EL insurance industry
- Lessons from the asbestos litigation in the US.

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3.1.1. 2004 mesothelioma estimates

The 2004 Working Party's low, medium and high estimates, for the cost of mesothelioma claims to the UK EL insurance industry between 2004 and 2040 are summarised in Table 1. Please note that the discounted figures use a 5% discount rate that was roughly the yield on ten-year gilts at the time of the 2004 paper.

Table 1. 2004 market estimate figures: mesothelioma

	Undiscounted			Discounted @ 5%		
	Inflation					
Projection of Numbers	Low	Medium	High	Low	Medium	High
Low	£3.0 bn	£3.8 bn	£4.9 bn	£1.5 bn	£1.8 bn	£2.1 bn
Medium	£3.6 bn	£4.4 bn	£5.8 bn	£1.7 bn	£2.0 bn	£2.5 bn
High	£4.0 bn	£5.0 bn	£6.6 bn	£1.9 bn	£2.2 bn	£2.7 bn

In estimating the future cost to the UK EL insurance industry from mesothelioma claims, the 2004 Working Party made assumptions relating to:

1. The number of future mesothelioma claims; and
2. The level of compensation payable for each claim.

Table 2 details the key selections made in the 2005 Working Party's mesothelioma estimates.

Table 2. 2004 key selections: mesothelioma

Estimate	HSE Model (Non-clearance)	Average Claim Costs for 2003	Inflation (Wage and Court Inflation)
Low	$k = 2.0$	£50 k	4% and 4%
Medium	$k = 2.6$	£50 k	4% and 6%
High	$k = 3.0$	£50 k	4% and 8%

Each of these assumptions is discussed in more detail below.

3.1.1.1. 2004 future number of mesothelioma claims. The 2004 Working Party estimates used the 2003 HSE model (Ref: 5) to project the future number of mesothelioma claims including nil claims. The low, medium, and high future claim projections were all scaled to the same level of claims, 1,422, in 2004. The past number of mesothelioma claims included nil claims.

The graph, Figure 2 shows the low, medium, and high projections of the future number of mesothelioma claims, together with the actual historical claims from the data collected through the survey carried out by the 2004 Working Party.

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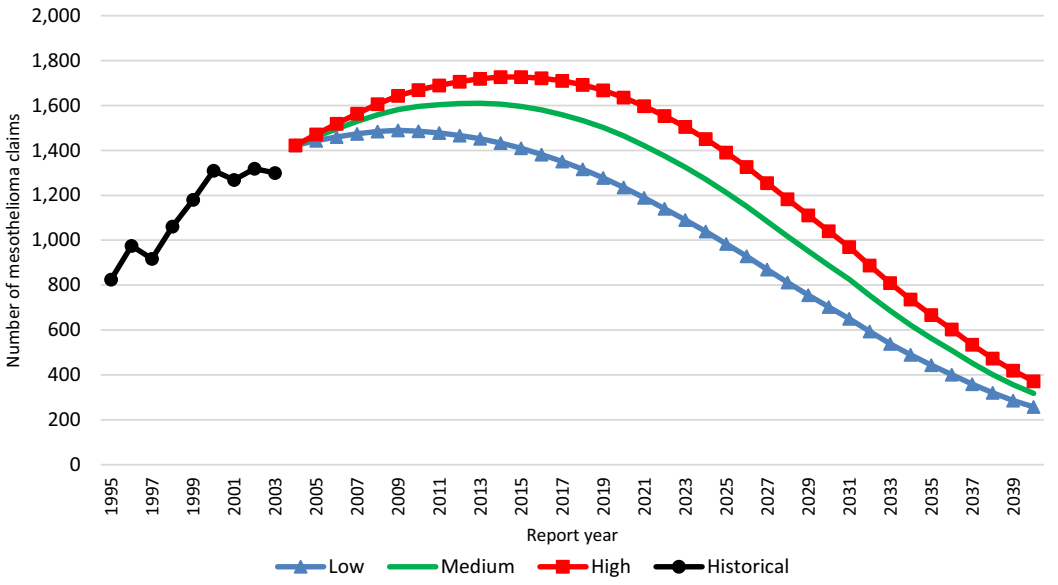


Figure 2. 2004 number of claims: mesothelioma.

The low and high estimates were based on the 2003 HSE projections of the future number of mesothelioma deaths, but used a different k factor, varying the increase of the risk of developing mesothelioma with increasing time from exposure: $k = 2$ and $k = 3$, respectively. The medium future claim projections used the HSE selected value for k of 2.6.

The 2004 Working Party's future claim projections used the HSE non-clearance model, which assumes that the asbestos fibres do not leave the lungs once they are inhaled.

The exposure used in these claim projections incorporated "background" exposure to asbestos (This means that there is exposure to asbestos after 1990, long after asbestos ceased being imported into the UK). The claim projections were then cut-off at 2040 as it was believed that the majority of claims reported after 2040 were expected to have been caused by background environmental exposures, which were unlikely to be covered by insurance contracts. The 2004 Working Party also felt that should the industry-sharing agreements continue in their then present forms up to 2040, some of the liability for these claims would relate to future periods of insurance and would therefore fall outside of the Working Party's scope.

Table 3 summarises the key assumptions underlying the 2004 Working Party's projections of the future number of mesothelioma claims to the UK EL insurance industry.

Table 3. 2004 number of claims summary: mesothelioma

Estimate	Low	Medium	High
Nil Claims		Included	
Starting level		1,422	
k factor	2.0	2.6	3.0
Peak year	2009	2013	2015
Peak number of claims	1,489	1,610	1,727
Total future claims	37,914	43,492	47,777

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3.1.1.2. 2004 average cost of mesothelioma claims. The 2004 Working Party selected a market average cost for mesothelioma claims that was mid-way between the actual average cost from the data collected through the survey of the UK EL insurance industry and their fitted average cost curve. Figure 3 details the actual average incurred cost and the fitted average cost together with the selected starting average cost. Figure 3 includes nil claims.

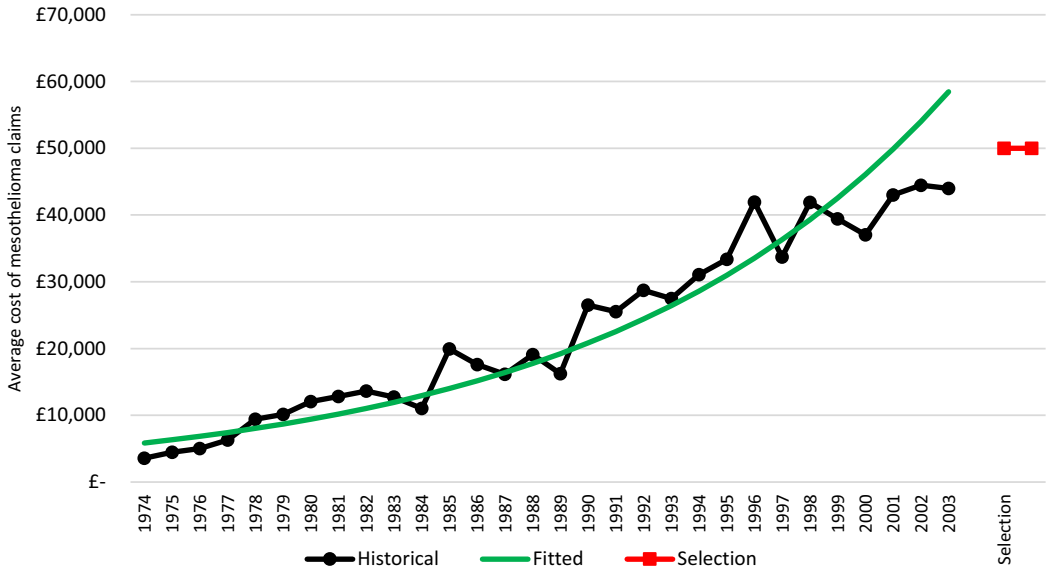


Figure 3. 2004 historical average cost: mesothelioma.

An exponential curve was fitted using regression analysis, which gave a reasonable fit, apart from the last four years. It was suggested that this slowdown in the average cost of mesothelioma claims in the last four years was due to a couple of possibilities:

- Under-reserving of claims on these recent years.
- A change in the trend of average costs.

The 2004 Working Party believed that a combination of the two factors might be the most likely; as the graph suggested that the rate of increase in the average cost has been slowing over the past ten years.

It was expected that the underlying mesothelioma costs would start to decrease, as the average age of claimants will become older (with lower compensation amounts for loss of earning or future care). This is discussed in more detail in Section 3.1.1.3.

3.1.1.3. 2004 future inflation of mesothelioma claims. The 2004 Working Party considered the award to mesothelioma claimants to be comprised of the following components:

- A fixed cost component
- An age-related component

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In order to determine the future cost of mesothelioma claims, the 2004 Working Party used an average cost model that assessed the future expected average cost, taking into account:

- court inflation on the fixed component
- wage inflation as well as the increase in the average age of claimants in the age-related-component

Figure 4 details the low, medium, and high mesothelioma average cost per claim in future years. All the scenarios assumed that wage inflation was 4% p.a. with court inflation of 4%, 6% and 8% p.a.

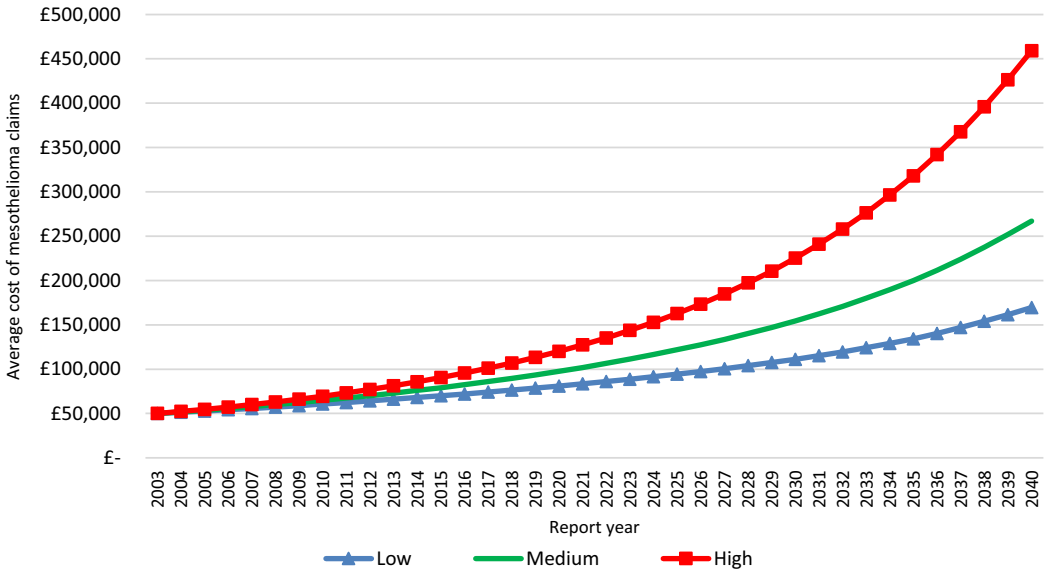


Figure 4. 2004 average cost: mesothelioma.

The overall inflation rate starts lower and tends towards the court inflation. This effect is in part due to the dampening impact of the increasing average age of claimants, as follows.

From one year to the next the average age of mesothelioma claimants increases by less than a whole year. Initially, the wage-related component of an average mesothelioma award makes up the greater proportion of the claim; therefore, the inflation on the wage-related component of the award increases at less than 4% p.a. Eventually, as claimants get older, the fixed part of the claim makes up the majority of the award and the inflation rate tends to increase towards the assumed level of court inflation.

3.1.1.4. 2004 claims per claimant. To derive the number of different insurers against which an individual makes a claim (and hence the ratio of the number of claims to the number of claimants), the 2004 Working Party looked at the difference between:

- their selected average cost per claim (based on the data they had collected); and
- the estimated 100% indemnity costs provided by several companies.

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In order to compare the two, the 2004 Working Party had to remove nil claims and legal expenses from their selected average cost.

Table 4 details the 2004 Working Party assumptions on the proportion of claims that settle at nil costs and the proportion of legal expenses per claim for each disease type. These figures were then compared to the average 100% indemnity costs that various companies had supplied to estimate the ratio of claims per claimant.

Table 4. 2004 derivation of claims to claimant ratio

Disease Type	Mesothelioma	Asbestosis	Lung Cancer	Pleural Plaques/Thickening*
2004 selected ACPC (including nils)	£50,000	£17,000	£38,000	£11,000
Settling at nil %	20%	20%	20%	20%
2004 selected ACPC (excluding nils)	£62,500	£21,250	£47,500	£13,750
Legal costs %	15%	15%	15%	30%
ACPC (excluding legal expenses and nils)	£53,125	£18,062	£40,375	£9,625
Estimated average 100% indemnity costs	£108,222	£45,222	£115,000	£12,491
Claims to Claimant ratio	**2.0**	**2.5**	**2.8**	**1.3**

*The 2004 Working Party combined the pleural plaques and pleural thickening claims together by assuming that 90% of these claims were pleural plaques.

A reasonable proportion of people who make asbestos-related claims would have periods of employment with asbestos exposure at more than one company. A separate claim would then be made to the insurer of each of these companies.

Taking this into account, the 2004 Working Party selected a ratio 2.5 for all asbestos-related claims; which suggested that, on average, each claimant makes a claim with 2.5 insurance companies. They noted that this ratio was reasonably consistent across the non-pleural diseases. The 2004 Working Party suggested that the observed lower ratio on pleural plaques/thickening claims might be due to the different characteristics of those claims.

The 2004 Working Party noted that using a ratio of 2.5 implied that, for mesothelioma claims, only a third of those currently dying from mesothelioma were making an insurance claim. The 2004 Working Party's assumed that there was no change in the future proportion of people dying from mesothelioma that made an insurance claim and noted that if this proportion were to increase going forward, then their estimates would be understated.

3.1.2. 2004 lung cancer estimates

The 2004 Working Party's low, medium, and high estimates, for the cost of lung cancer claims to the UK EL insurance industry between 2004 and 2040 are summarised in Table 5.

Table 5. 2004 market estimate figures: lung cancer

	Undiscounted			Discounted @ 5%		
	Inflation					
Projection of Numbers	Low	Medium	High	Low	Medium	High
Low	£39.4 m	£42.4 m	£46.0 m	£29.8 m	£31.7 m	£34.0 m
Medium	£117.8 m	£137.7 m	£165.8 m	£67.8 m	£76.6 m	£88.5 m
High	£211.7 m	£266.2 m	£352.9 m	£98.7 m	£116.9 m	£144.2 m

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3.1.2.1. 2004 future number of lung cancer claims. The graph in Figure 5 shows the low, medium, and high projections of the future number of lung cancer claims, including nil claims, together with the actual historical claims from the data collected through the survey carried out by the 2009 Working Party.

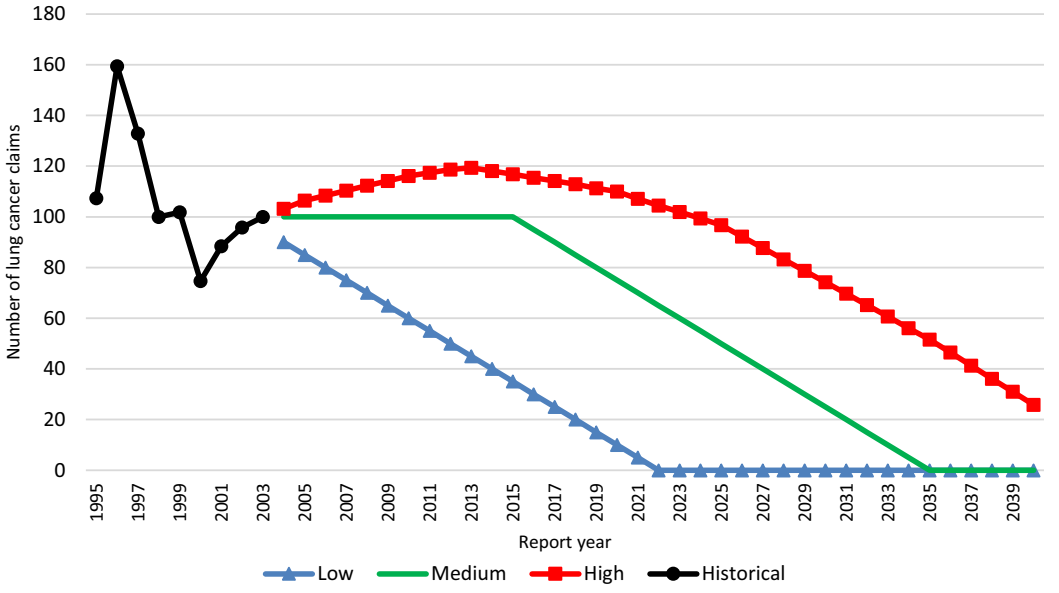


Figure 5. 2004 number of claims: lung cancer.

The 2004 Working Party observed that the number of claims had been showing a downward trend over the past fifteen years. The low projection assumed that the trend would continue in a linear fashion. The high projection assumed that the trend was the same as for the medium estimate of future mesothelioma claim numbers (i.e. the 2003 HSE projection). The medium projection was in between the two and assumed that the current number of claims continued for a period and then tailed-off. The 2004 Working Party highlighted that one of the biggest uncertainties affecting the number of lung cancer claims was the possibility of lawyers targeting all lung cancer claims, most of which will be smoking related. The 2004 Working Party did not consider this in their projections.

3.1.3. 2004 asbestosis estimates

The 2004 Working Party's low, medium, and high estimates, for the cost of asbestosis claims to the UK EL insurance industry between 2004 and 2040 are summarised in Table 6.

Table 6. 2004 market estimate figures: asbestosis

	Undiscounted			Discounted @ 5%		
	Inflation					
Projection of Numbers	Low	Medium	High	Low	Medium	High
Low	£448.7 m	£545.1 m	£672.8 m	£312.2 m	£364.3 m	£429.8 m
Medium	£568.1 m	£712.9 m	£912.3 m	£371.3 m	£443.0 m	£536.2 m
High	£823.4 m	£1,087.3 m	£1,471.0 m	£486.6 m	£601.9 m	£759.1 m

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3.1.3.1. 2004 future number of asbestosis claims. Figure 6 shows the low, medium, and high projections of the future number of asbestosis claims, including nil claims, together with the actual historical claims from the data collected through the survey carried out by the 2009 Working Party.

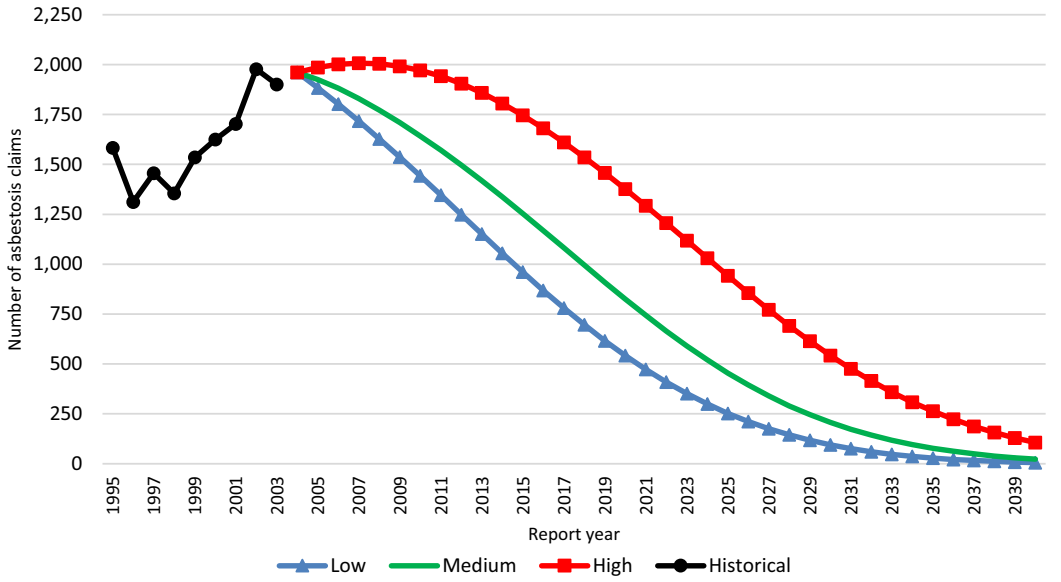


Figure 6. 2004 number of claims: asbestosis.

The 2004 Working Party commented that unlike mesothelioma, which can allegedly be caused by a single asbestos fibre, it requires a reasonable exposure to asbestos in order to develop asbestosis. They therefore expected a much earlier peak in the number of asbestosis claims, due to the earlier reduction in heavy asbestos exposure through the introduction of tighter regulations.

The various projections were based on the Working Party's "high level model". The medium projection assumed that they were more or less at the peak. The high curve assumed that asbestos claims continued to rise until 2008 and the low curve assumed that they were already past the peak and asbestosis claim numbers were firmly on their way down.

3.1.4. 2004 pleural plaques/thickening estimates

The 2004 Working Party's low, medium, and high estimates, for the cost of pleural plaques/thickening claims to the UK EL insurance industry between 2004 and 2040 are summarised in Table 7.

Table 7. 2004 market estimate figures: pleural plaques/thickening

	Undiscounted			Discounted @ 5%		
	Inflation					
Projection of numbers	Low	Medium	High	Low	Medium	High
Low	£212.9 m	£223.3 m	£234.2 m	£199.4 m	£208.6 m	£218.3 m
Medium	£714.9 m	£763.4 m	£815.2 m	£641.6 m	£682.7 m	£726.5 m
High	£1,193.7 m	£1,302.8 m	£1,423.1 m	£1,018.8 m	£1,105.3 m	£1,200.0 m

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3.1.4.1. 2004 future number of pleural plaques/thickening claims. Figure 7 shows the low, medium, and high projections of the future number of pleural plaques/thickening claims, including nil claims, together with the actual historical claims from the data collected through the survey carried out by the 2004 Working Party.

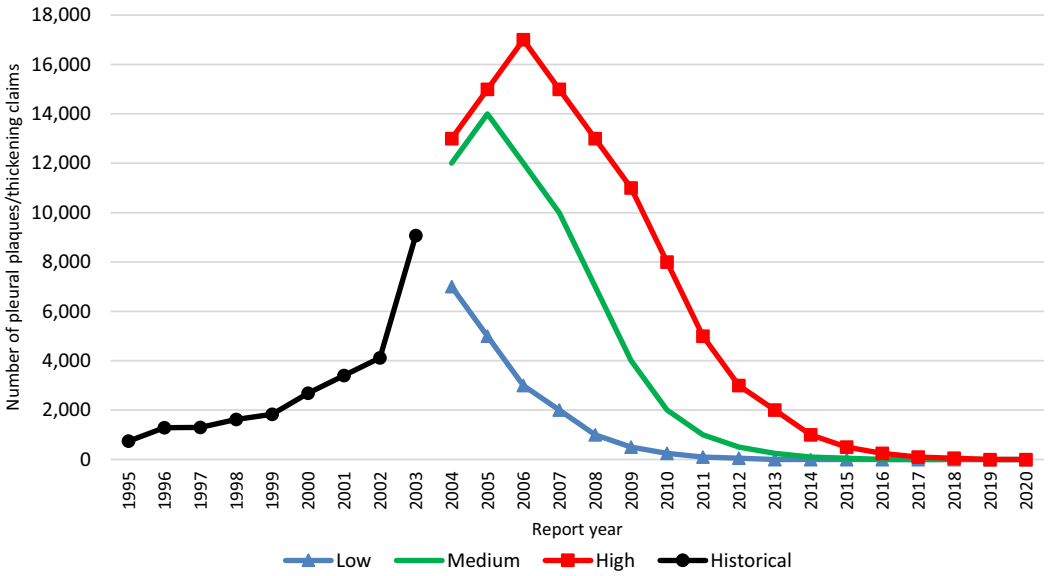


Figure 7. 2004 number of claims: pleural plaques/thickening.

The 2004 Working Party stated that this was the most difficult projection due to the extremely high numbers of claims seen in the past few years. They saw the big question was whether or not insurers were about to see a surge in claims as was seen in the US, or would the pleural plaques test cases stem the issue and see claims fall, both in number and cost.

3.1.5. 2004 assumptions on the future average costs of non-mesothelioma claims

Table 8 details the key selections made in the 2004 Working Party's non-mesothelioma estimates on average costs, including nil claims.

Table 8. 2004 non-mesothelioma ACPC and inflation

Disease type	Average claim costs for 2003	Inflation Low	Inflation Medium	Inflation High
Lung Cancer	£38,000	Wage = 4%, Court = 4%	Wage = 4%, Court = 6%	Wage = 4%, Court = 8%
Asbestosis	£17,000	1%	3%	5%
Pleural plaques/thickening	£11,000	1%	3%	5%

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The 2004 Working Party used the data they collected through the survey of the UK EL insurance industry to derive their selected average costs and inflation assumptions as shown in Figure 8.

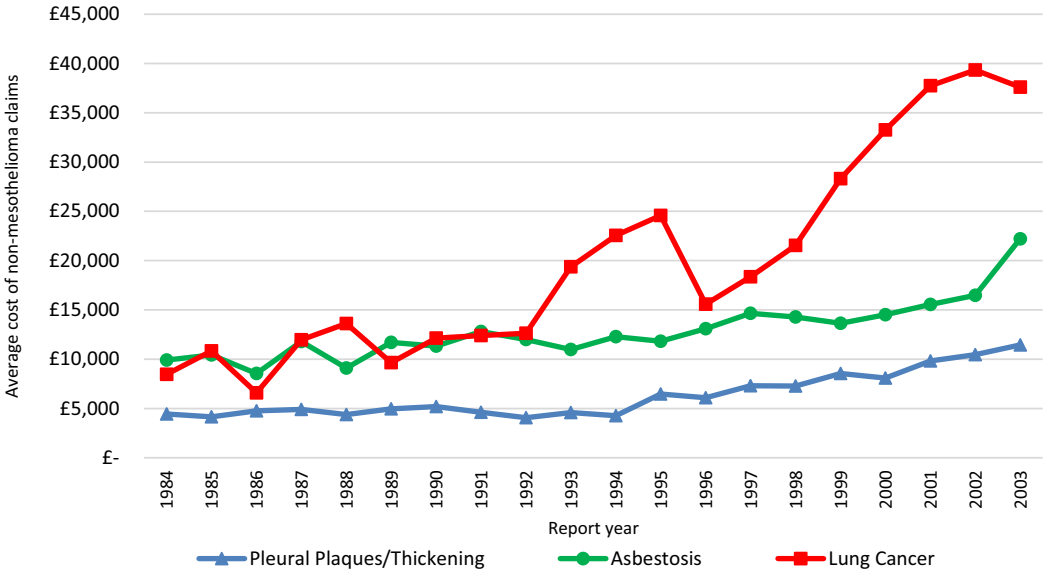


Figure 8. 2004 ACPC for non-mesothelioma claims.

The 2004 Working Party used the same low, medium, and high inflation assumptions for lung cancer claims, as they derived for mesothelioma claims; see Section 3.1.1.3 for more details on the mesothelioma inflation assumptions. They based this decision on the following:

- The average cost of lung cancer claims had increased substantially over time and had a similar pattern to the average cost of mesothelioma claims
- A fitted exponential curve to the average cost of lung cancer claims implied a rate of inflation that was similar to that implied for mesothelioma claims
- There are similar opinions regarding how older claimants could cause average costs to plateau in the future.

For asbestosis and pleural plaques/thickening claims, the 2004 Working Party assumed inflation rates of 1%, 3%, and 5% for their low, medium, and high estimates, respectively. The medium assumption was based around the observed inflation in both asbestosis and pleural claims over the last decade.

3.2. The 2008 Paper

After the 2004 paper, the notifications of mesothelioma insurance claims increased significantly above the projections. The data collected by the Working Party during 2008 showed that the notification rate for mesothelioma claims was running at approximately double the rate based on the medium estimate of the 2004 paper as shown in Figure 9.

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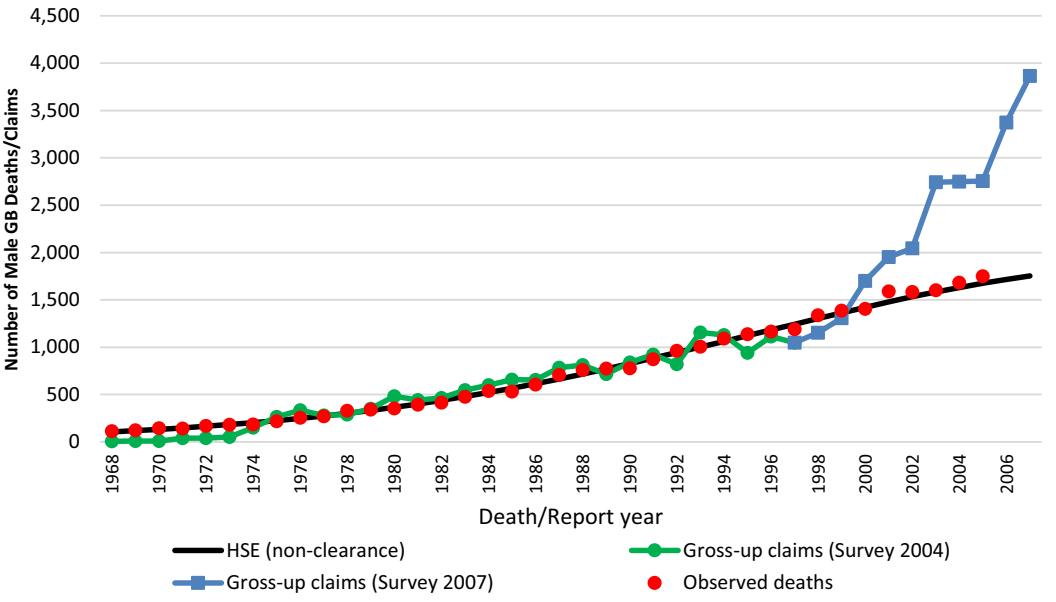


Figure 9. Mesothelioma insurance claims and GB male death experience 1968–2008.

Through to 2004 the number of insurance claims was closely correlated to the number of deaths. Since 2004, however the number of insurance claims increased significantly relative to the number of deaths. The 2008 paper investigated the factors that might have influenced this trend, by considering the following five theories:

1. Increase in the propensity to for mesothelioma sufferers to make a claim.
2. Claims being shared more between insurers
3. Insurers' exposure was different from UK exposure, for example, more insurance coverage during more recent exposures
4. Speed-up and backlog of claims – Claims being identified faster and catch-up from claims on hold due to legal cases
5. HSE model under-estimated deaths.

The 2008 Working Party concluded that the main driver was the rise in the proportion of mesothelioma sufferers who were making insurance claims. In the 2004 paper, it was estimated that around one third of mesothelioma sufferers were making insurance claims. The Working Party obtained claimant level data that gave a more reliable estimate of this proportion and showed that this proportion rose from 36% in 2003 to 56% in 2007, leading to an increase in insurance claim notifications. The other theories above were investigated and the Working Party concluded that these had had either a neutral or small impact.

No updated projection of the UK EL Insurance Market estimate was produced at this stage; as Professor Peto and the HSE were both due to publish updates to their work in the near future.

The 2008 paper (Ref: 2), which is available at the IFoA's UK Asbestos practice area, also covered the following:

- The results of the Working Party's survey of the UK EL insurance industry;
- Details of the claims process for individual diagnosed with mesothelioma;
- Details of key asbestos-related litigation and legislation between since 2004;
- Things to consider around the reinsurance of UK asbestos claims; and
- Developments in US asbestos since 2004.

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3.3. The 2009 Paper

The 2009 paper (Ref: 3), which is available at the IFoA's UK Asbestos practice area, produced a new UK EL Insurance Market estimate. Under this new estimate the undiscounted cost of UK mesothelioma-related claims for the period 2009 to 2050 could be around £10 bn. Of this figure, over £8 bn related to the period 2009 to 2040, which is approximately double the estimate of £4 bn for the same period that was presented in the 2004 paper. The estimate made in 2004 did not include periods after 2040. The 2009 paper highlighted the continued uncertainty and that the actual outcome could be appreciably more or less than the estimate. Alternative scenarios giving a cost of around £5 bn or over £20 bn for the period 2009 to 2050 were also presented.

Including the potential cost of asbestos-related lung cancer, pleural thickening and asbestosis claims, the total UK EL Insurance Market future cost of UK asbestos-related claims was quoted in the 2009 paper as being around £11 bn. This compares to the estimate of £4.7 bn presented in the 2004 paper. Again, the estimate made in 2004 did not include periods after 2040.

As clarified in the House of Lords ruling on 17 October 2007, asymptomatic pleural plaques are, under then current legislation, not compensable in the UK. Scotland (2009) and Northern Ireland (2011) have subsequently introduced specific legislation making pleural plaques compensable in those jurisdictions. At the time of writing of the 2009 paper, the Scottish Bill was undergoing judicial review and the Northern Ireland Bill had not been introduced. Hence, the 2009 paper estimates did not include any amounts in relation to pleural plaques.

The new estimate also highlighted the uncertainty around estimating asbestos-related claims. For example, alternative scenarios give a cost of around £5 bn or over £20 bn for the period 2009 to 2050.

Figure 9, highlighted how the claims experience through to 2009 deviated from 2004 where there had been consistency with the actual number of mesothelioma deaths. The increase in claims meant that the actual incurred costs of mesothelioma claims for the period 2004–2008 in 2009 of £924 m were significantly higher when compared to the expected projections made in the 2004 paper of £396–£437 m.

3.3.1. Comparison against 2004 estimate

Table 9, details a high-level comparison of the movements between the 2009 and 2004 estimated cost of asbestos-related claims to the UK EL Insurance Market.

Table 9. Summary of the UK EL Insurance Market estimate changes (mid-scenarios), 2004 to 2009

Impact on UK EL Insurance Market Cost (Change due to)	£bn
2004 Estimate (2009 to 2040)*	**4.7**
Projection of mesothelioma deaths	0.6
Proportion of mesothelioma deaths that result in a claim	3.7
Mesothelioma average cost	0.7
Mesothelioma inflation	(0.6)
Extension of mesothelioma projections to 2050	1.7
Non-mesothelioma claims	0.5
2009 Estimate (2009 to 2050)†	**11.3**

Please note to make the scenario for 2009 easier to compare to the 2004 scenario the same low, medium and high terminology has been used where appropriate.
*Medium number and inflation scenarios for all disease types.
†Medium number and inflation scenarios for all non-mesothelioma disease types and Mesothelioma scenario 23 (Adjusted HSE deaths, RPI = 2.5% and propensity to make a claim scenario 3).

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3.3.1.1. Changes in mesothelioma death projection. As the level of mesothelioma deaths during the period 2004 to 2008 was not too different from that expected in the 2009 Market Estimate. The 2009 Working Party considered that the model structure used by the HSE/HSL to continue to be the most appropriate model structure to use to project future mesothelioma deaths. The previous estimates also used the HSE model to estimate mesothelioma deaths and the increase was due to the updated parametrisation by the HSL in 2009, which increased the peak year, peak level and overall deaths. These increases were principally due to the changes to exposure by year and the use of the latest population projections.

The 2009 Working Party did however use different assumptions from those used by the HSL 2009, reducing the impact of the HSL parametrisation.

3.3.1.2. Changes in the proportion of mesothelioma deaths that result in a compensation claim. In the 2004 paper, the Working Party observed that around one third of deaths resulted in an insurance claim and this relationship was assumed to continue. After 2004, it was observed that the proportion of mesothelioma deaths that result in an EL insurance claim almost doubled. This is the main reason why the EL Insurance Market estimate was increased in the 2009 paper.

The Working Party investigated, by communicating with the various parties involved in the mesothelioma claim process, what the key drivers were behind this increase. The Working Party found that there was no single explanation but all of the following had had an influence:

- Publicity. With the various legal cases that had taken place over the last few years, compensation for mesothelioma was often in the news headlines, and hence public awareness of the availability of compensation is likely to have increased.
- The use of the internet had increased and hence access to specialist information and the ability to bring people with a common interest together, no matter the physical distance apart, had improved. There is a wealth of information available on the web to help patients and their carers find out more about asbestos-related conditions, treatment, symptom management and support, both personal and financial.
- The NHS National Mesothelioma Framework improved support for mesothelioma sufferers. There was an improvement in the pre-death diagnosis rate in a number of specialist centres. It is understood that the claim success rate increases when the claim is made prior to death due to the ability to obtain a witness statement from the sufferer. An increase in pre-death diagnoses had increased the likelihood of successful claims against former employers and/or their insurers.
- Anecdotally, it was suggested that as awareness had improved it was possible that there had been an increase in the number of claims made retrospectively (e.g., by relatives after the sufferer had died) even where the death certificate did not state the cause of death to be mesothelioma.

The 2009 Working Party developed future scenarios for the proportion of deaths that result in a mesothelioma sufferer making a claim for compensation. Figure 10 shows the Working Party's male mesothelioma deaths projection and three of five projection scenarios (propensity to make a claim scenarios) considered for the number of claimants against either the UK insurer or the Government.

These patterns were built from data obtained by the 2009 Working Party from the CRU on the clawback from compensators of social security benefits paid to mesothelioma sufferers. This data is discussed in Section 3.3.2.3.

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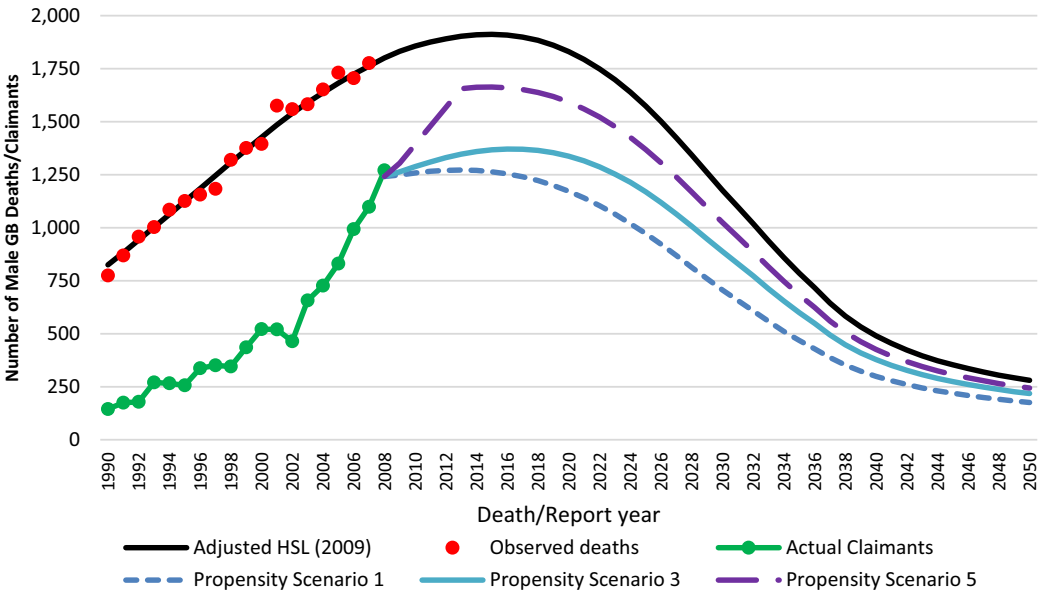


Figure 10. 2009 mesothelioma deaths and claimants.

3.3.1.3. Changes in mesothelioma average costs. A significant sample of mesothelioma claims contributed by Working Party member insurers was analysed and a model of the average claim size by age and year of settlement developed. The sample enabled a more robust and detailed analysis to be carried out than was carried out in 2004. The data was based on actual settlement values and therefore provided a better indicator than the summary market data, which for recent report years was necessarily based on reserves.

This analysis showed that the estimated average cost of a mesothelioma claim in the 2004 market data had understated the true picture somewhat. Basing the estimate on the sample data thus increased the total estimated Insurance Market cost.

3.3.1.4. Changes in mesothelioma inflation. The analysis of claimant costs demonstrated that a greater proportion of the claim was influenced by the age of the claimant than was assumed in the 2004 model. This resulted in a larger off-set to inflation than was previously assumed to be the case. Further, it was anticipated that the future claims inflation would likely be lower than that assumed in 2004. Economic factors and a more detailed analysis of the individual heads of claim both led to this conclusion.

3.3.1.5. Changes due to extending the mesothelioma projections to 2050. The 2004 Insurance Market estimate cut-off the future projection in the year 2040. The cut-off was a proxy to allow for the impact of non-occupational exposures and to adjust for the exposure post 2004 used in the model having an influence on the projection. In 2009, the Working Party considered it more appropriate to cut-off the projections at 2050. The potential impact of non-occupational exposures was allowed for explicitly, and the market cost estimated related to all asbestos

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exposure that has occurred or is expected to occur in the future. Claims arising from future exposures do not represent a current liability, but rather a future liability, hence insurers were advised to adjust the results appropriately for their current exposure.

3.3.1.6. Changes due to non-mesothelioma claims. The future cost of lung cancer, asbestosis and pleural thickening claims to the UK EL Insurance Market was estimated to be around £1.2 bn. Each of these non-mesothelioma claim types is difficult to project into the future. The Working Party took a pragmatic approach for these claim types and made future projections based on a number of alternative scenarios given the experience. The main reason for the increase in the projected cost of these claims was due to reflecting the greater than previously expected experience for asbestos-related lung cancer claims.

3.3.2. 2009 mesothelioma estimates

As the 2009 Working Party considered 5 mesothelioma deaths models, 5 propensity for a mesothelioma sufferer to make a claim scenarios and 3 inflation scenarios, they produced 75 mesothelioma cost scenarios. Some of those scenarios relating to the cost of mesothelioma claims to the UK EL insurance industry between 2009 and 2050 are summarised in Table 10.

Table 10. 2009 market estimate figures: mesothelioma

Scenario Numbers	Deaths Model	Propensity Scenario	Undiscounted			Discounted @ 5%		
			RPI Inflation					
			1.5%	2.5%	3.5%	1.5%	2.5%	3.5%
7- 9	HSE/HSL (2009)	3	£9.7 bn	£12.2 bn	£15.4 bn	£4.5 bn	£5.3 bn	£6.3 bn
16–18	Adjusted HSE	1	£7.1 bn	£8.7 bn	£10.8 bn	£3.6 bn	£4.2 bn	£4.9 bn
19–21	Adjusted HSE	2	£7.9 bn	£9.7 bn	£12.1 bn	£3.9 bn	£4.6 bn	£5.4 bn
22–24	Adjusted HSE	3	£8.2 bn	**£10.1 bn**	£12.6 bn	£4.0 bn	£4.7 bn	£5.5 bn
25–27	Adjusted HSE	4	£8.5 bn	£10.5 bn	£13.0 bn	£4.2 bn	£4.9 bn	£5.8 bn
28–30	Adjusted HSE	5	£9.4 bn	£11.6 bn	£14.5 bn	£4.6 bn	£5.4 bn	£6.4 bn
37–39	Latency	3	£5.4 bn	£6.4 bn	£7.6 bn	£3.2 bn	£3.6 bn	£4.2 bn
52–54	Birth Cohort	3	£16.2 bn	£20.5 bn	£26.2 bn	£7.0 bn	£8.4 bn	£10.1 bn
67–69	Alternative Birth Cohort	3	£10.6 bn	£13.1 bn	£16.4 bn	£5.1 bn	£6.0 bn	£7.1 bn

For comparison, estimates are discounted using the same rate in the 2004 paper; the 2009 paper did not produce discounted reserves. **Bold** highlights the figure feeds the £11.3 bn figure quoted in Table 9.

3.3.2.1. 2009 future number of male mesothelioma deaths. Figure 11 shows projected GB male deaths from the different model structures – a simple "latency" model, a birth cohort model, and the HSE/HSL model structure, together with the actual deaths.

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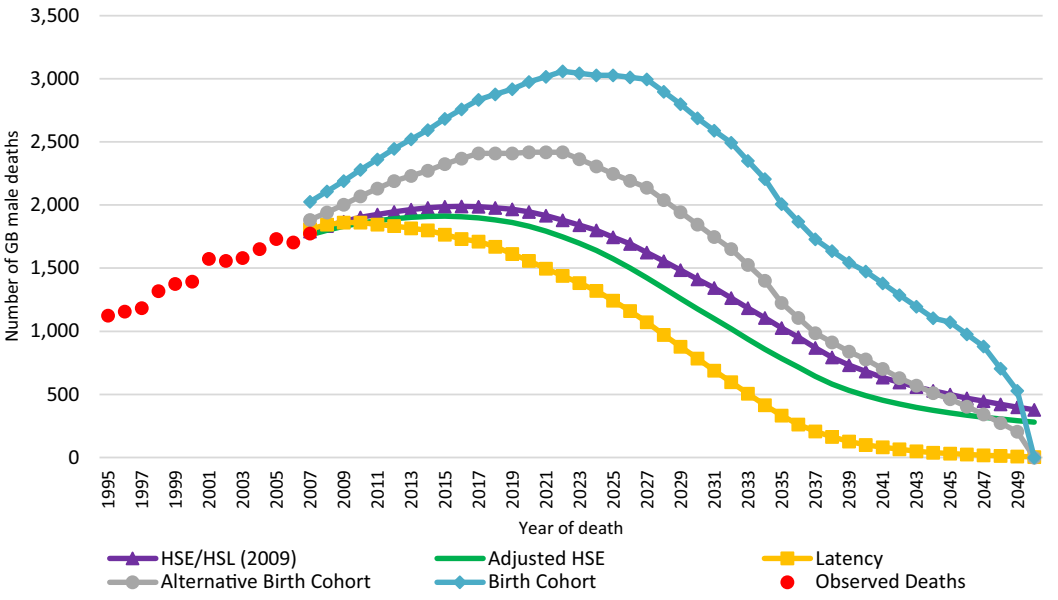


Figure 11. 2009 number of male GB mesothelioma deaths.

The 2009 Working Party selected a model structure based on that used by the HSL, but made some changes to the selected underlying assumptions. The HSL's approach was to use optimisation processes to achieve the best possible fit to the past data. Whether or not the assumptions implied by this approach are applicable to future experience is uncertain.

The Working Party considered alternative assumptions within the structure of the HSE/HSL model. These changes were:

- **Applying a cap on the *k* factor**. This limited the increase in the risk of developing mesothelioma after 60 years from first exposure. The main age-group that this affects is the 80+ group and will have the effect of reducing the projected number of deaths from this age group.
- **Alternative exposure curve for the period from 1979 to 1999**. HSL had assumed that exposure deduced in a straight line from 1978 until 1999. The Working Party based the exposure over the 1979 to 1999 on the asbestos imported into the UK.
- **No exposure on ages post 49**. This did not have a significant impact on the model fit or future projections.

The Working Party discussed the first and second of the changes with the HSE. The HSE agreed that both were conceptually reasonable and, in relation to the first, referred to a study on mesothelioma in people working on gas masks in WWII (see Section 7.3.5.4) that had pointed to a levelling off in deaths at advanced ages. The HSE have since incorporated a cut-off in their model.

3.3.2.2. 2009 claims per claimant. For their 2009 estimates, the Working Party used a more sophisticated method to estimate the claims per claimant. As (i) their insurance survey data included females and claims from the UK, (ii) their estimated mesothelioma deaths covered only males in England, Scotland, and Wales, and (iii) the CRU data covered UK claims paid by insurers and the Government; they need to make assumptions around the female claims, deaths from Northern Ireland and proportion of Government claims.

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Table 11 details the derivation of claims to claimant ratio.

Table 11. 2009 derivation of claims to claimant ratio

Year	2003	2004	2005	2006	2007	2008
UK EL Insurance Market claims*	1,951	2,016	2,181	2,444	2,641	3,052
Selected nil claims %	21.0%	21.4%	21.0%	21.0%	21.0%	21.0%
Non-nil UK EL Insurance Market claims	1,540	1,584	1,723	1,931	2,086	2,411
Male GB CRU claimants†	760	846	961	1,150	1,272	1,448
Selected Government %	20.0%	20.0%	20.0%	20.0%	20.0%	16.0%
Selected Withdrawn %	10.0%	10.5%	10.0%	10.0%	10.0%	10.0%
Male GB CRU claimants (excluding withdrawn and Government)	547	605	692	828	915	1,095
Female (To Male) %	0.8%	1.5%	1.1%	1.5%	2.4%	3.2%
GB Claimants (based on CRU)	551	615	700	841	937	1,130
NI % of GB	3.1%	3.2%	2.3%	2.9%	2.0%	2.2%
UK Estimated Claimants	568	634	716	865	956	1,154
Claims to Claimant Ratio	**2.7**	**2.5**	**2.4**	**2.2**	**2.2**	**2.1**

*Assuming that the Working Party survey covered 80%.
†Converted from financial year to calendar year assuming claims evenly distributed over the year.

From the 2009 calculation there is a fall in the claims to claimant ratio from the 2.5 calculated in the 2004 paper. The Working Party suggested that this could be due, at least in part, to the Compensation Act 2006. Since the passing of the 2006 Act, insurers are seeing increasing evidence of claimants seeking early full damages from a single identified and solvent insurer. This then leaves that insurer to use the provisions of the Compensation Act 2006 to retrospectively seek recovery from other potential defendants to the claimant's case. This change in market behaviour could have an influence on the number of claims per mesothelioma claimant.

More details on the 2009 CRU data analysis can be found in Appendix I.

3.3.2.2.1. Proportion of CRU paid by the government

The proportion of claimants that are paid by the Government was estimated from data provided by the CRU. It is not possible to determine the exact proportion as not all claims could be determined as either Government or Insurance Market. This ratio had been stable over the last few years at around 20%. See Appendix J for the analysis.

In 2008, however, the ratio appeared to be closer to 16% and the Working Party assumed that the 2008 Government percentage was a one-off at 16%, whereas they assumed that 20% of all claimants related to the Government for all subsequent years.

3.3.2.2.2. Proportion of female claimants

The Working Party concluded from its survey data that the number of EL mesothelioma claims from females had increased from around 1% in 2003 to around 3% in 2008. The Working Party has assumed that this ratio is likely to be around 5% of the number of claims from males in the future.

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3.3.2.2.3. Proportion of NI claimants

The Northern Ireland HSE reported that there are about 40 mesothelioma deaths per year from males and females combined.

As the 2009 Working Party's mesothelioma models were based on GB deaths, they increased the estimated mesothelioma claim numbers by 2% to allow for Northern Ireland claims.

The Working Party calculated this ratio of 2% by analysing the male GB deaths, instead of the total GB deaths. However, given the volume of mesothelioma deaths from Northern Ireland this error does not materially affect the claims to claimant ratio or UK EL Insurance Market estimates, especially when considering the uncertainty around estimating the financial cost of mesothelioma claims.

3.3.2.3. 2009 propensity for a mesothelioma sufferer to make a claim. The 2009 Working Party used data from the Compensation Recovery Unit (CRU) to estimate the number of mesothelioma sufferers that make a claim for compensation.

The data from the CRU was received under a Freedom of Information request and although the CRU data is on a mesothelioma claimant (and not claim) basis, the 2009 Working Party had to make a number of assumptions as the data was only supplied in one-way groupings (i.e. a separate split by Gender, Age, Claim Status, etc. but not combined).

Comparing CRU male mesothelioma registered claimants to HSE male mesothelioma deaths gives an indication of how the propensity for a mesothelioma sufferer to claim varies by age. This analysis showed that the older a mesothelioma sufferer, the less likely they are to make a claim for compensation.

The 2009 Working Party used this analysis to produce five different propensity to claim scenarios:

(1) Scenario 1: Each age band stays constant at the 2008 level
(2) Scenario 2: Ratios across all age bands increase for ten years. The rate of increase each year is a (decaying) proportion of the increase in the previous year
(3) Scenario 3: As scenario 2 but rates continue to increase to 2050
(4) Scenario 4: Within ten years the claimant death ratio in each age band reaches 90% of the theoretical maximum assuming 13% of sufferers remain unable to claim. As in scenarios 2 and 3 the rate of increase in each age band decays exponentially
(5) Scenario 5: Within five years, the claimant death ratio in each age band reaches 100% of the theoretical maximum assuming 13% of sufferers remain unable to claim. Increases are linear.

3.3.2.4. 2009 future average costs of mesothelioma claims. In 2004, the Working Party assumed that costs were split into 2 main components that experienced different inflation (with only lost income related to the age of the claimant). The 2009 Working Party concluded that other components of the total award were in fact age dependent. In addition, they found that differences existed in the size of some of the components depending on whether the claimant was living or deceased at the time of settlement.

The 2009 Working Party used detailed claims data on the components of mesothelioma awards to analyse which components were related to the age of the claimant and the different inflation measures of each component (RPI, wages and court).

The 2009 Working Party developed 3 mesothelioma inflation scenarios based on different views of a long term RPI inflation, with wage inflation being RPI+1.5% and court inflation being RPI+2.0%.

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Figure 12 details the different RPI scenarios for future mesothelioma average claimant cost using the adjusted HSE model with propensity to claim scenario 3.

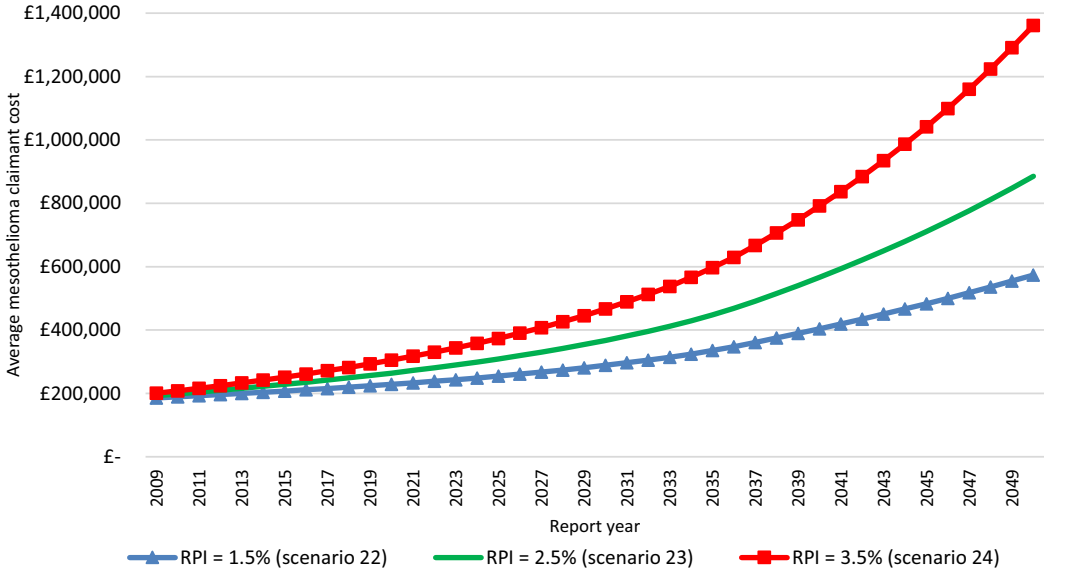


Figure 12. 2009 average cost: mesothelioma (Adjusted HSE and Propensity to claim scenario 3).

See Section 8.1 for further details on the 2009 average cost per mesothelioma claim model.

3.3.3. 2009 lung cancer estimates

The 2009 Working Party's low, medium, and high estimates, for the cost of lung cancer claims to the UK EL insurance industry between 2009 and 2050 are summarised in Table 12:

Table 12. 2009 market estimate figures: lung cancer

	Undiscounted			Discounted @ 5%		
	Inflation					
Projection of Numbers	Low	Medium	High	Low	Medium	High
Low	£171.0 m	£200.8 m	£237.8 m	£125.6 m	£143.9 m	£166.1 m
Medium	£394.5 m	**£512.3 m**	£678.8 m	£239.2 m	£293.6 m	£366.3 m
High	£951.6 m	£1,331.7 m	£1,912.7 m	£492.6 m	£641.3 m	£852.7 m

Bold highlights the figure feeds the £11.3bn figure quoted in Table 9.

3.3.3.1. 2009 future number of lung cancer claims. Figure 13 shows the low, medium, and high projections of the future number of lung cancer claims, including nil claims, together with the actual historical claims from the data collected through the survey carried out by the 2009 Working Party.

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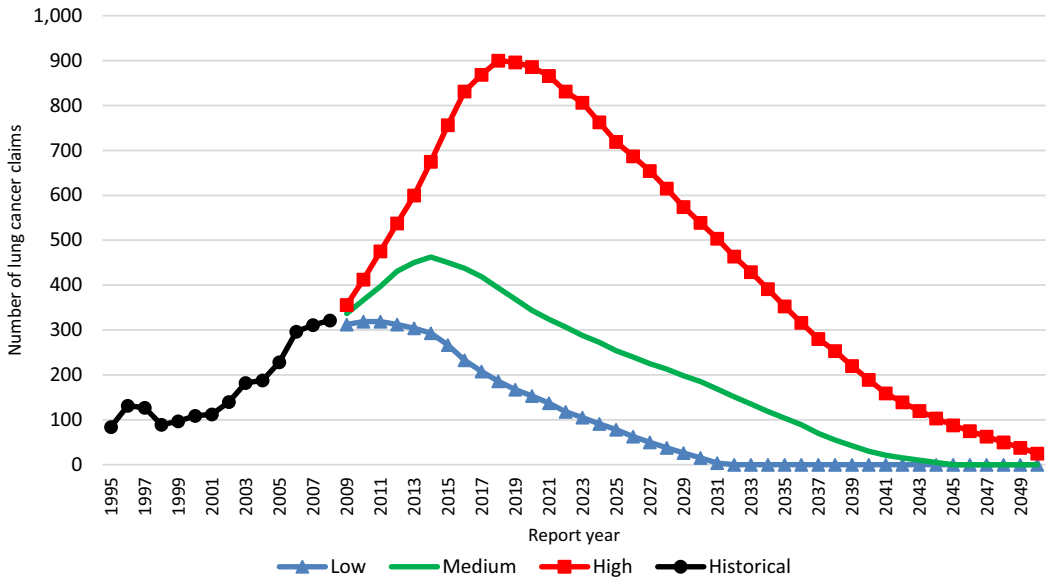


Figure 13. 2009 number of claims: lung cancer.

The 2009 Working Party stated that lung cancer claims are the most uncertain of the non-mesothelioma asbestos claim types. They used a pragmatic methodology to estimate future claims based on the biggest influences for these claims, which were smoking rates and the propensity to claim.

The Working Party's scenarios were as follows:

- **Low** – The pool of potential lung cancer claimants reduces 7% faster than the pool of potential mesothelioma claimants. No change in the propensity to claim.
- **Medium** – The pool of potential lung cancer claimants reduces 2% faster than the pool of potential mesothelioma claimants. The trend in propensity to claim seen in the last five to seven years continues for another few years.
- **High** – The pool of potential lung cancer claimants reduces just 1% faster than the pool of potential mesothelioma claimants. The propensity to claim increases at 10% per year for the next ten years.

3.3.4. 2009 asbestosis estimates

The 2009 Working Party's low, medium, and high estimates, for the cost of asbestosis claims to the UK EL insurance industry between 2009 and 2050 are summarised in Table 13:

Table 13. 2009 market estimate figures: asbestosis

	Undiscounted			Discounted @ 5%		
	Inflation					
	Low	Medium	High	Low	Medium	High
Low	£227.1 m	£308.7 m	£424.7 m	£173.3 m	£229.1 m	£305.5 m
Medium	£354.2 m	**£502.9 m**	£726.0 m	£247.8 m	£338.1 m	£467.2 m
High	£626.9 m	£940.2 m	£1,437.0 m	£390.1 m	£556.1 m	£805.4 m

Bold highlights the figure feeds the £11.3 bn figure quoted in Table 9.

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3.3.4.1. 2009 future number of asbestosis claims. Figure 14 shows the low, medium, and high projections of the future number of asbestosis claims, including nil claims, together with the actual historical claims from the data collected through the survey carried out by the 2009 Working Party.

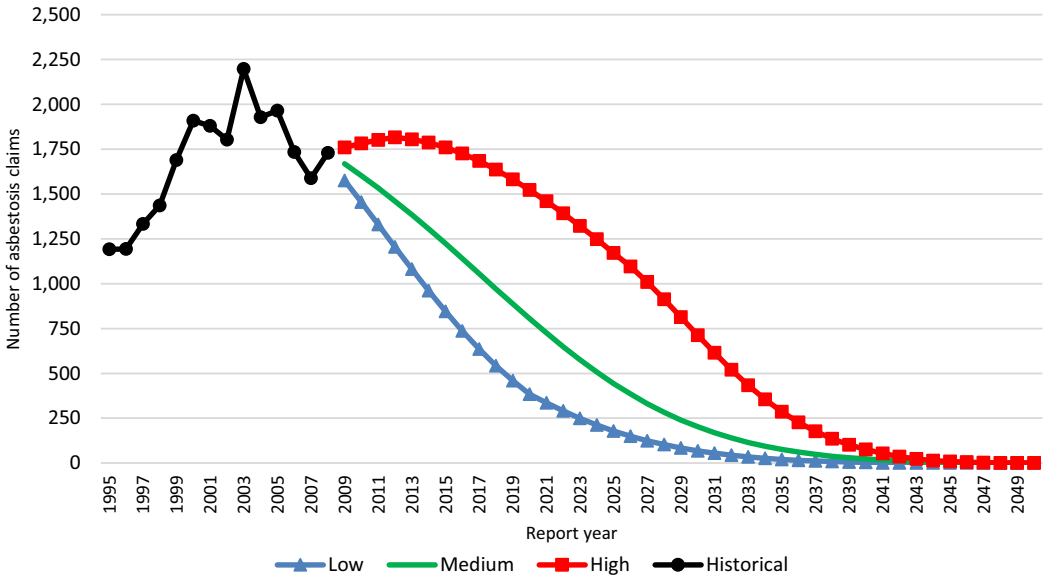


Figure 14. 2009 number of claims: asbestosis.

Given that claims had been following the pattern of the 2004 medium project curve, which was based on the 2004 Working Party's simplified epidemiological "high level model", the 2009 medium projection took the 2004 model and adjusted it reflect the level of claims from the most recent data.

The 2009 Working Party highlighted that there was significant uncertainty about future developments. These related both to the uncertainty in epidemiological estimates (e.g., the long-term trends might be better represented by mesothelioma death numbers, which do not appear to be reducing much at all, or alternatively they could decrease more rapidly than expected) and to potential changes in the propensity to claim. They, therefore, endeavoured to capture this in the low and high scenarios.

The low scenario assumed that claims were past their peak and would decrease until 2020 at a rate derived from the original HSE 2009 asbestos exposure curve with a 42-year lag, after 2020, the 2004 Working Party low pattern would apply.

The high scenario assumed that claims had yet to reach their peak and would increase until 2012 at a similar rate to mesothelioma deaths, followed by a decreasing pattern modelled based on the 2004 Working Party high scenario (with a somewhat steeper gradient after 2025).

3.3.5. 2009 pleural thickening estimates

The 2009 Working Party's low, medium, and high estimates, for the cost of pleural thickening claims to the UK EL insurance industry between 2009 and 2050 are summarised in Table 14.

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Table 14. 2009 market estimate figures: pleural thickening

	Undiscounted			Discounted @ 5%		
	Inflation					
Projection of Numbers	Low	Medium	High	Low	Medium	High
Low	£74.2 m	£85.0 m	£98.0 m	£57.7 m	£64.7 m	£73.0 m
Medium	£156.7 m	**£197.3 m**	£252.8 m	£101.0 m	£121.2 m	£147.5 m
High	£276.5 m	£374.9 m	£522.0 m	£154.8 m	£195.2 m	£251.7 m

Bold highlights the figure feeds the £11.3 bn figure quoted in Table 9.

3.3.5.1. 2009 future number of pleural thickening claims. Figure 15 shows the low, medium, and high projections of the future number of pleural thickening claims, including nil claims, together with the actual historical claims from the data collected through the survey carried out by the 2009 Working Party.

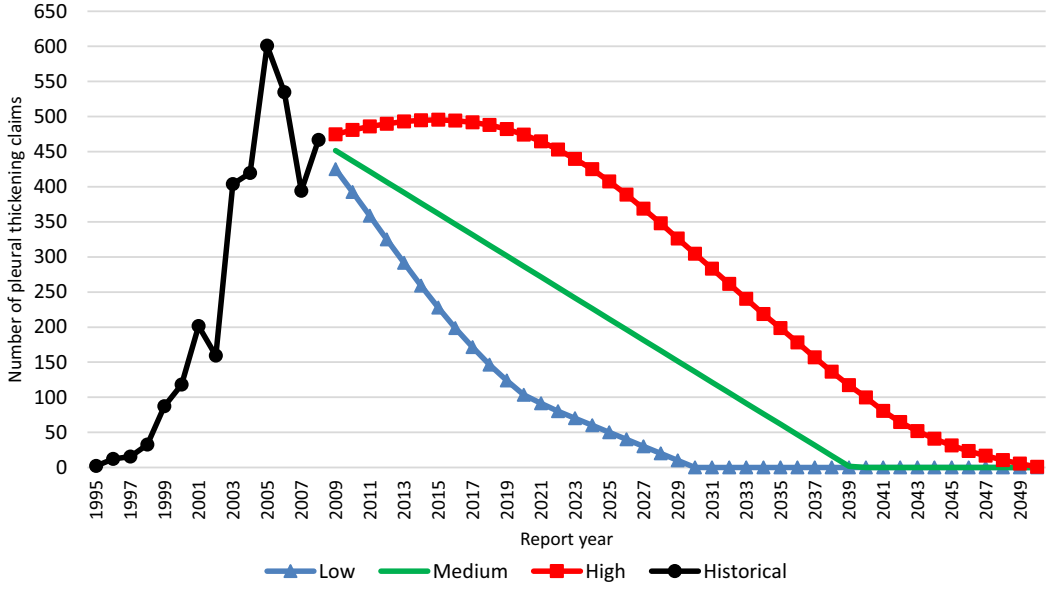


Figure 15. 2009 number of claims: pleural thickening.

The 2009 Working Party selected the following three scenarios (based around the asbestosis curves) as follows:

- **Low**: Future pleural thickening claim numbers continue to decrease at a similar rate to that experienced from 2005 to 2008 and eventually tail off by 2030.
- **Medium**: A straight-line reduction in claim numbers from 2009 to 2040.
- **High**: Claim numbers increase from the 2008 level until a peak in around 2015 and then tail off by 2050.

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3.3.6. 2009 assumptions on the future average costs for non-mesothelioma claims

Table 15 details the key selections made in the 2009 Working Party's non-mesothelioma estimates, on average costs including nil claims.

Table 15. 2009 non-mesothelioma ACPC and inflation

	Average Claim Costs for 2008			Inflation		
Disease Type	Low	Medium	High	Low	Medium	High
Lung Cancer	£41,639	**£41,639**	£41,639	1%	**3%**	5%
Asbestosis	£16,000	**£18,750**	£22,000	1%	**3%**	5%
Pleural thickening	£20,000	**£20,000**	£20,000	1%	**3%**	5%

Bold highlights the assumptions that feed the £11.3 bn figure quoted in Table 9.

When selecting their average claim costs for 2008, the 2009 Working Party used data from their Insurance Market survey which provided the:

- average incurred cost per claim including nil claims
- average settled cost per claim excluding nil claims.

The Working Party noted that the recent average incurred amounts would tend to decrease over time as open claims settle. This is because case estimates on average overstate the eventual settlement cost (primarily because (i) there is limited information when a claim is first notified especially on an insurer's share of the claim and (ii) claims that settle for nil will typically be reserved at full cost until the claims is settled). The Working Party therefore used settled costs as the basis for projection. These costs excluded nil claims.

However, the 2009 Working Party's future number of non-mesothelioma claims included nil claims. In combining average costs excluding nils with claim numbers including nils, they overestimated the projected future cost of non-mesothelioma claims. However, given the size of the future cost of non-mesothelioma claims in relation to the future cost of mesothelioma claims this error will not materially affect the UK EL Insurance Market estimates, especially when considering the uncertainty around estimating the financial cost of mesothelioma claims.

The 2009 Working Party assumed inflation rates of 1%, 3%, and 5% for their low, medium, and high estimates, respectively. They believed that these were a reasonable alternative future inflation estimates based on the mesothelioma analysis.

4. Background on Asbestos

The purpose of this section is to collate and consolidate useful background information from the Working Party's previous papers, in order to provide a useful reference point for both those new to the subject and for experienced practitioners, to avoid the need to refer back to previous papers.

4.1. What is Asbestos?

The word asbestos is derived from ancient Greek and means "inextinguishable, unquenchable or inconsumable". It is a naturally occurring silicate that has six varieties from two groups of minerals (the serpentine minerals and the amphibole minerals). Only three types were/are mined for commercial use, these being:

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- **Chrysotile** – Mg3Si2O5(OH)4. This is commonly known as white asbestos. It has white, soft, curly fibres and its fibre bundles have splayed ends and kinks. This mineral accounts for about 95% of the world production of asbestos and is the only member of the serpentine group.
- **Amosite** – (Fe2+Mg)5Si8O22(OH)2. Commonly known as brown asbestos. It has pale brown needle-like fibres (all the amphiboles including crocidolite have hard needle-like fibres). It was discovered in Transvaal, South Africa and the word amosite was coined from the term "Amosa" standing for "Asbestos Mines of South Africa".
- **Crocidolite** – Na2(Fe2+, Mg)3Fe3+Si8O22(OH)2. Commonly known as blue asbestos. Blue and brown asbestos owe their colour to the large amounts of iron they contain.

4.2. Why was Asbestos Used?

The most properties of asbestos fibres are their thermal and chemical stability and resistance, combined with high tensile strength. The presence of asbestos in commercial products varies depending upon the product's uses. While all forms of asbestos are fibrous silicates, they differ in their chemical composition and properties, crystalline structure, and fibre dimensions and as such, their commercially useful properties also vary. All asbestos types are excellent thermal insulators and have been widely used as fireproofing (on steel structural beams and soffits) and insulation materials (on boilers, ovens, kilns, steam pipes, and hot water pipes). Both chrysotile and crocidolite have high tensile strength, lending themselves well to the manufacture of woven asbestos products. All the asbestos types show low electrical and thermal conductivity, low biodegradability and good sound absorption properties.

In summary, asbestos is a very versatile mineral with many favourable qualities. It is also available in abundance and easily mined, which makes it relatively inexpensive to use. It was considered a very useful material in the construction and manufacturing industries, and was often referred to as the "magic mineral" in the late 1800s.

Asbestos is not mined in the UK as it does not naturally occur in this country, and hence all exposure is related to asbestos imports from abroad. These imports began in the late 1800s due to the industrial revolution and the versatility of asbestos within the construction and manufacturing industry. Asbestos has been used extensively in over 3,000 commercially manufactured products. Asbestos prohibition laws in the United Kingdom were first introduced in the mid-1980s. In 1985, the UK banned the import and use of blue (crocidolite) and brown (amosite) asbestos. 1992 saw the introduction of a law that also banned some uses of white (chrysotile) asbestos, traditionally considered less lethal than the other forms of the mineral. In 1999, the UK government banned the use and import of chrysotile asbestos, although its use was permitted until 2005.

Commercially manufactured asbestos-containing materials can be broadly divided into the following categories:

- Thermal insulation (for example, pipe and boiler insulation)
- Fireproofing materials (for example, sprayed insulation, fire door insulation)
- Asbestos cement/fibrocement products (for example, roof and wall claddings)
- Decorative and acoustic applications
- Electrical switchboards, insulators and fittings
- Vinyl floor coverings
- Asbestos felts and paper-like products
- Friction materials (for example brake linings)
- Paints, coatings, sealants, and adhesives
- Packings and gaskets
- Textiles (for example woven cloths, blankets)
- Miscellaneous and unusual products (for example, asbestos socks, phone boxes, and gas masks).

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4.3. Why is Asbestos Dangerous?

Exposure to asbestos fibres is linked to a number of lung diseases, ranging from symptomless, harmless "scarring" of the lungs to a cancer of the membranes lining the lungs. Asbestos-related diseases take a long time to develop following exposure to asbestos. The period between exposure and manifestation of the disease is known as the latency period. This time delay can be longer than 60 years. Hence, the true dangers of asbestos were not fully understood until a long time after asbestos was extensively used and many people had been exposed.

Asbestos fibre in the lung is extremely resistant to the body breaking it down. While most medical experts believe that some of the asbestos fibre burden is cleared by the body, most will just remain in the lung.

The different asbestos types have different properties, which change their resistance to the body breaking them down. Fibres that are long but extremely thin are extremely hard for the human body to break down.

4.4. Types of Asbestos-Related Disease

There are five main conditions to be considered: calcified pleural plaques, pleural thickening, asbestosis, asbestos-related lung cancer, and mesothelioma. These are listed below in increasing order of severity.

4.4.1. Pleural plaques

These are areas of thickening, which occur on the parietal pleura, most commonly on the lower chest walls and diaphragm. They are diagnosed by X-ray or CT scan, showing up as shadows in the chest area. A British Thoracic Society paper (Ref: 6) notes that pleural plaques are benign and they are nearly always asymptomatic. There are typically no symptoms related to pleural plaques and someone with pleural plaques has no impairment of normal lung function. Pleural plaques develop 15–20 years after first exposure to asbestos but, as there are no symptoms, the latency period can be much longer as the period will depend on when the plaques are detected.

The House of Lords' judgment in 2007 dismissed all claims for symptomless pleural plaques across the UK. Between 2009 and 2011, however, the Scottish and Northern Irish governments introduced bills to make pleural plaques compensable again. A market framework was established shortly afterwards. This framework agreed the level of indemnity and costs, enabling the substantial backlog of cases to be cleared. See Section 5.2.10 for more details on pleural plaque claims.

4.4.2. Pleural thickening and asbestosis

Pleural thickening is thickening of the outer lining of the lung (mesothelium). The symptoms are reduced elasticity/capacity of the lungs with varying degrees of breathlessness.

Asbestosis is diffuse, interstitial fibrosis of the lungs. It normally develops 15–40 years after first exposure to asbestos and is normally associated with substantial dust exposure. It is a disabling and progressive condition, which leads to increasing breathlessness and, in extreme cases, death through heart failure. There is some interchangeability of the expressions "asbestosis" and "pneumoconiosis". Pneumoconiosis is a lung disease caused by inhalation of mineral or metallic dust. Pneumoconiosis caused by asbestos fibres is effectively asbestosis. The expression pneumoconiosis also includes, for example, silicosis and kaolinosis.

Generally, those exposed to high levels of asbestos dust would have been more likely to develop asbestosis and in the past individuals with asbestosis were generally associated with heavy exposure to asbestos.

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Asbestosis is often diagnosed distinctively from other types of pneumoconiosis and interstitial lung diseases if the patient had any known exposure to asbestos.

Solicitors and claims handlers now more often use the terms pleural thickening and asbestosis interchangeably. This can also be seen in the similarities in trends and values in the average cost, nil rate and number of claims data from the survey for pleural thickening and asbestosis claims, see Appendix J for more details.

Pleural thickening and asbestosis, cause breathlessness, they are not generally fatal. Unfortunately, the remaining two types of asbestos-related disease are malignant, and account for the vast majority of asbestos-related deaths.

4.4.3. Asbestos-related lung cancer

Asbestos can cause cancer of the inner lining of the lung. It is associated with heavy asbestos dust exposure and hence asbestosis, and usually develops after 20 years from first exposure. As there are other causes of lung cancer (for example smoking), asbestos is not always identified as the cause or a contributing factor, and hence there are fewer asbestos-related lung cancer claims to date, when compared with mesothelioma claims.

4.4.4. Mesothelioma

This is the most serious type of asbestos disease. It is a tumour, usually on the outer lining of the lung and occasionally on the peritoneum, the lining of the abdomen. It is usually fatal within two years of diagnosis. It is generally associated with amphibole asbestos fibres, and can arise from very low asbestos exposures, with onset typically 30 to 50 years after first exposure.

The latest National Lung Cancer Audit Pleural Mesothelioma Report (Ref: 7) has survival rates for mesothelioma sufferers slightly improving with 43% surviving 1 year in 2014 compared with 40% for the period 2008 to 2012.

4.4.1.1. Mesothelioma latency. Mesothelioma can develop from very short or very low intensity exposures and the latency period for mesothelioma makes it difficult to estimate the future number of deaths.

There are medical studies that have looked at the reasons why the latency periods for mesothelioma vary between individuals, with some of the influencing factors being intensity of asbestos exposure and genetic predisposition. A 2006 paper by C Bianchi and T Bianchi entitled "Malignant Mesothelioma: Global Incidence and Relationship with Asbestos" (Ref: 8) noted that:

> Page 379: "An inverse relationship exists between the intensity of asbestos exposure and the length of the latency period . . . "
>
> Page 383: " . . . Insulation workers showed relatively short latency periods (range 28–32 years, mean 29.6 years, median 29.0 years) . . . latency periods were longer among shipyard workers (range 14–72 years, mean 49.1 years, median 51.5 years) . . . and among women with history of domestic exposure to asbestos (range 27–62 years, mean 54.1 years, median 54.0 years)"

4.4.5. Dose-related versus event-related diseases

For some asbestos-related diseases, the greater the exposure to asbestos the greater the severity of the disease. This is true for pleural thickening and asbestosis for example. These diseases are known as "divisible". This is because, if there are a number of identified times when exposure to asbestos had occurred, then it is likely that these all contributed to the development of the asbestos

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disease. Hence, the emergence of the disease can be divided between the different times when exposure occurred.

This is not the case for mesothelioma, where it is generally believed that exposure to one single fibre can be the cause of the disease. Indeed, there is no known threshold of asbestos exposure below which mesothelioma cannot occur. Therefore, there only needs to be one event where there is exposure to asbestos for mesothelioma potentially to develop. Hence, the emergence of mesothelioma cannot be divided between the different times when exposure occurred, and diseases of this type are known as "indivisible". These differences have had an impact on apportioning claims between employers/insurers.

It should however be noted that the level of exposure to asbestos is a key determinant of the *likelihood* of mesothelioma developing. Whilst it is generally accepted that the disease can be caused by a single fibre, it's also thought that the likelihood of a single fibre leading to mesothelioma is extremely low. This has led to the concept of a de minimis level of exposure causing mesothelioma to be examined in the courts.

4.5. Use of Asbestos in the UK

It is informative to trace the historical use of asbestos in the UK. The following is a simple and by no means complete chronology of events.

- 1st Century – The Roman, Pliny the Elder, noted the negative health effects of asbestos, referring to the sickness that seemed to follow those who worked with asbestos, and noted that slaves working in asbestos mines die young of lung disease.
- 1880s – The start of the commercial importation of asbestos, initially for use in the textile industry.
- 1897 – The first Workmen's Compensation Act is passed – it makes no reference to industrial diseases.
- 1898 – Factory Inspector report is critical of dusty conditions in factories and adverse impact on health of workers (respiratory diseases).
- 1899 – Ferodo Limited (leading producer of asbestos brake linings) is established in Derbyshire.
- 1900 – Doctor Montague Murray performs a post-mortem on an unnamed worker who had worked for fourteen years in the asbestos industry. The lungs were stiff and black with fibrosis caused by inhalation of asbestos dust. The worker previously told Murray that he was the only survivor from ten others in his workroom. Dr Murray reported this to a UK government commission.
- 1906 – The Compensation Act adds six industrial diseases to Workmen's Compensation Act, none of them are asbestos related.
- 1920 – Turner and Newall Limited established in Rochdale, Lancashire, will become world-leading producer of asbestos products.
- 1924 – Death of Nellie Kershaw: first officially recorded asbestos-related death due to "pulmonary asbestosis".
- 1930 – A Government-commissioned report (Merewether) finds high levels of asbestosis in asbestos factory workers and recommends legislation.
- 1931 – Introduction of Asbestos Industry Regulations.
- 1930s – The Prudential loads mortality rates to allow for the impact of asbestos.
- 1948 – National Insurance (Industrial Injuries) Act of 1946 comes into effect, replacing the Workmen's Compensation Scheme with the Industrial Injuries Scheme.
- 1950s – Growing emergence of link between lung cancers and asbestos exposure, Richard Doll publishes evidence in 1955.

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- 1960s – Growing emergence of link between mesothelioma and asbestos exposure, Professor Chris Wagner publishes evidence following study of South African miners.
- 1967 – Voluntary industry ban on import of blue (crocidolite) asbestos.
- 1968 – The British Occupational Hygiene Society suggests a safety standard for white (chrysotile) asbestos of 0.2 fibres/ml. The asbestos industry conducts a single survey at Turner and Newall's Rochdale plant and comes up with the level of 2 fibres/ml to be incorporated into the 1969 Asbestos Regulations. Later work suggests that 1 in 10 workers would contract asbestos-related disease at this level.
- 1969 – The Asbestos Regulations 1969, gives the first quantitative limit for asbestos dust exposure.
- 1974 – The Health and Safety at Work Act.
- 1983 – The Asbestos (Licensing) Regulations are enacted covering the most hazardous jobs such as asbestos stripping or removal.
- 1985 – The import of brown and blue asbestos banned.
- 1987 – The Control of Asbestos at Work Regulations (CAW) 1987 – further tightening of dust limits and controls.
- 1995 – Turner and Newall sells its last asbestos business (T&N acquired by US firm Federal Mogul in 1998). Both firms are now in insolvent administration).
- 1999 – The import of white asbestos banned although its use was permitted until 2005.
- 2002 – The Control of Asbestos at Work Regulations (CAW) 2002.
- 2006 – The Control of Asbestos at Work Regulations (CAW) 2006.
- 2012 – The Control of Asbestos at Work Regulations (CAW) 2012.

Unpleasant skin conditions and respiratory illnesses were recognised in asbestos workers early in the 20th century. However, due to the long latency periods, the links with lung cancer and mesothelioma were only detected after a significant amount of exposure had occurred. With hindsight, the 1st Century Roman scholar, Pliny the Elder had noted the negative health effects of asbestos, referring to the sickness that seemed to follow those who worked with asbestos, and that slaves working in asbestos mines die young of lung disease.

The 1931 regulations were heavily influenced by the asbestos manufacturers. The regulations failed from the outset because they applied only to a small minority of individual workers who were directly exposed to dust in asbestos factories (the so-called scheduled processes). The controls were inadequately policed and enforced, and in the meantime the success and proliferation of products and materials containing asbestos meant that not only did the core asbestos importing and processing industry grow, but so did the ancillary industries manufacturing asbestos-containing products. The number of individuals exposed grew at a huge rate, especially from the 1940s, with continuing public ignorance as to the true dangers and effects of breathing in asbestos dust.

The links to the more serious cancers were made through the 1950s and 1960s, but it still took nearly 40 years from the first asbestos regulations in 1931 until regulations controlling the amount of asbestos exposure were passed.

One reason, other than the Second World War, why asbestos regulation was not regarded as an important political or social issue during this time was probably the low number of deaths actually involved. The total recorded number of UK deaths in relation to asbestos in 1960 was only 31, compared with 1,503 in the mining industry, and hence the pressure for reform was more pressing in other areas. However, this short-sighted measure conceals that 700,000 were employed in the mining industry compared to 15,000 in asbestos manufacture, so the actual frequency per employee was very similar (0.207% compared to 0.215%). A more holistic review of risk/safety in different industries could have saved many lives, a point that may still have relevance today.

There are a number of health and safety and other statutory regulations that relate to asbestos. The following is a short summary of the most relevant regulations.

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4.5.1. The Factory and Workshop Act 1901

Section 79 of the 1901 Act fell within Part IV of the Act headed "Dangerous and Unhealthy Industries". It provided as follows (page 3, Section 6 of Ref: 9):

> "Where the Secretary of State is satisfied that any manufacture, machinery, plant, process, or description of manual labour, used in factories or workshops, is dangerous or injurious to health or dangerous to life or limb, either generally or in the case of women, children, or any other class of persons, he may certify that manufacture, machinery, plant, process, or description of manual labour, to be dangerous; and thereupon the Secretary of State may, subject to the provisions of this Act, make such regulations as appear to him to be reasonably practicable, and to meet the necessity of the case".

4.5.2. The asbestos industry regulations 1931 (S.I. No 1140)

The 1931 Regulations were made under Section 79 of the 1901 Act. They applied to (page 4, Section 10 of Ref: 9):

> "All factories and workshops and parts thereof in which the following processes or any of them are carried on:
>
> (i) Breaking, crushing, disintegrating, opening and grinding of asbestos, and the mixing or sieving of asbestos, and all processes involving manipulation of asbestos incidental thereto.
> (ii) All processes in the manufacture of asbestos textiles, including preparatory and finishing processes.
> (iii) The making of insulation slabs or sections, composed wholly or partly of asbestos, and processes incidental thereto.
> (iv) The making or repairing of insulating mattresses, composed wholly or partly of asbestos, and processes incidental thereto.
> (v) Sawing, grinding, turning, abrading, and polishing, in the dry state, of articles composed wholly or partly of asbestos in the manufacture of such articles.
> (vi) The cleaning of any chambers, fixtures, and appliances for the collection of asbestos dust produced in any of the foregoing processes".

Excluded from the scope of the Regulations were:

- Factories and workshops where certain of the processes referred to were carried out only occasionally and no one was employed on them for more than 8 hours in any week
- Factories or workshops where, by reason of the restricted use of asbestos, or the methods of working or otherwise, all or any of the Regulations could be suspended or relaxed without danger to the health of those employed there.

The Regulations set out the detailed duties of the occupier of the factory or workshop in matters of safety such as ventilation and the control of asbestos dust.

Britain was the first country in the world to introduce such laws to govern the use of asbestos in the workplace. However, as can be seen from the above, these regulations only applied to workers involved in certain processes involved in the manufacture of asbestos, known as the scheduled processes. A large number of workers were not included in these scheduled processes, for example building trade workers, insulation engineers, and plumbers.

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4.5.3. The shipbuilding and ship repairing regulations 1960 (S.I. No 1932)

These regulations revoked and superseded the Shipbuilding Regulations 1931 (1960 Regs., reg. 1(2)), which did not refer to asbestos. Regulation 76 of the 1960 Regulations provided for protection from dust, which specifically included asbestos (regs. 76(1)(a) to (d)).

4.5.4. The asbestos regulations (1969)

These regulations revoked the 1931 regulations and expanded the statutory duty of employers to ensure that all staff in factories, power stations, warehouses, institutions, and other premises were protected from the dangers of working with asbestos. The regulations applied to every process that used either asbestos, or any article that contained asbestos, and sought to minimise exposure to asbestos dust through the use of exhaust ventilation, protective equipment and clothing, cleaning at regular intervals of machinery, plants and interior surfaces by dustless methods and the introduction of improved handling procedures. The regulations set a limit of 2 fibres per millilitre of air for asbestos.

4.5.5. Health and Safety at Work Act 1974

This Act requires employers to conduct their work in such a way that employees will not be exposed to health and safety risks.

4.5.6. The asbestos (licensing) regulations 1983 (as amended 1998)

These regulations were introduced when it was considered necessary to register all contractors working with high risk asbestos materials in order to control the standards of workmanship within the industry. Licences are issued to companies or individuals by the HSE and may be revoked by them. Except for specifically exempted conditions, asbestos work must not be carried out without a licence, and the enforcing authority must be notified at least 14 days prior to works. Adequate information, instruction and training must be provided to those likely to be affected by the operations of a licensed contractor.

4.5.7. The asbestos (prohibitions) regulations 1987 (as amended 1999)

These regulations were implemented in 1987 to prohibit the use of amosite (brown asbestos) and crocidolite (blue asbestos) in high-risk activities. The prohibition of chrysotile (white asbestos) came into effect on 24 November 1999.

The 1999 legislation forbids the import of crude fibre, flake, powder or waste chrysotile and the new use of asbestos cement, boards, panels, tiles, and other products. Chrysotile-containing products installed prior to 24 November 1999 can remain in place until they reach the end of their service life. The sale of second-hand asbestos cement products and building materials covered with asbestos-containing coatings is forbidden. Laid under the Consumer Protection Act, the Road Vehicles (Brake Linings Safety) Regulations 1999 prohibit "the supply, exposure for supply or fitting to a motor vehicle or trailer of brake linings containing asbestos" as of 1 October 1999.

4.5.8. The control of asbestos at work (CAW) regulations 1987 (as amended 1998)

These regulations provide a framework for protection of workers involved in either the asbestos manufacturing industry or the removal industry. The CAW Regulations revoke the Asbestos Regulations 1969. The main requirements are to:

- Identify the type of asbestos.
- Assess, plan and notify work with asbestos materials.

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- Prevent or reduce the exposure to asbestos through use of properly maintained control measures.
- Designate restricted access areas including respirator zones and asbestos areas.
- Monitor and record airborne fibre concentrations, to be carried out by an independent laboratory conforming with EN 45001 by accreditation with UK Accreditation Service.
- Provide proper storage, distribution and labelling of raw asbestos and asbestos waste.
- Make employers responsible for adequately informing workers, including provision of training and health surveillance when required.

4.5.9. The control of asbestos at work regulations 2002

The objective of the Control of Asbestos at Work Regulations 2002 (CAW 2002) is to further reduce the risk of exposure to asbestos for the following target groups:

- Property maintenance/construction workers.
- Asbestos removal workers.
- Workers in buildings containing asbestos-containing materials (ACMs).

CAW 2002 builds upon the 1987 regulations. Employers continue to be required to prevent exposure at work to asbestos or, where this is not reasonably practical, to ensure that the exposure is kept below the (tightened) control limits.

CAW 2002 also extends the scope and importance of the UK asbestos regulations, with the creation of "the dutyholder" and the "duty to manage asbestos".

4.5.10. The control of asbestos regulations 2006

The Control of Asbestos Regulations (2006) Act combines all of the above legislation into one single law, prohibiting the use, supply, and importation of all asbestos.

4.5.11. The control of asbestos regulations 2012

The current asbestos regulations, The Control of Asbestos Regulations 2012, came into force on 6 April 2012, and apply to all work with asbestos in the UK. The accompanying Approved Code of Practice L143 describes in detail how such work should be carried out. The regulations require that every non-domestic property should have an Asbestos Management Plan that details how the person responsible for the maintenance of a building, the Duty Holder, will proceed to ensure that persons are not exposed to asbestos. This updated the previous asbestos regulations to take account of the European Commission's view that the UK had not fully implemented the EU Directive on exposure to asbestos. In practice, the changes are fairly limited.

Despite the considerably tightened asbestos regulations, it is important to realise that the best advice, and HSE policy, is non-removal of asbestos when it is in good condition and does not need to be disturbed. This is supported by studies that observe higher fibre levels after removal. The US and Canadian agencies give similar advice to the HSE, the Environmental Protection Agency guidance in the US noting (page S-1, Introduction Ref: 10):

"The presence of asbestos in a building does not mean that the health of building occupants is necessarily endangered. As long as asbestos-containing material remains in good condition and is not disturbed, exposure is unlikely".

4.6. Compensation Process

There are a number of parties that can be involved in the compensation paid to individuals suffering from asbestos-related diseases:

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- **Companies** (if they still exist): Either their former/current employers and the public who developed an asbestos-related disease from exposure to asbestos used by the company.
- **Insurers**: Generally, through EL policies and sometimes through Public Liability (PL) policies.
- **Government**: Either as an employer, through specific benefits such as PWCA, or indirectly through the FSCS (see Section 4.6.2) and the Diffuse Mesothelioma Payment Scheme (see Section 5.3.4). Note that both of the latter are funded by the UK Insurance Industry through separate levies on premiums.

4.6.1. Multiple compensators

Where there are multiple compensators the compensation costs are normally apportioned between parties using a time-exposed to asbestos basis.

Although mesothelioma is deemed to be *indivisible* under the Fairchild v Glenhaven ruling (see Section 5.2.6), insurers still share the costs of compensating a mesothelioma sufferer using the same basis as *divisible* asbestos-related diseases.

For Mesothelioma, if one or more compensators are insolvent then the remaining solvent parties must still compensate 100% of the damages awarded. However, for the other diseases the damages may be reduced proportionately.

4.6.2. Financial services compensation scheme (FSCS)

The FSCS is the UK's statutory compensation scheme for customers of authorised financial services firms. The FSCS can pay compensation if a financial services firm (which includes insurers) is unable to pay the full value of claims against it.

The FSCS pays a different percentage of a claim depending on the type of insurance/claim (compulsory/non-compulsory and death, incapacity, etc.) when the insurer went insolvent. Further details can be found at (Ref: 11).

Providing negligent exposure to asbestos can be established, the FSCS will provide compensation where the insurer is insolvent. Since EL became compulsory in 1972 (and 1975 in Northern Ireland) (see Section 5.2.2 for more details), the FSCS pays up to 100% of compensation that was due for asbestos-related diseases where the exposure all occurred in 1972 (1975 in NI) and after. If the exposure relates to a period prior to 1972 (1975 in NI) the FSCS pays up to 90% of compensation that was due.

5. Key Legal and Other Developments

5.1. Introduction

The legal system in the UK has evolved over time, through litigation and new legislations, to clarify the compensation given (and who pays that compensation) to individuals who develop asbestos-related diseases.

In Section 5.2, the Working Party has summarised some of the key cases and legislation that should assist those in estimating the future cost of asbestos-related diseases for their company.

In Section 5.3, the Working Party has included other developments around asbestos-related diseases, such as the government schemes that also pay compensation and guidelines around general damages.

5.2. Key Litigation/Legislation

There are many different parties involved in the processes that compensate an individual who has developed an asbestos-related disease through their employment, including the government, the employee's company, and the company's insurers.

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Given the long latency periods of asbestos-related diseases, many ex-employees can find that their employer no longer exists, that the company did not have any EL insurance or that the company's insurers have become insolvent. Given that, an employee's exposure to asbestos is generally over multiple years it is not always possible to identify the exact point at which the injury occurred.

Most of the litigation and legislation around asbestos-related diseases centres around whether and who is liable to pay the compensation and how much compensation a party should pay. The different legal systems around the UK can lead to differences in compensation awarded to asbestos-related claimants in different parts of the UK.

5.2.1. Third Party (Rights against Insurers) Act

The Third Parties (Rights against Insurers) Act 1930 enables a third party who has a claim against an insured to bring a direct action against their insurers in the event of the insured's insolvency.

Although the Act was established principally for motor claims, it is used when an employee of an insolvent company has developed an asbestos-related disease from exposed to asbestos during their employment to bring a claim against that company's insurance.

The Third Parties (Rights against Insurers) Act 2010, made it easier for a third party to pursue a claim directly against liability insurers if the insured is or becomes insolvent through removing the need to sue the insured first in order to establish liability.

5.2.2. Employers' Liability (Compulsory Insurance) Act 1969

The Employers' Liability (Compulsory Insurance) Act 1969 made the purchase of EL insurance compulsory in Great Britain from 1972 and from 1975 in Northern Ireland.

5.2.3. Pneumoconiosis, etc. (Workers' compensation) Act 1979 (PWCA Act)

The PWCA Act provides lump sum compensation for ex-employees who have a dust-related disease, where the employer who is responsible for the causing of this disease has ceased trading and cannot be sued by the employee, and no insurer can be traced.

The Department for Work and Pensions (DWP) administers the PWCA compensation scheme set up under the PWCA Act.

5.2.4. Helsinki criteria

There was an international expert meeting on asbestos, asbestosis and cancer in Helsinki on 20–22 January 1997 to discuss disorders of the lung and pleura in association with asbestos, and to agree upon state-of-the-art criteria for their diagnosis and attribution with respect to asbestos. The output from the meeting was a paper entitled "Asbestos, asbestosis, and cancer: the Helsinki criteria for diagnosis and attribution". The group decided to name this document "The Helsinki Criteria".

The meeting considered all the asbestos-related diseases, but it has had particular significance with respect to asbestos-related lung cancer claims. The Helsinki Criteria (Ref: 12) outlines a set of criteria to identify those cases of lung cancer that could be attributed to asbestos inhalation. The criteria are one or more of the following:

- The presence of asbestosis
- A count of 5,000–15,000 asbestos bodies per gram of dry lung tissue.
- An uncoated fibre burden of 2 million amphibole fibres more than 0.005 mm in length.
- One million amphibole asbestos fibres more than 0.001 mm in length.
- An estimated cumulative exposure to asbestos of 25 fibre years or more.

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- An occupational history of heavy exposure for a year or 5–10 years moderate exposure and a 10-year time lag at least between the exposure and the onset of cancer.

The Helsinki Criteria have been widely adopted in France, Belgium, Denmark, Norway, Sweden, and Finland and have been accepted by the courts in Australia.

In the UK, there was no precedent set for the use of the Helsinki Criteria until Heneghan versus Manchester Dry Docks (see Section 5.2.18). It was generally used as reference material by respiratory physicians to assist them in forming their opinion on whether the lung cancer is asbestos related and universally accepted as being of merit.

5.2.5. Ballantine versus Newalls [2000] All ER (D) 815

This case set out that compensation already received from the 1979 Pneumoconiosis Scheme (see Section 5.3.2) should be deducted from any other compensation awarded.

On 15 June 2000, the Court of Appeal considered that 1979 Pneumoconiosis Act provided compensation for illness so the entire payment should be deducted from damages.

5.2.6. Fairchild versus Glenhaven [2002] UKHL 22 (Ref: 13)

Under the rule of causation, an individual must be able to prove that their injury was caused by the other party in order to bring a successful claim against that other party. For mesothelioma sufferers, where medically a "single fibre" could cause the cancer to develop, it was difficult for them to prove who out of several parties had exposed them to the asbestos fibres that caused their mesothelioma.

In June 2002, the House of Lords established for mesothelioma:

(a) A party that had "materially increased the risk" of the claimant developing mesothelioma were liable to pay compensation.
(b) All parties who had materially increased the risk were "jointly and severally liable".

Fairchild v Glenhaven did not set out on how the compensation was to be shared amongst employers and insurers. Therefore, the UK EL Insurance Market set up a practice of proportioning the claim by the number of years the claimant was employed (and covered).

In Fairchild v Glenhaven the Justices acknowledged that the ruling was unfair to employers and their EL insurers (who may only have been responsible for a small proportion of the exposure but were having to pay the full cost of compensation), but this was the "lesser of two evils" when compared to the mesothelioma sufferer not receiving their full compensation.

5.2.7. Phillips versus syndicate 992 [2003] EWHC 1084 (Ref: 14)

This case follows on from principle established in Fairchild versus Glenhaven. It considered who is responsible for the compensation for the exposure that contributed to the claimant dying of mesothelioma during void periods of cover. That is, where defendants or their insurers are untraced or insolvent.

Phillips' (the claimant) employer was liquidated in 1979 and had only purchased insurance for a proportion of the period during which he was employed (which was all pre-1972).

In May 2003, the High Court ruled that the insurers were liable to pay compensation in full including for the period the insolvent employer had no insurance cover. The main reasoning behind the ruling was that the claimant should receive compensation in full.

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5.2.8. Barker versus Corus [2006] UKHL 20 (Ref: 15)

This is another case clarifying how liability should be apportioned following Fairchild versus Glenhaven; but unlike the Fairchild versus Glenhaven case some of the employers, who had exposed the mesothelioma sufferer to asbestos, were insolvent.

In May 2006 the House of Lords, ruled that a solvent employer/insurer should not be jointly and severally liable, but only proportionately liable. That means if two employers had increased the risk equally, but only one was solvent the claimant would only get 50% of compensation due to them, as the solvent party would not have to bear the costs of the insolvent party.

This judgment meant that there could be circumstances where mesothelioma sufferers would not be paid their full compensation.

5.2.9. Compensation Act 2006 (Ref: 16)

There was a lot of political fallout over the Barker versus Corus (Ref: 15) judgement and the Government introduced a new clause into the Compensation Act 2006, entitled "Mesothelioma: damages".

This clause effectively restored the rights of mesothelioma claimants to recover full compensation from whichever responsible party (employer or insurer) can be traced.

The House of Lords agreed to the Government amendments to the Act on 19 July 2006 and the Act received Royal Assent on 25 July 2006. The Act only applies in the UK (so does not apply to the Crown dependencies the Isle of Man, Bailiwick of Guernsey and Bailiwick of Jersey).

5.2.10. Pleural plaques compensable?

With the increasing volumes of pleural plaque claims, a number of compensators brought to trial test cases designed to reduce the level of compensation for pleural plaque claims. They argued that pleural plaques, a scarring of the lungs, should not be categorised as an illness or disease. The claimants argued that pleural plaques indicated an increased risk of developing a more serious asbestos-related injury, therefore leading to increased anxiety levels.

In October 2007, the House of Lords judgment dismissed all claims for symptomless pleural plaques (whether or not accompanied by psychiatric conditions). In 2009 the Scottish Government introduced a bill to make pleural plaques compensable again. Insurers challenged the bill in the courts. The challenge was ultimately dismissed by the Supreme Court in 2011. Following the dismissal, the Northern Ireland Assembly introduced similar legislation. These bills did not opine on the quantum of awards for pleural plaque claims.

Shortly after the legislation was passed (*Damages (Asbestos-related Conditions) (Scotland) Act 2009* and *The Damages (Asbestos-related Conditions) Act (Northern Ireland) 2011*), a market framework was established to agree the level of indemnity and costs, which enabled the substantial backlog of cases to be cleared. This framework has been coming under pressure with some cases going to trial.

5.2.10.1. Scotland: Full and final awards – Harris versus MoD [2016] CSOH 49 (Ref: 17). This case established a new precedent in Scotland for the higher awards of damages in the case that the individual is diagnosed with pleural plaques and the case is being settled on a full and final basis.

The claimant sued for damages not only based on his current condition (i.e. pleural plaques) but also on the risk that he would develop a more serious condition (i.e. mesothelioma or lung cancer). Assessment by a medical expert suggested that he had a 5.2% of developing such a condition, and that in such an instance he would be entitled to compensation of £66,000. On this basis, he was awarded damages of 5.2% of the £66,000 on top of the normal award for pleural plaques.

This has the potential to inflate costs related to pleural plaques claims in two ways. The first is that there is a higher level of indemnity awarded, with the additional risk that there will be a higher

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level of legal costs associated with each claim. The second is that to determine an accurate assessment of the risk posed to an individual a medical specialist may need to be employed alongside experienced claims handlers to deal with these more complex claims and correctly calculate the financial implications of a possible mesothelioma or lung cancer claim.

5.2.10.2. Northern Ireland: Stress and anxiety – McCauley versus Harland and Wolff plc [2015] NICA 28 (Ref: 18). Another further development affecting pleural plaques is that solicitors might pursue cases for awards in respect of stress and anxiety and the concern associated with being exposed to asbestos, where pleural plaques has been evidenced.

The precedent for this may have been set on 20 May 2015 when Harland and Wolff lost an appeal to pay £10,000 compensation to the widow of a former shipyard worker (noting it was unlikely that a claimant would recover more than £15,000 even with prolonged anxiety and stress). The Court of Appeal in Northern Ireland upheld the verdict that the plaintiff was entitled to damages for the stress and anxiety her husband suffered after learning that he had pleural plaques.

This is one of the few pleural plaque cases that has been settled on the grounds of stress and anxiety. it remains too early to say whether similar judgments will follow as each case made for stress and anxiety will depend on its unique facts and circumstances.

5.2.11. Public Liability policy wording – Bolton versus MMI and CU [2006] EWCA. Civ 50 (Ref: 19)

This case was essentially a dispute between two public liability (PL) insurers (MMI and Commercial Union) regarding which insurer's policy indemnified Bolton Metropolitan Borough Council.

PL insurers generally use wording "injury occurring" or "happening"; otherwise known as an occurrence basis.

The Court of Appeal upheld the High Court judgement that mesothelioma had "occurred" 10 years before death (based on various medical experts' views on the first mutation). It also upheld the finding that the PL polices triggered were the policies in force 9 to 11 years before the claimant's death.

The evidence relating to tumour development was revisited in *Durham v BAI and Others (2012)* where the emphasis was on angiogenesis (the point at which a tumour establishes its own blood supply). Experts claimed this occurs around five years before the onset of symptoms. Insurers now commonly use this reduced time from the onset of symptoms in settling claims, however, this has not been tested in the courts.

5.2.12. Child Maintenance and Other Payments Act 2008 (CMAOPA) (Ref: 20)

The CMAOPA amended the terms of payments made by the Government under the PWCA Act. The major effects of the CMAOPA were:

- To remove the restriction that payments under the PWCA Act were limited to cases where there was no civil compensation claim.
- To extend payments under the PWCA Act to all mesothelioma victims, where this had previously been limited to cases of employment exposure only. Thereby including cases of domestic exposure and cases where the source of exposure is unknown.
- To make PWCA Act payments fully recoverable by the Government from any compensator via the Compensation Recovery Unit (CRU) in the same way as other State benefits. The Government clawback led to an immediate increase in the insurance cost of mesothelioma claims in 2008.

These amendments under the CMAOPA apply to mesothelioma only. In respect of other lung conditions, qualification under the PWCA Act is still restricted to cases of employment exposure.

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5.2.13. Employers' Liability policy wording – Durham versus BAI (run-off) [2012] UKSC 14 (Ref: 21)

The EL market has instances of inconsistency in wordings, with some policies written on an "injuries caused" basis and some on an "injuries occurring or manifesting" basis; the latter being an insurance wording more commonly offered by PL insurers.

In late 2008, insurers brought five test cases to the courts on whether the *Bolton* judgement could be applied to EL policies with similar wording.

In March 2012 the Supreme Court handed down its judgment, on a 4–1 majority, that EL policies respond on an exposure basis regardless of wording (unlike PL policies); returning the trigger basis to that used prior to the litigation.

5.2.14. Damages (Scotland) Act 2011 (Ref: 22)

The Damages (Scotland) Act came into force on 7 July 2011 and made major changes to the provision of damages in many fatal EL disease claims. There is now a simplified method of assessing compensation for loss of financial support suffered by the surviving family. This is calculated on the basis of 75% of the deceased's net income, and results in a fairer and more generous approach being taken by the Courts in cases involving the death of a family breadwinner.

Furthermore, the Act recognised the change in family dynamics that has taken place over previous years. Although only direct relatives are entitled to make a claim for the pain and suffering of losing a loved one, this was extended to include half-blood relatives, such as stepsiblings. Also, with regard to loss of support, someone accepted by the deceased as a grandchild would now become entitled to compensation. This is especially relevant given the current economic climate and the need to rely on extended families for childcare.

This is principally the reason why mesothelioma awards in Scotland are on average higher than those in England & Wales.

5.2.15. Jackson reforms and LASPO Act (Ref: 23)

The Legal Aid, Sentencing and Punishment of Offenders Act 2012 (LASPO Act), which gained Royal Assent on 1 May 2012 and became law on 1 April 2013 sought to implement many of the recommendations put forward by Lord Justice Jackson. The LASPO Act applies to all personal injury claims.

The LASPO Act made After the Event (ATE) insurance premiums and success fees no longer recoverable from the losing insurer, in order to ensure that legal costs become more proportionate to the value of a claim.

From 1 April 2013 claimants may now bring a claim under a Damages Based Agreement (DBA), under which lawyers are not paid if they lose a case but may take a percentage (up to 25% for personal injury cases) of the damages recovered for their client as their fee, if the case is successful.

The potential reduction in legal costs to insurers is offset, at least in part, by an increase in general damages on all personal injury claims. In the case of Simmons versus Castle (Ref: 24), the Court of Appeal confirmed that the 10% increase in general damages would not apply to those cases funded by a CFA entered into before 1 April 2013. After this time, however, general damages in all civil claims should be 10% higher to assist claimants in paying for their own lawyer's success fee. When the LASPO Act became law on 1 April 2013, it applied to all personal injury claims with the exception of mesothelioma.

The Government announced that it had decided to apply the LASPO provisions to mesothelioma cases with effect from July 2014, but the High Court overturned the decision to apply the LASPO reforms to mesothelioma cases.

No win no fee agreements for mesothelioma cases therefore continue to operate on a pre-LASPO Act basis with any additional legal costs, namely success fees and ATE insurance

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premiums, remaining recoverable from the losing party. Therefore, mesothelioma claimants do not generally receive the 10% general damages uplift, since this relates to application of the LASPO reforms. A further review of the applicability of the LASPO Act to mesothelioma claims has been expected.

5.2.16. Recovery of medical costs for asbestos diseases (Wales) bill [2013] (Ref: 25)

A private member's bill to enable the Welsh Ministers to recover from a compensator some of the costs incurred by the NHS in Wales in providing care and treatment to the victim of the asbestos-related disease was approved by the Welsh Assembly in 2013.

The Counsel General for Wales referred the Bill to the Supreme Court for a determination of two issues:

- Whether the Bill was within the legislative competence of the Welsh Assembly under the Government of Wales Act.
- Whether the Bill was within the legislative competence of the Welsh Assembly on the Grounds of Compatibility with the European Convention on Human Rights.

The Supreme Court handed its judgment down in 2015. In both areas it found that the Bill was outside the competence of the Welsh Assembly.

A similar Bill was introduced into the Scottish Parliament in 2015, but, following the Supreme Court judgment, the terms of the proposal were substantially changed. At the time of writing, the latest version of the Bill, introduced in 2020, placed the onus on the employer rather than the insurer and restricted the liability to future events. The Bill was withdrawn in December 2020.

5.2.17. IEG versus Zurich [2015] UKSC 33 (Ref: 26)

This case deals with the recoveries that insurers can make from companies that self-insured some of the periods when the mesothelioma sufferer was exposed to asbestos.

In this case the employer argued it could choose which year to place its share of the compensation in and so maximise the insurance cover. Therefore, if the employer was only insured for a single year it could choose to put 100% of the claim in that year. As the case was based in Guernsey, Guernsey Law applied and therefore the Compensation Act 2006 did not apply.

The Supreme Court, in 2015, voted unanimously (7–0) that Zurich would only have to pay its share of the claim to IEG (i.e. 6 out of 27 years on risk) rather than 100% of the value of the claim. This follows the Barker ruling (as the Compensation Act 2006 does not apply).

Furthermore, by a majority of 4–3, they ruled that if the claim had been brought under the Compensation Act, Zurich would have been liable to pay 100% of the value of the claim to the sufferer. Zurich would, however, be entitled to seek contributions from other insurers and IEG (for periods of uninsured or untraced exposure) for the years on which Zurich did not provide cover. This is how insurers have handled claims since the Compensation Act came into force.

This left the existing industry practice, in place since Fairchild v Glenhaven, on appointment of mesothelioma awards unchanged.

5.2.18. Heneghan versus Manchester dry docks [2016] EWCA Civ 86 (Ref: 27)

This case agreed the Helsinki Criteria before the trial and so in effect ratified it as the basis of causation for asbestos-related lung cancer.

There were a number of parties who had contributed to Mr Heneghan's asbestos-related lung cancer, but no one party had a majority of the responsibility (>50%).

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The Court of Appeal found that a successful asbestos-related lung cancer claimant should receive damages from each liable defendant limited to a sum consistent with the amount by which each defendant increased the risk of the disease manifestation.

The claimant contention that all negligent defendants should owe joint and several liabilities (consistent with the Compensation Act 2006) to pay 100% was rejected. This left the existing industry practice on settling lung cancer claims unchanged.

Had there been >50% responsibility for one party, they could be fully liable to pay the total compensation (and then they could seek contributions from the other parties).

5.2.19. Ministry of Justice (MoJ) versus Knauer [2016] UKSC 9 (Ref: 28)

This case dealt with the date from which a mesothelioma claimant's future losses (which are discounted) are calculated.

The Supreme Court ruled that a claimants' future losses should be calculated from the date of trial, previously the date of death was used. Since the date of trial is normally after date of death the claimant's future losses will be higher.

It is expected that the average impact of this change will be small, given the small number of cases that go to trial and the increases in insurers settling the claim before the mesothelioma sufferer dies (see Appendix J for more details)

5.2.20. The negligence and damages bill 2015–16 (Ref: 29)

Introduced by Andy McDonald MP to the House of Commons in October 2015, as a private members Bill. The Negligence and Damages Bill looks to address:

1. psychiatric injury, suffered as a result of witnessing the death or injury of others.
2. damages for bereavement.

The wording in Part 3, Section 9 *Sums of damages payable to relatives* (Ref: 29) is near identical with the current wording in Scotland. Therefore, the Negligence and Damages Bill would open up payments to a wide range of "relatives", consistent with that in Scotland.

Very few private members Bills make it into legislation and the Negligence and Damages Bill effectively died at the end of the 2015/16 Parliamentary session, in May 2016.

5.2.21. The Fatal Accidents Act 1976 (Ref: 30)

On 13 May 2020 the House of Lords and House of Commons Joint Committee on Human Rights published a report on the scope of awards in England and Wales for wrongful death. The Committee's main recommendations were that the award should be extended to cohabiting couple. This recommendation has since been adopted within UK legislation.

The Committee also recommended that the scope of awards should be extended to close family members including children and siblings. However, in response to a parliamentary question on 19 July 2021, the Under-Secretary of State at the Home Office and Ministry of Justice, Chris Philp MP, replied (Ref: 31):

> "The Government believes that the existing system involving a fixed level of award and clear eligibility criteria represents a reasonable, proportionate and practical approach, and the Government does not currently have any plans for wider consultation on the bereavement damages regime or the Fatal Accidents Act more generally."

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5.2.22. Ogden – Discounting rate on personal injury awards

The Actuarial Tables with explanatory notes for use in Personal Injury and Fatal Accident Cases (also called the Ogden tables after the Chairman, Sir Michael Ogden QC, of the first Working Party that produced the tables), provide a multiplier to allow for life expectancy based on suitable mortality and investment return. They are produced by the Government Actuary's Department.

The discount rate used in personal injury cases had been fixed by the Lord Chancellor at 2.5% (based on the yield on Index-Linked Government Stock in 2001). However, in 2011, the Helmot versus Simon [2009–10] GLR 465 judgement (Ref: 32), in Guernsey, used a discount rate of 1%.

In late 2016, the Association of Personal Injury Lawyers (APIL) launched legal action against the Lord Chancellor for failing to review the discount rate to reflect changes in the economy, suggesting the discount rate should be between −0.5% and −1% (based on gilts as at 31 October 2016).

On the 27 February 2017, the Lord Chancellor announced that the discount rate would be −0.75% in England & Wales, effective from the 20 March 2017.

Based on a deceased male aged 75 (at the time of his death) this change in the Ogden discount rate would increase the total mesothelioma award by 6.75% (11.55% for a 70-year-old and 3.68% for an a 80-year-old) (Ref: 33).

On the 28 March 2017, the Scottish Government set the Scottish discount rate, via The Damages (Personal Injury) (Scotland) Order 2017 (Ref: 34), from 2.5% to −0.75% bringing Scotland into line with England & Wales.

On the back of these changes the UK Government launched a full consultation in March 2017 around the discount rate used in the Ogden rates. This consultation and other research "indicated that claimants often take more investment risk than the law currently assumes" (Paragraph 6, Ref: 35).

As a result of this work, on September 2017, the Lord Chancellor and Justice Secretary proposed legislation, where the discount rate would be set by reference to "low risk" rather than "very low risk" investments as at present, better reflecting evidence of the actual investment habits of claimants (Ref: 36). This proposed legislation would also ensure that the discount rate is reviewed more regularly in future, at least every three years.

The MoJ published a press release in September 2017 (Paragraph 11, Ref: 37), which states: "While it is difficult to provide an estimate, based on currently available information if the new system were to be applied today the rate might be in the region 0% to 1%".

5.2.22.1. Ogden discount rate in England and Wales. Following consultation, the Lord Chancellor announced on 7 September 2017 that the government would legislate to change the basis on which the discount rate is set in England and Wales. This legislation was introduced as part of the government's "Civil Liability Bill". The Civil Liability Bill received Royal Assent on 20 December 2018 and became an Act of Parliament (law).

On 19 March 2019, the Lord Chancellor announced that the review of the Ogden discount rate would start. Based on the Civil Liability Act 2018, that meant that a new Ogden discount rate must be announced on or before 5 August 2019. The Terms of References explained the roles of the Treasury and GAD in setting the discount rate (Ref: 38).

On 25 June 2019, GAD published report recommending that the Ogden discount rate be set at +0.25%. This was based on there being "a 50/50 likelihood that a representative claimant experiences a rate of return that is lower than this level." (Page 37, Paragraph 4.25, Ref: 36). The Lord Chancellor has discretion to set the Ogden discount rate and on 15 July 2019, the Lord Chancellor set rate at −0.25%, effective 5 August 2019. Based on *Schedule A1: Assumed rate of return on investment of damages: England and Wales* of the Civil Liability Act 2018, the next review cycle of the Ogden discount rate must be started by 14 July 2024 (Within the 5 year period following the last review. Page 9, Paragraph 1(3) Ref: 39).

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5.2.22.2. Ogden discount rate in Scotland and Northern Ireland. On 24 April 2019 the Scottish Government, set out how to change the basis on which the discount rate is set in Scotland, via The Damages (Investment Returns and Periodical Payments) (Scotland) Act 2019 which was passed on 19 March 2019.

The Damages (Investment Returns and Periodical Payments) (Scotland) Act 2019 sets out the notional portfolio, duration and adjustments and other assumptions for the GAD to use in calculating discount rates as well as the timings when reviews should occur.

The GAD was instructed to review the Ogden discount rate in Scotland. On 27 September 2019, they published a report concluding the Ogden discount rate should remain at −0.75%.

Based on *Setting the rate for* Section B1 *(1): Scotland* of The Damages (Investment Returns and Periodical Payments) (Scotland) Act 2019, the next review cycle of the Ogden discount rate must be started by 27 September 2024.

Up to 2021, the Ogden discount rate in Northern Ireland had remained at 2.5%. However, in March 2021 the NI Justice Minister, Naomi Long, announced that legislation would be enacted on 31 May 2021 to reduce the rate to −1.75%. The bill introducing a new framework for the calculation of the discount rate had expected to be enacted in 2021, but delays mean that it is unlikely to come into force until 2022.

5.3. Other Developments

This section discusses the various government schemes from which individuals with an asbestos-related disease can also receive compensation, as well as how insurers are traced and guidelines around general damages.

5.3.1. Industrial injuries disablement benefit (IIDB)

IIDB is a weekly allowance provided on a "no fault" basis. A sufferer can claim IIDB if they were employed in a job or were on an approved employment training scheme or course that caused their disease or accident. A sufferer cannot claim if they were self-employed.

The list of "prescribed diseases" includes the following asbestos-related diseases:

- Pneumoconiosis with asbestos agent (D1).
- Mesothelioma (D3).
- Asbestos-related lung cancer (D8 & D8A).
- Pleural thickening (D9).

The amount paid in compensation is based on the recipient's assessed level of disability on a scale of 20% to 100%. Claimants with mesothelioma and asbestos-related lung cancer are automatically entitled to the 100% benefit level, which is £168 per week as of April 2016.

There are additional benefits available under the scheme such as constant attendance allowance, which are described in the DWP publication "Benefit and Pension Rates" (Ref: 40).

Since the 2009 paper, various simplifications were affected by parliament in 2012 (Ref: 41), such as paying those in work the same rate regardless of age and incorporating trainees and those injured before 5 July 1948 into the main scheme.

The DWP publishes quarterly statistics about the number of awards, split by disease type, age, region, etc. Figure 16, shows the number of asbestos-related assessments (rounded to the nearest 10 claims) (Table 1.13, Ref: 42).

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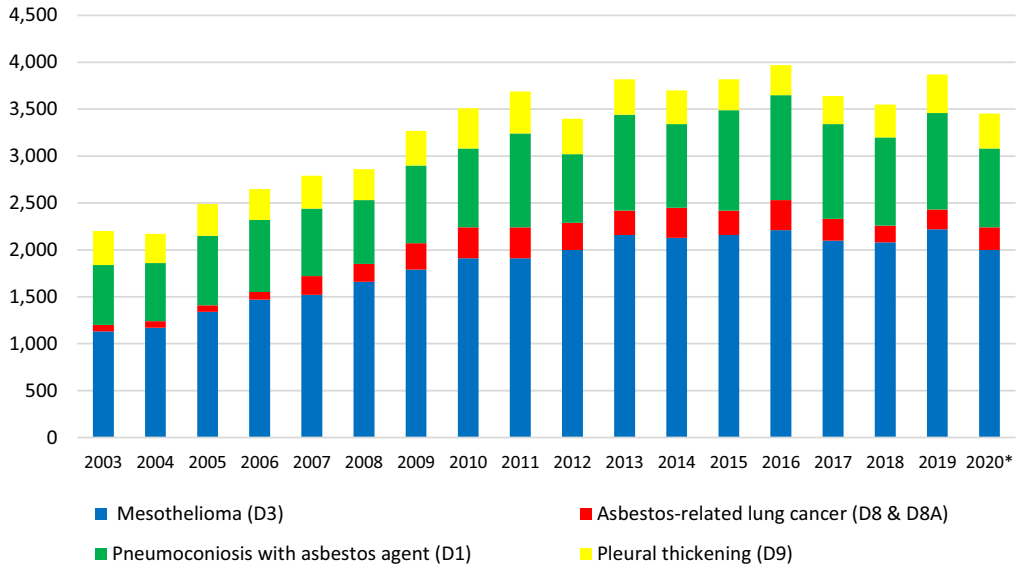


Figure 16. IIDB number of asbestos-related assessments resulting in payment.
*Gross-up to full year by multiplying by 4/3

5.3.2. Pneumoconiosis (Workers Compensation) Act 1979 scheme (PWCA scheme)

The PWCA Scheme (Ref: 43) allows lump sum payments to claimants, provided that:

- The dust-related disease has been caused through employment.
- The claimant is receiving IIDB for one of the prescribed diseases.
- The claim has been made within 12 months of the decision awarding IIDB.
- The claimant hasn't taken civil action because their former employer has stopped trading.
- The claimant has not brought a court action or received compensation from an employer in respect of the disease.

Dependants may also claim within twelve months of the death of the sufferer.

Payments from this scheme are deducted from any other damages awarded through a court action or compensation claim.

The IIDB publishes quarterly statistics in relation to the number and size of awards made (rounded to the nearest 10 claims) under the PWCA Scheme. Table 16, details the latest number of claims and average award from March 2007 to March 2021 (Table 3.1, Ref: 42).

Table 16. PWCA scheme payments as at March 2021

Year	Number of Claims from Sufferers	Total Payments Made to Sufferers	Average Sufferer Award	Number of Claims from Dependants	Total Payments Made to Dependants	Average Dependant Award
2007*	1,300	£18,559,631	£14,277	190	£893,062	£4,700
2008	2,010	£29,570,358	£14,712	270	£1,351,688	£5,006
2009	2,320	£33,375,789	£14,386	320	£1,637,659	£5,118

(*Continued*)

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Table 16. (*Continued*)

Year	Number of Claims from Sufferers	Total Payments Made to Sufferers	Average Sufferer Award	Number of Claims from Dependants	Total Payments Made to Dependants	Average Dependant Award
2010	2,490	£35,608,745	£14,301	280	£1,963,431	£7,012
2011	2,490	£35,652,415	£14,318	280	£2,385,787	£8,521
2012	2,830	£39,654,387	£14,012	270	£2,523,324	£9,346
2013	2,910	£41,790,373	£14,361	330	£2,661,449	£8,065
2014	3,090	£42,729,297	£13,828	310	£2,582,345	£8,330
2015	3,270	£43,359,804	£13,260	350	£2,706,109	£7,732
2016	3,080	£41,106,042	£13,346	310	£2,671,138	£8,617
2017	2,770	£36,097,115	£13,031	240	£2,642,327	£11,010
2018	3,140	£40,943,096	£13,039	320	£2,616,615	£8,177
2019	3,070	£40,329,880	£13,137	270	£2,165,471	£8,020
2020	2,070	£32,434,514	£15,669	190	£1,991,571	£10,482
2021Q1	730	£9,988,973	£13,684	70	£647,668	£9,252

*9 months of data.

5.3.3. Diffuse mesothelioma scheme 2008

In October 2008, The Diffuse Mesothelioma Scheme 2008 (known as the 2008 Mesothelioma Scheme) was introduced via the CMAOPA. This 2008 Mesothelioma Scheme enabled lump sum payments to be made to people who suffer from diffuse mesothelioma and met the following criteria:

- Are not entitled to a payment under the PWCA Scheme.
- Have not been given a payment for developing mesothelioma from an employer, a civil claim or elsewhere.
- Are not entitled to compensation from a Ministry of Defence scheme.

Mesothelioma sufferers must claim within 12 months of diagnosis. If recipient of a 2008 Mesothelioma Scheme payment then receives compensation from a civil claim for their condition, the 2008 Mesothelioma Scheme payment is recovered from the responsible party and the balance will be paid to the mesothelioma sufferer.

The IIDB publishes quarterly statistics in relation to the number and size of awards made (rounded to the nearest 10 claims) under the 2008 Mesothelioma Scheme. Table 17, details the latest number of claims and average award from September 2008 to March 2021 (Table 3.2, Ref: 42).

Table 17. 2008 diffuse mesothelioma scheme payments at March 2021

Year	Number Of Claims From Sufferers	Total Payments Made to Sufferers	Average Sufferer Award	Number of Claims from Dependants	Total Payments Made to Dependants	Average Dependant Award
2008*	190	£3,327,830	£17,515	20	£24,993	£1,250
2009	510	£7,485,141	£14,677	50	169,584	£3,392
2010	430	£7,825,090	£18,198	10	16,593	£1,659

(*Continued*)

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Table 17. (*Continued*)

Year	Number Of Claims From Sufferers	Total Payments Made to Sufferers	Average Sufferer Award	Number of Claims from Dependants	Total Payments Made to Dependants	Average Dependant Award
2011	470	£9,214,664	£19,606	10	48,451	£4,845
2012	440	£9,683,318	£22,008	50	302,504	£6,050
2013	470	£9,814,793	£20,883	20	92,142	£4,607
2014	430	£8,760,285	£20,373	Negligible	Negligible	Negligible
2015	410	£8,350,928	£20,368	10	39,393	£3,939
2016	420	£8,748,674	£20,830	Negligible	Negligible	Negligible
2017	370	£8,054,849	£21,770	20	112,879	£5,644
2018	430	£9,327,173	£21,691	20	89,896	£4,495
2019	440	£9,267,298	£21,062	Negligible	Negligible	Negligible
2020	390	£8,394,444	£21,524	Negligible	Negligible	Negligible
2021Q1	110	£2,340,189	£21,274	Negligible	Negligible	Negligible

*3 months of data.

5.3.4. Diffuse mesothelioma payment scheme

The Mesothelioma Act 2014 established the Diffuse Mesothelioma Payment Scheme (DMPS), run by the DWP, to make payments to mesothelioma sufferers (or their dependents) who meet the following criteria:

(a) Diagnosed with mesothelioma on or after 25 July 2012
(b) Mesothelioma was caused by exposure to asbestos when working in the UK
(c) Cannot trace the employer that exposed you to asbestos, or their insurers
(d) Have not made a civil claim against any employer or insurer
(e) Have not received damages or a specified payment for mesothelioma and are not eligible to a specified payment.

People can claim from the DMS or the PWCA, but any payments from these will be deducted from the amount they receive from the DMPS.

The DMPS, started by paying 80% of the average value of claims that go to court. The 80% was decided, principally, to make sure that mesothelioma sufferers were incentivised to seek compensation from their employer(s) or their insurers. The compensation increased to match 100% of average civil claims, but only for those diagnosed with mesothelioma on or after 10 February 2015.

The DMPS is funded by a levy on the insurance industry, which was £40 m in 2017 including a £5 m shortfall from 2016. If a mesothelioma sufferer receives a payment from the DMPS and then makes a successful claim against a liable employer/insurer, the employer/insurer deducts the amount of the DMPS payment from the compensation payment made to the sufferer and repays the DMPS the amount it paid out.

Figure 17 details the DMPS Payment Tariff for those diagnosed with mesothelioma on or after 10 February 2015 (including a £7,000 contribution to legal fees).

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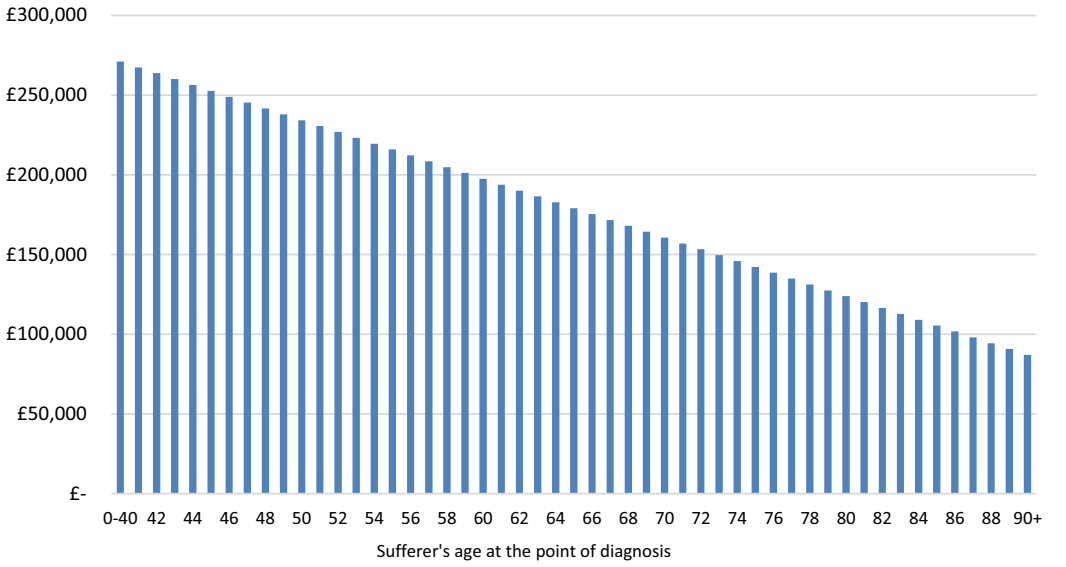


Figure 17. DMPS payment tariff (Ref: 44).

The DWP publish statistics on the DMPS, including applications received, success rates and payments. The latest official statistics (Ref: 45) (April 2018 to March 2019) show:

- The Scheme receives around 31 claims a month last year in 2018/19 (consistent with the rate of claims received in 2017/18)
- 8.0% of applications received are from females (8.1% in 2018/19)
- Almost two thirds of claimants were aged between 65 and 79
- 71% of claims are successful (excluding pending cases but including withdrawn applications). For applications in 2018/19 the success rate is currently 78%
- The mean award, for the last 12 months, was around £148,000 (up from £145,000 in 2017/18)
- £172.6 m has been awarded since the DMPS started, made up of £143.5 m of direct payments to applicants and £29.1 m repaid to the DWP.

5.3.5. Employers' Liability Tracing Office (ELTO)

The ELTO (Ref: 46) was introduced in 2011 and was set up to provide a tracing service for individuals to trace their former employers' EL policies. It replaced the previous voluntary Employers' Liability Code of Practice (ELCOP) tracing service.

ELTO maintains an electronic database of EL policies, which contains:

- All new and renewed EL insurance policies from April 2011
- Policies from before April 2011 that have new claims made against them
- Policies voluntarily provided by ELTO members
- Policies that were identified through the previous tracing service ELCOP.

The database contains 25 million policies (8.9 million of which are voluntary policy records) and can be searched via an online facility that is free for claimants and their representatives to use. Over 99% of the EL Insurance Market is signed up to ELTO membership.

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Figure 18 details the number of enquires made and the proportion of successful enquires which traced an EL policy in 2015 to 2017 for asbestos-related diseases.

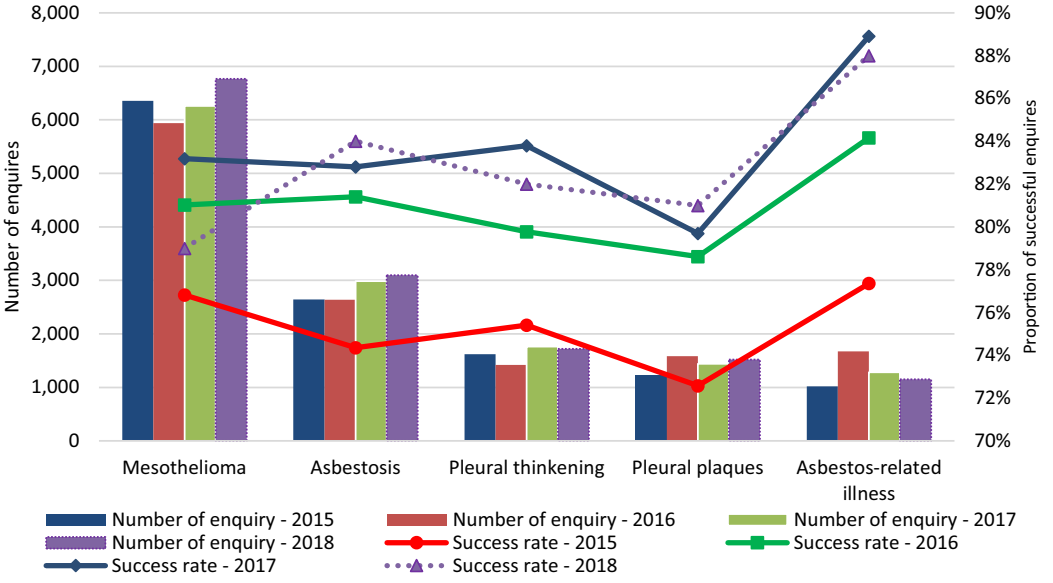


Figure 18. ELTO enquires in 2015 to 2017 (Ref: 47).

Multiple enquires can be made by one claimant, and 87% (82% in 2015) of mesothelioma claimants found at least one EL policy to potentially make a claim against in 2018. This is lower than the non-mesothelioma claimant success rate of 97% (94% in 2015) (please note though that this figure will include claimants for diseases and accidents).

ELTO is funded through a levy on its members in proportion to gross written premium, with no levy payable for insurers writing less than £5 m annual premium. The total net levy for 2016 is quoted as around £2.4 m in the 2018 business plan and £3.0 m in the 2020 business plan.

5.3.6. MesobanK

MesobanK (Ref: 48) was set up in 2012 (in memory of Mick Knighton) and initially funded by voluntary industry contributions. It collaborates with hospitals around the UK to identify patients with mesothelioma and collect samples, providing:

- Tissue, blood and data from over 300 patients
- New cell line culture collection
- Provides kits to operating teams to make tissue collection easier
- Online data management system to collect useful facts on patients that provide samples.

It is the UK's largest collection of high-quality tissue, cells and blood samples from mesothelioma patients. MesobanK supports biomedical research being undertaken across a wide range of institutions within the UK, EEA, USA, Canada, Australia, and New Zealand and applications from researchers undertaking biomedical research directly concerned with asbestos-related disease diagnosis and treatment.

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5.3.7. Idiopathic pulmonary fibrosis

Idiopathic Pulmonary Fibrosis (IPF), also known as cryptogenic fibrosing alveolitis, is a subset of interstitial lung diseases with no identifiable cause, therefore by definition it currently has no established causal links with asbestos exposures. The average survival period after diagnosis is 3 years, and there is currently no cure for IPF, though treatments exist to relieve symptoms and slow down progression, with 20% of people surviving for more than 5 years after diagnosis.

Both the symptoms and radiological features of IPF are similar to asbestosis, making it difficult to distinguish the two. Diagnosis of asbestosis in the UK is often based on the patient's recollection of asbestos exposure, and clinicians currently have no clear guidelines on how to estimate a patient's past asbestos exposures. This caused a recent HSL study (Page 109, Ref: 49) to raise the speculation as to "whether a proportion of IPF mortality is in fact due to unrecognised asbestos exposure".

Correct diagnosis is important to the individuals involved. In the UK, asbestosis patients may be eligible for compensation, some of which may feed into insurance claims. IPF patients are not currently eligible for compensation from their employers (as the cause is unknown), but recently the NHS has licensed an effective but costly anti-fibrotic treatment (£20,000 to 30,000 per year) for IPF patients alone.

In recent years, there are about 4,000 IPF deaths each year in the UK, compared to 2,000 to 2,500 deaths each year for mesothelioma. Given the number of IPF deaths each year in the UK, if asbestos was proven to cause the majority of IPF cases (or if they were found to be misdiagnosed asbestosis), it could have significant implications on the insurance industry.

While Barber (2015) (Ref: 49) established a strong statistical correlation between UK historic asbestos import and IPF deaths with a selected latency period, research is still at its infancy on whether there is a causal link between asbestos and IPF. Current related research includes an IPF 3-year case-control study using an estimate of life-time asbestos exposures, and a clinical trial study on the effectiveness of the IPF anti-fibrotic treatments on asbestosis patients.

5.3.8. Guidelines for general damages in personal injury cases – England and Wales

The Judicial College (which took over from the Judicial Studies Board in April 2011) publishes the "Guidelines for the assessment of general damages in personal injury cases" (JC Guidelines). The JC Guidelines are designed to provide guidance on the level of damages being awarded by courts in England and Wales. They are not designed to provide the definitive assessment of damages in any particular case, rather a guide to the appropriate range. The JC Guidelines are designed to reflect the general level of current awards, and all judges involved in personal injury cases will automatically receive a copy of the latest JC Guidelines.

Note that the JC Guidelines cover general damages only. Awards for specific losses (special damages) are excluded.

The latest JC Guidelines are set out in the 15th edition (published in November 2019) and Table 18 summarises the award levels for asbestos-related diseases:

Table 18. JC guidelines of general damages: 15th edition

Disease	Lower Band	Upper Band
Mesothelioma (excluding 10% uplift)	£59,730	£107,410
Lung cancer	£65,710	£91,350
Asbestosis (>10% disability)	£36,060	£99,330
Pleural thickening (>10% disability)	£36,060	£99,330
Asbestosis/Pleural thickening less than 10% disability	£14,140	£36,060

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There is no-longer any separate categorisation of provisional awards for asbestos-related diseases.

5.3.8.1. Inflation within the JC guidelines. The JC Guidelines have generally increased in line with the Retail Price Index (RPI). However, the 13th edition introduction did set out the intention that before the publication of 14th edition (due in 2017), they would review whether RPI is still an appropriate inflation index to use; considering that the Consumer Price Index (CPI) is now more widely used by the ONS. The 14th and the 15th editions again raised the use of a different inflation index this point, but stated that the time "may yet come" but had "not yet" come in the publishing of those editions.

With CPI currently running lower than RPI, if they had used CPI to allow for inflation, the awards for General Damages would have been lower.

5.3.8.2. Guidance on 10% uplift. The 14th edition states "only a few (if even that) awards for mesothelioma will attract the 10% Simmons versus Castle uplift" (see Section 5.2.15 for more details).

5.3.8.3. Changes since the 6th edition. Since the Working Party first published the figures in the sixth edition of the JC Guidelines regarding asbestos-related claims in the 2004 paper, there have been seven subsequent editions.

Figure 19, details the awards for each edition of the JC Guidelines (staring from the sixth edition) for each asbestos-related disease.

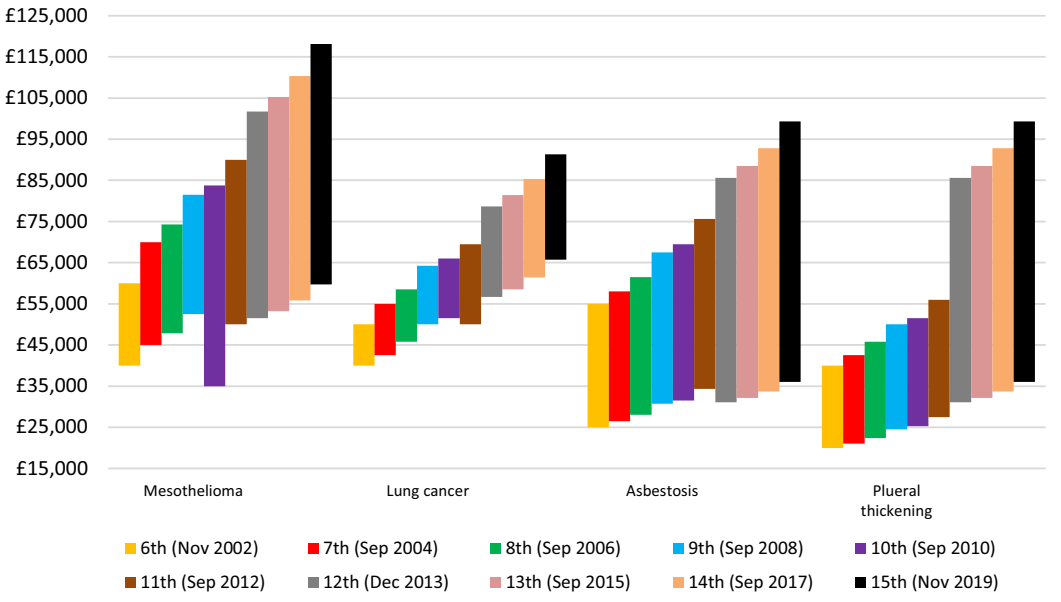


Figure 19. JC guidelines on general damages: editions 6th (Nov-2002) to 15th (Sep-2019) (Figures on the 12th edition JC Guidelines and onwards have the 10% uplift applied, apart from on the lower end award for mesothelioma which is without the 10% uplift. Asbestosis and pleural thickening figures from the 12th edition based on the excess of 10% disability).

5.3.9. Guidelines for general damages in personal injury cases – Northern Ireland

Like the Judicial College in England and Wales, the Judicial Studies Board for Northern Ireland publishes the "Guidelines for the Assessment of General Damages in Personal Injury Cases in Northern Ireland" (also known as the Green Book (Ref: 50).

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The first edition of the Green Book was published in 1996 and, like the JC Guidelines, each edition allows for inflation by RPI. Figure 20, detail the awards for each edition of the Green Book (from the first edition) for each asbestos-related disease.

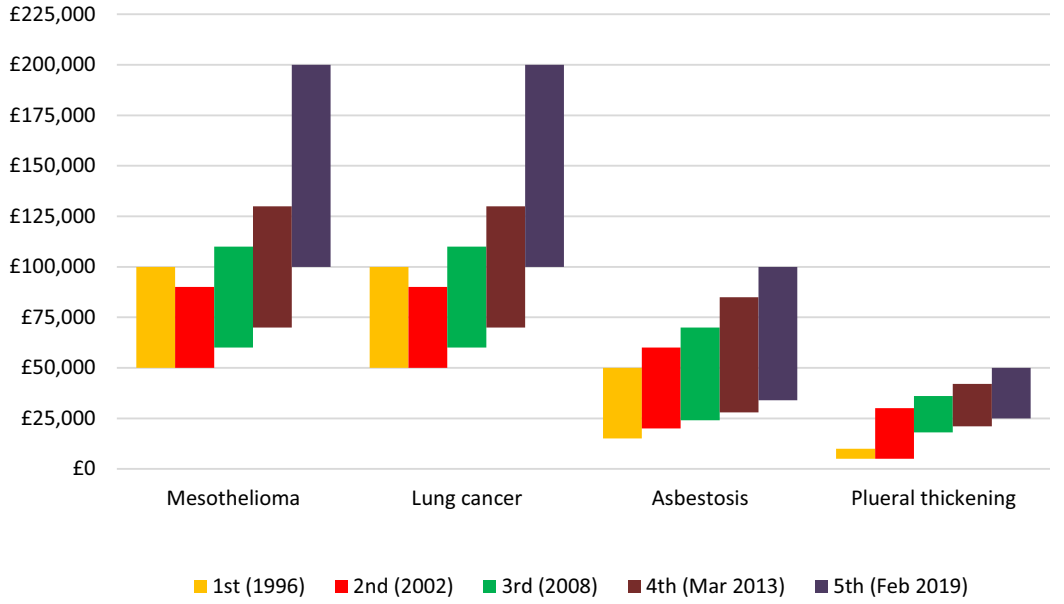


Figure 20. Green Book on general damages: editions 1st (1996) to 5th (Feb-2019).

5.3.10. General damages in personal injury cases – Scotland

Under Scots law the compensation paid in personal injury cases is split into pecuniary and non-pecuniary losses.

Scots law uses the term Solatium (a non-pecuniary loss) to describe the amount awarded to the injured party for pain and suffering caused by the injury.

There is no Scottish equivalent of the JC Guidelines/Green Book in relation to Solatium (general damage) awards. Awards rely on previous case precedent only. However, the JC Guidelines are often used as a starting point for assessing Solatium (general damage) in Scottish cases.

6. Estimating Mesothelioma Deaths

6.1. Summary

The 2009 Working Party paper took as its foundation the HSL (an agency of the HSE) research report entitled "RR728 – Projection of mesothelioma mortality in Great Britain" (HSL 2009) (Ref: 51). This research report used the HSE's non-clearance model (on which the Working Party's 2009 estimate were based) and re-parameterised it for the then latest deaths data up to 2006. The HSL parameterised the model using a number of optimisation techniques (their published curve is based on the Markov Chain Monte Carlo parameterisation).

Since 2009 the HSE/HSL have been updating the non-clearance model for the new deaths experience and in 2010 looked at alternative model structures such as the Revised Risk model and the Two-Stage Clonal Expansion (TSCE) Model.

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Figure 21 details the male mesothelioma projections produced by the HSE/HSL, between 2009 to 2019, against the actual deaths. Please note that the deaths data used to parameterise these models are 3–5 years behind the publication of the model.

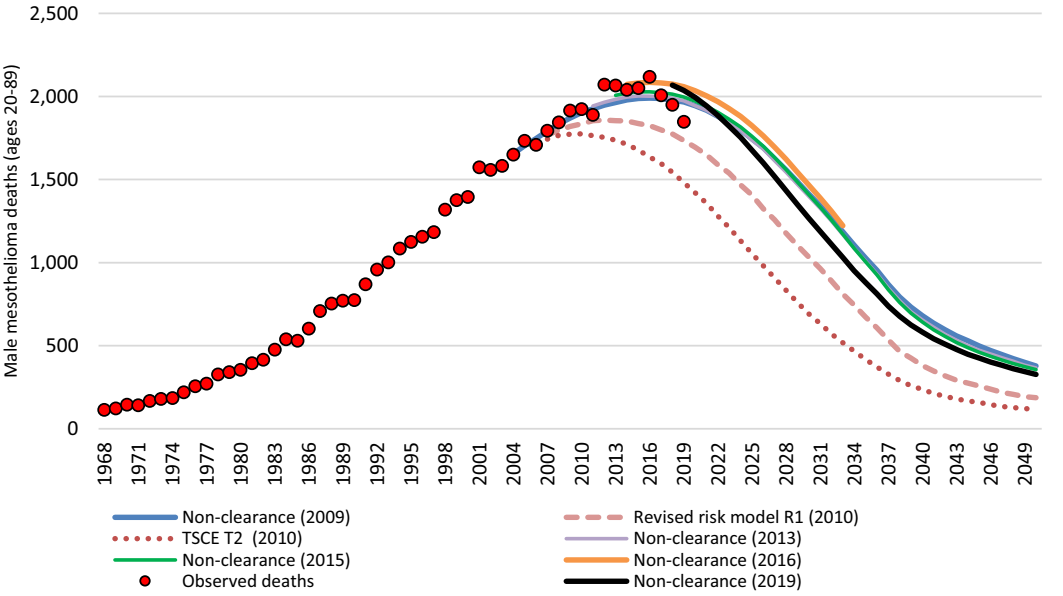


Figure 21. HSE/HSL male mesothelioma projections from 2009 to 2016 against observed deaths.

The structure of the non-clearance models remains the same as the one in 2009, with an explicit allowance for "background" mesothelioma (i.e. those deaths that would have occurred in the absence of any industrial exploitation of asbestos in Britain).

In 2013 a group of academics (María Martínez-Miranda, Bent Nielsen, and Jens Nielsen) published (and in 2015 updated) a separate projection of GB male mesothelioma deaths (Ref: 52) without an exposure curve nor any population data. Their model uses a GLM to estimate the parameters at each age and birth year. Using the same data as the latest HSE/HSL non-clearance model their Age-Birth GLM model produced similar results. The papers are discussed in more detail in Section 6.4.

The GLM Age-Birth model is attractive because of the relative simplicity of its construction but it finds it difficult to capture some of the key characteristics of the historical mesothelioma deaths data. Although the HSE/HSL non-clearance model is more complex, the additional complexity allows greater flexibility and the ability to better reflect the observed characteristics of the historical data. As in 2009, the Working Party believe that this should then provide a more credible platform on which to build the projection of future deaths. The practitioner needs to be fully aware of their own choices for the various models.

As with all models used to predict mesothelioma in GB (such as the non-clearance and GLM Age-Birth models), they generally fit the past data well, but the future projections are very sensitive to slight changes in the parameters used with the models. There is particular uncertainty around the parameters used in estimating future deaths, as there is limited quantifiable data to assist in the fitting process around the level and intensity of people exposed to asbestos in the periods where there is limited to no actual experience.

The Working Party when evaluating these models and their parameters has made use of visualising the deaths in Age-Birth Year and Age-Death Year heat maps, like the one shown in Figure 22, to help consider the appropriateness of any future predictions the models produce.

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Please note that since the Working Party parameterised its mesothelioma deaths models, the HSE published new deaths data (deaths in 2019). Therefore, the Working Party's deaths have been parameterised using deaths up to 2017 on the HSE/HSL model and up to 2018 on the GLM Age-Birth model.



Figure 22. Heat map of actual male GB mesothelioma deaths (reported 1968 to 2019).

Figure 23 details the Working Party's Central scenarios using the HSE/HSL non-clearance model and GLM Age-Birth model. The Working Party has also produced Low and High scenarios using alternative parameters, to provide some measure of the uncertainty around the parameters used in those models. Further details on the HSE/HSL non-clearance model and GLM Age-Birth model can be found in Sections 6.3 and 6.4, respectively.

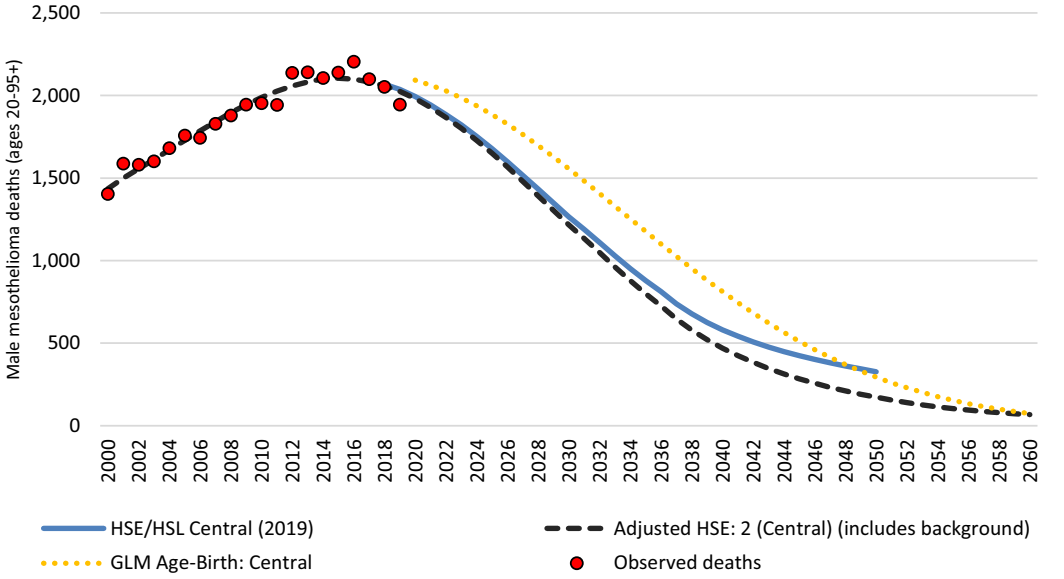


Figure 23. Selected Central scenario male mesothelioma projections against observed deaths.

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In the following sections the GLM Age-Birth and the HSE/HSL non-clearance models are explained in more detail.

6.2. Actual Experience

At the time of the 2009 Working Party's UK EL Insurance Market estimates, mesothelioma deaths were observed up to 2008. Since then the HSE has recorded mesothelioma deaths for an additional 11 years, up to 2019 (please note that the 2019 was recently published in July 2021 and so the Working Party's parameters are based on data prior to 2019). The recent mesothelioma deaths experience is higher than those estimated in 2009.

Figure 24 details the actual male and female GB mesothelioma deaths from 1990 to 2019.

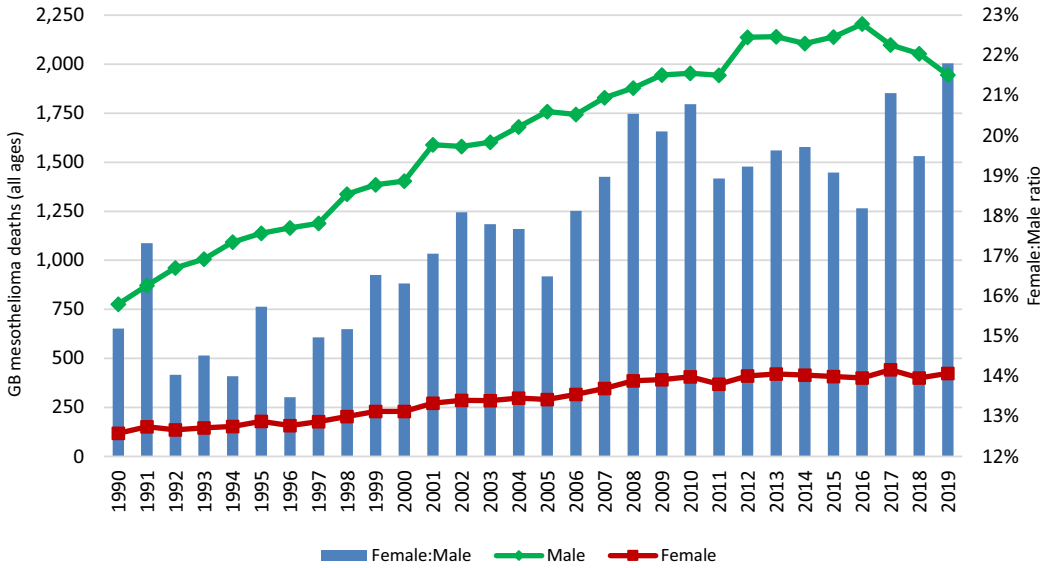


Figure 24. Male and female GB mesothelioma deaths.

As shown by Figure 24, male deaths have now fallen in three successive years. Up to 2016, every fall in deaths has been followed by an increase the following year. Female deaths, on the other hand, have been more or less static in recent years. The ratio of female to male mesothelioma deaths, over the last 10 years, has been between 16% to 22%.

This is much higher than the ratio of female to male mesothelioma claims from the survey, which is between 4% and 7%, (see Appendix J for more details and Section 7.2.5 for details on the CRU female to male mesothelioma claimant ratio). The most likely explanation for this difference is that many female mesothelioma sufferers were exposed to asbestos outside the workplace.

6.2.1. Experience by age

Analysing the deaths by age band, from Figure 25 for male mesothelioma deaths:

- The proportion of deaths from the 90+ age band has been steadily increasing with around 4% of the total GB male mesothelioma deaths in recent years coming from this age band.

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- The proportion of deaths (and number of deaths) from ages 70+ are generally increasing year on year, whereas the deaths from ages 64 and younger are generally decreasing.
- The deaths relating the 65–69 age band are decreasing over the last 4 years and have been decreasing as a proportion of total deaths.

This experience supports the theory that the exposure to asbestos in the 1970s was lower than the exposure to asbestos in the preceding periods.

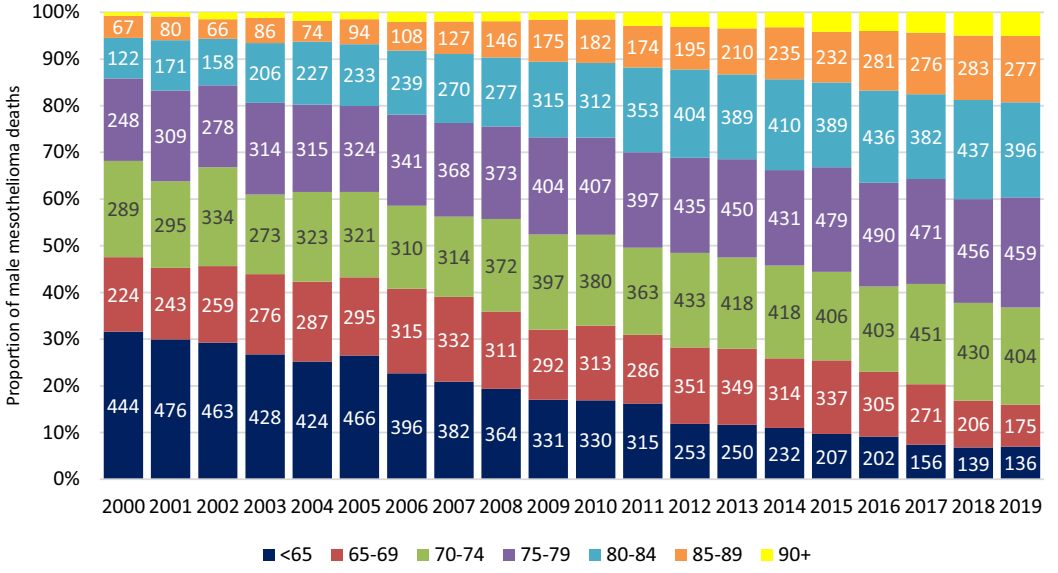


Figure 25. Male GB mesothelioma deaths by age band.

Analysing the deaths by age band, from Figure 26 for female mesothelioma deaths the experience is similar to that for males, although more volatile due to the smaller volumes:

- The proportion of deaths from the 90+ age band has been steadily increasing with around 4.4% of the total GB female mesothelioma deaths in recent years coming from this age band.
- The proportion of deaths (and number of deaths) from ages 70+ are generally increasing year on year, whereas the deaths from ages 64 and younger are generally decreasing.
- The deaths relating to the 65–69 age band have been generally increasing in number each year, but the last four years have seen a decrease (which is consistent with the experience for males).

Overall, the experience of female deaths by age band is consistent with the experience for male deaths.

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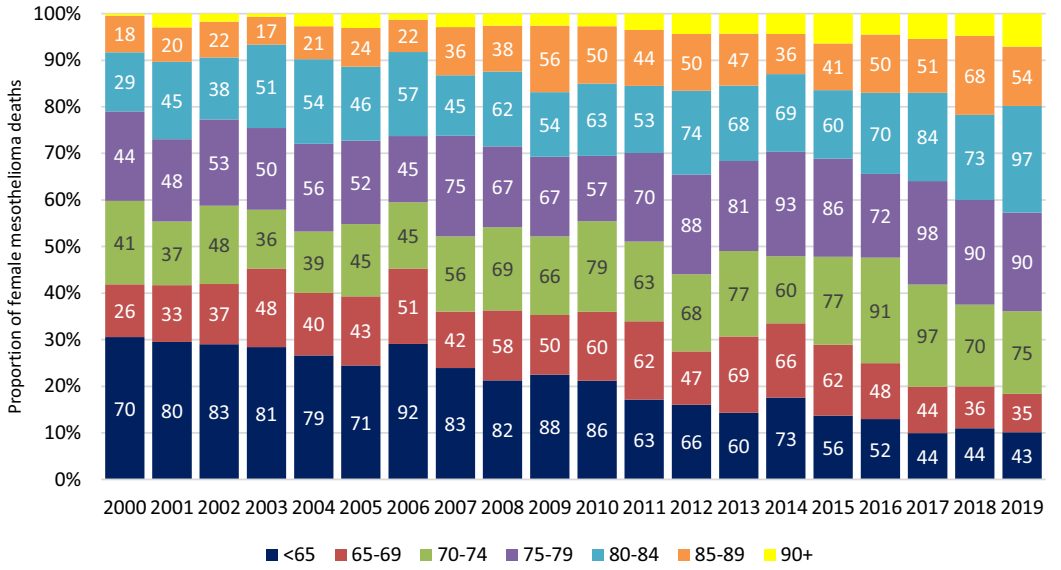


Figure 26. Female GB mesothelioma deaths by age band.

Analysing the average age at death, for males and females, shows similar trends. Since 1968, the age at death has increased by around three years every 10 years, but over the last ten years the average age at death for males has increased by four years.

Figure 27 details the average age at death for males and females. The most recent experience over the last ten years, shows that the average age at death has converged for males and females. The reason for the difference in the past years could be due to the lack of data relating to female deaths due to mesothelioma. In the absence of other data, the very close average age at death in the most recent years suggests that the male and female mesothelioma sufferers have similar characteristics, in particular, their exposure.

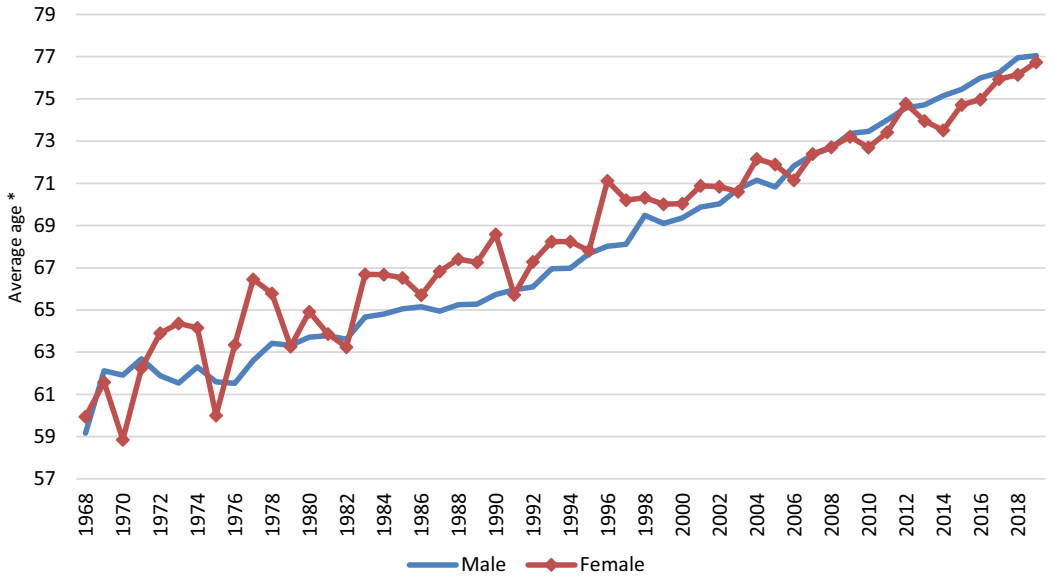


Figure 27. Average age of male and female mesothelioma deaths.
*Assuming 19 for age band 0–19, 22 for age band 20–24 and 97 for age band 95+

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6.2.2. Experience by country

As shown by Figure 28, the overall number of deaths due to mesothelioma in the UK (For GB see Page 5, Table MESO01 Ref: 4) (For NI see Ref: 53) has been increasing steadily over the last 30 years and are dominated by the deaths in England. The deaths in England, account for around 86% of the total number UK deaths. Scottish deaths make up 8% with Welsh and Northern Irish deaths making up 4% and 2% the total UK deaths, respectively.

In Great Britain, the proportion by country is consistent when splitting the data by gender.

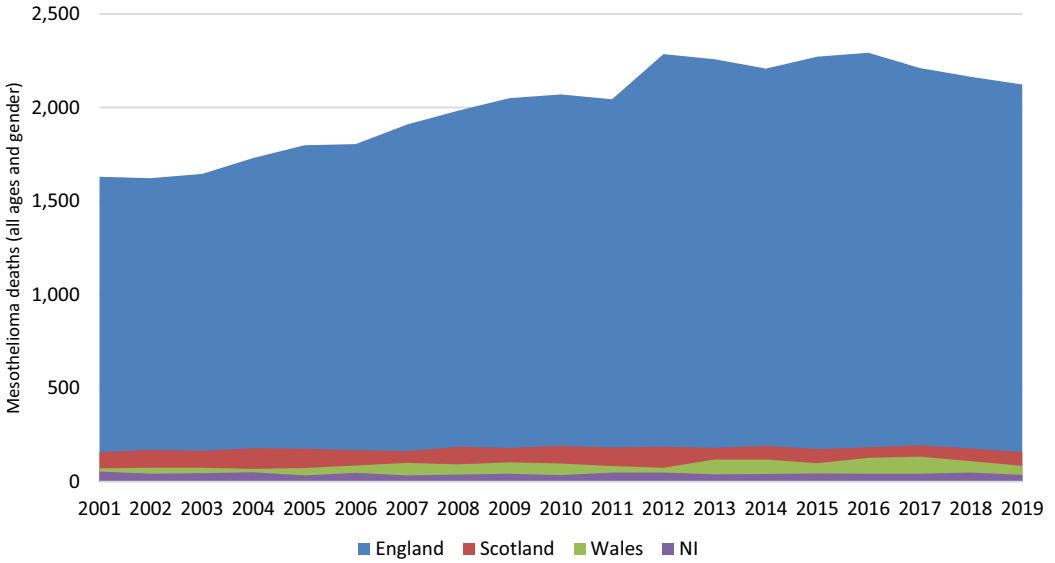


Figure 28. UK mesothelioma deaths split by country.

Over the last ten years the number of deaths in England per year has increased by approximately 2% per year. Whilst Scotland and Wales have far fewer numbers of deaths per year, and as such show more volatile experience, over the past ten years they have shown different experience from England. Scotland deaths per year appear to have flattened somewhat and have shown an average increase of 1% per year. Wales on the other hand, has shown a greater increase in the last ten years with an average increase of 6% per year, mainly due to a large increase in 2013. Northern Irish deaths appear to be remaining stable.

As shown in Figure 29, comparing the mesothelioma deaths data and the notified mesothelioma claims from the latest survey data the proportions by country are reasonably consistent.

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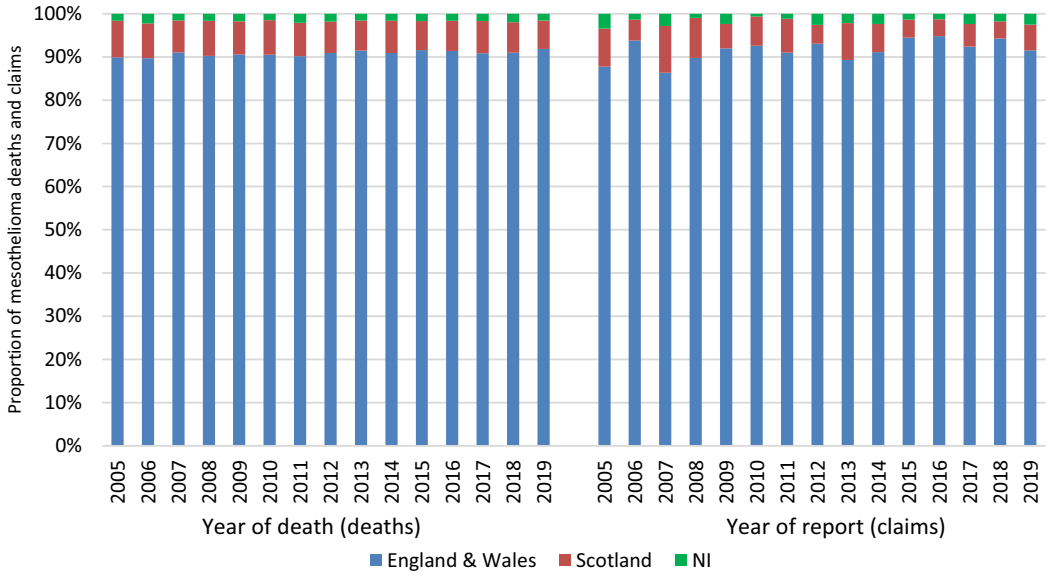


Figure 29. Mesothelioma deaths and claims split by country.

6.2.3. Comparison to 2009 estimates

Figure 30 compares the actual number of male deaths over the years 2009–2019 against those projected by the models used in the 2009 paper. The HSE/HSL (2009) model as well as the Adjusted HSE model most closely predicted the actual number of mesothelioma deaths in the years 2009–2019.

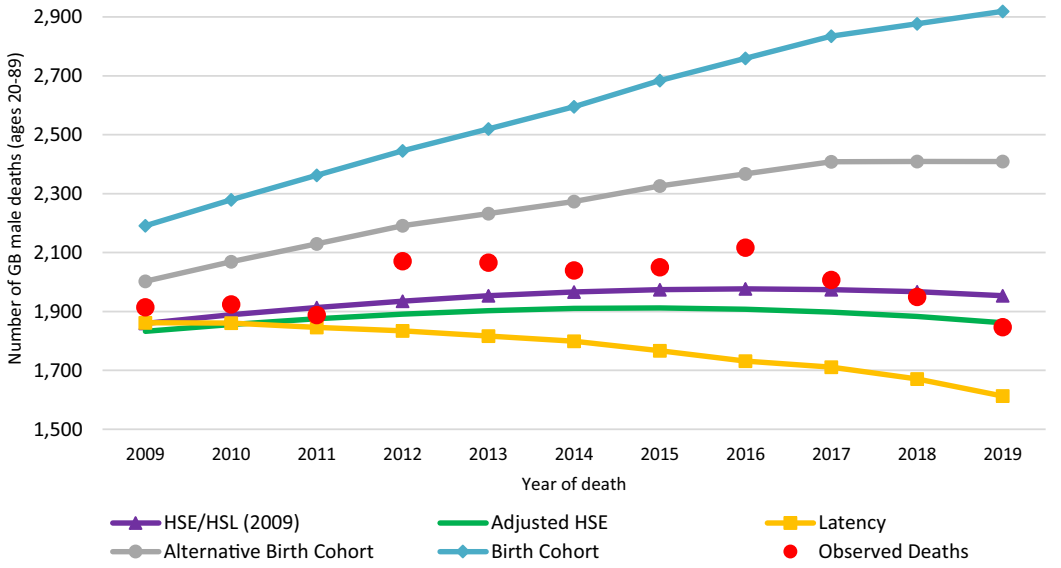


Figure 30. Male GB mesothelioma deaths 2009 to 2019: actual versus 2009 projections.

If the models were scaled to all be equal to the actual deaths in 2009, the HSE/HSL (2009) and Adjusted HSE model would still be the most accurate models over 2010 to 2019.

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Table 19 confirms that the HSE/HSL (2009) model has been the most accurate in projecting mesothelioma deaths over the period 2009 to 2019. The Birth Cohort model by comparison was the least accurate model overestimated the total number of deaths in years 2009–2019.

Table 19. Male GB mesothelioma deaths: actual versus 2009 projections

	2009 to 2019 Deaths			2010 to 2019 Deaths (Model Rescaled to 2009 Actual)	
2009 AWP Model	Projected Deaths	Actual Minus Projected	Total Squared Year Difference	Actual Minus Projected	Total Squared Year Difference
HSE/HSL (2009)	21,363	511	79,630	(117)	56,946
Adjusted HSE	20,730	1,144	166,621	223	51,155
Latency	19,509	2,365	634,911	1,817	430,050
Alternative Birth Cohort	24,817	(2,943)	1,010,065	(1,846)	517,341
Birth Cohort	28,465	(6,591)	4,587,681	(2,993)	1,313,178

6.3. HSE/HSL Non-clearance Model

For simplicity in this section the abbreviation HSE is used instead of HSE/HSL or HSL.

6.3.1. HSE 2019 projections

The latest publicly available projections (see Page 13, Table MESO06 Ref: 4) from the HSE are based on deaths up to and including year 2017. These projections predict that total annual numbers of GB mesothelioma deaths (for males and females) will remain at about 2,500 up to around the year 2020. Figure 31 shows the GB male mesothelioma deaths. Figure 32 shows the GB female mesothelioma deaths.

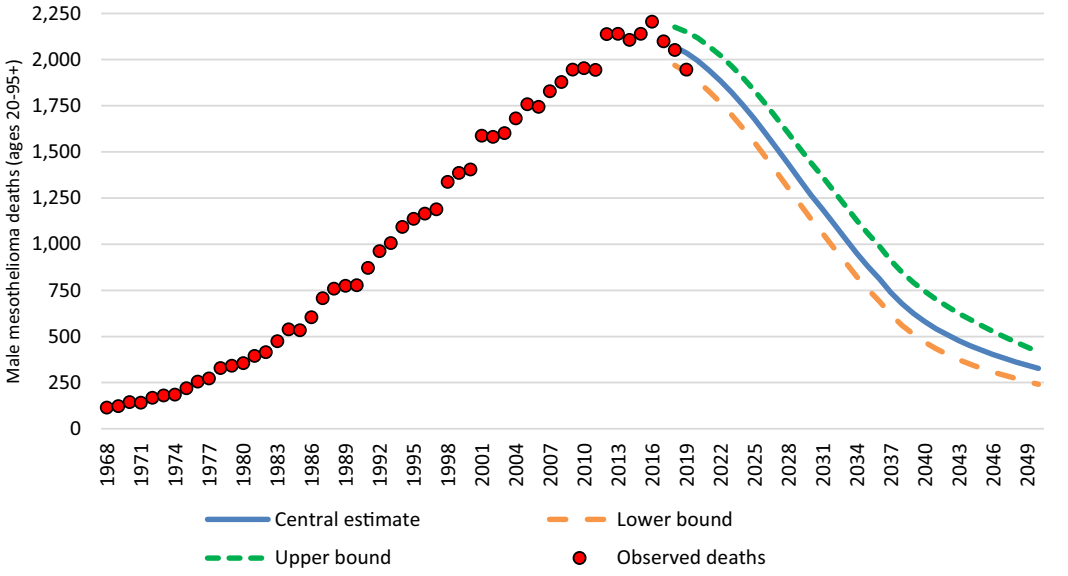


Figure 31. HSE 2018 projections for GB male mesothelioma deaths.

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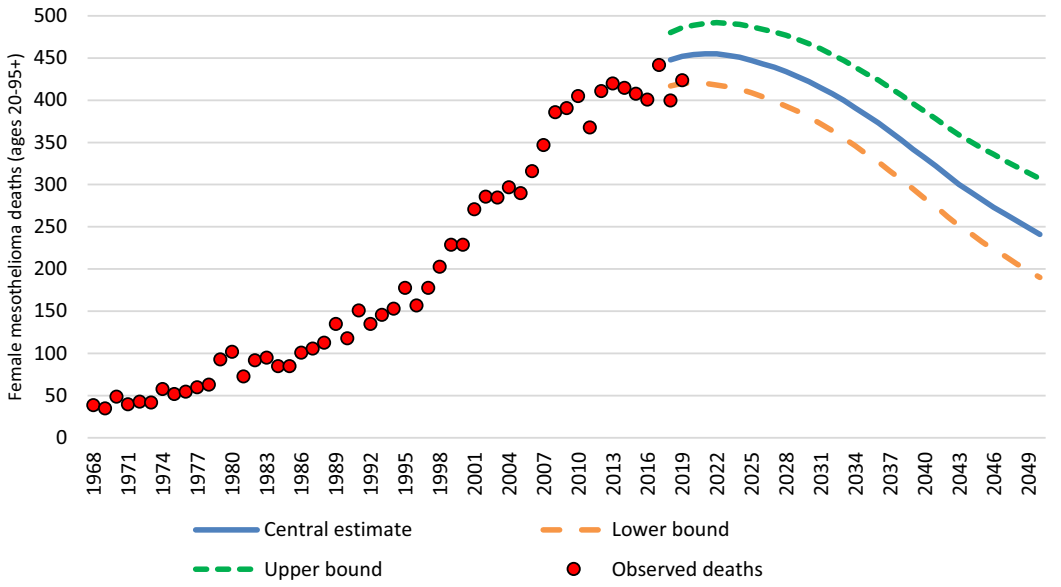


Figure 32. HSE 2018 projections for GB female mesothelioma deaths.

6.3.2. Structure

The structure of the HSE model remains consistent with the model used in the 2009 HSE projections, except that the HSE have adopted a cap on the "*k*-factor", being the exponent of time used in the model to represent the increased risk of developing mesothelioma with increased time from exposure to asbestos, as shown in the formula below. This brings the HSE model structurally into line with the Working Party Adjusted HSE projection from the 2009 Paper, which included *k*-factor capping.

The formula used by the HSE to estimate the number of mesothelioma deaths at age A, in year T ($F_{A,T}$) is:

$$F_{A,T} = \frac{\left[\sum_{l=1}^{A-1} W_{A-l} D_{T-l} I(l+1-L)^k 0.5^{l/H}\right] D_{xT} P_{A,T} \left(M - \sum_{A=20}^{94} \sum_{T=1968}^{2017} B_{A,T}\right)}{\sum_{A=20}^{94} \sum_{T=1968}^{2017} \left[\sum_{l=1}^{A-1} W_{A-l} D_{T-l} (l+1-L)^k 0.5^{l/H} D_{xT} P_{A,T}\right]} + B_{A,T}$$

Where:

- $P_{A,T}$ = The number of people alive (or person-years at risk) at age A in year T
- W_A = Age-specific exposure potential at age A
- D_T = Overall population exposure in year T
- D_{xT} = Proportion of mesothelioma deaths diagnosed in year T
- L = Lag period (in years) before effect starts
- H = Half-life (in years) for clearance of asbestos fibres from the lungs
- k = Exponent of time, modelling the increase in risk of developing mesothelioma with increasing time from exposure to asbestos
- $B_{A,T}$ = The total number of background deaths for age A in year T

  $B_{A,T}$ = background rate * $P_{A,T}$
  These deaths are then allocated to age using the proportion of $I * (A - L)^k$

- I = Indicator variable where $I = 0$ if $I < 1 - L$ and $I = 1$ otherwise
- l = Indexes years lagged from the risk year
- M = The total number of observed mesothelioma deaths to date

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The previous version of the HSE model as set out in the 2009 paper fitted this parameter set to actual deaths data from 1968 to 2006, and used the 2006 ONS population projection for Great Britain to determine death rates by age and year of death. The model was fitted over the 20–89 age range at age of death.

The 2019 update to the HSE model uses actual deaths from 1968 to 2017 to fit the model, as shown in the formula above. The most recent ONS population projection available at the time of fitting the model was the 2016 projection, which was used both for the HSE model fitting and the Working Party replication of the HSE model. For the 2019 published results, the HSE fitted the model over the age range at death of 20 to 94 years, and then extracted the results over just the 20 to 89 age range from this model run. The published results then apply an uplift factor to the results for ages 20 to 89 to allow for deaths at ages 90 and older. The approach taken for deaths at ages 90 and above is further discussed in Sections 6.3.4.6 and 6.3.5.5.

6.3.3. Parameters

The HSE have used a number of techniques to parameterise the model and achieve the best fit to historical data. These include the use of MATLAB's fminsearch function and the Metropolis-Hastings algorithm and a Markov Chain Monte Carlo technique, to minimise [the sum of the square of actual less modelled deaths, divided by the modelled number of deaths], by age and year of death.

Table 20 shows the fitted parameter set for the latest projections (See Page 13, Table MESO06 Ref: 4) published by the HSE in July 2019. There is one additional parameter which the HSE have fitted in their model in the 2019 parameterisation compared to the 2009 parameter set, being the cap on the k-factor term at 52 years from time of exposure to asbestos.

Table 20. HSE parameter estimates

k	2.547	Background Rate	1.25
Maximum exposure year	1964	**Half-life (years)**	1,000,000 (fixed)
Years from exposure at which *k* term stops increasing		52	
Change in exposure index (% per year) (describes the shape of D_T):		**Relative exposure potential by age group (W_A)**	
1899	0 (fixed)	0 to 4	0
1909	1000 (fixed)	5 to 15	0.002
1919	100000 (fixed)	16 to 19	0.19
1929	−74	20 to 29	1
1939	69	30 to 39	1.65
1949	−16.1	40 to 49	1.35
1959	28.2	50 to 59	0
1964	0 (by definition)	60 to 64	0
1969	−5.3	65+	0
1979	−17		
1989	−5		

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The Working Party have confirmed with the HSE that the parameter set above for the relative exposure potential by age group is the set used in the model. The parameter set published on the HSE website at the link shown includes an error whereby the relative exposure potentials are offset by one age group, so that the exposure potential used for ages 5 to 15 is shown in the published table against ages 0 to 4, and so on. The Working Party have used the parameter set shown above in the work and have successfully replicated the results of the HSE model in this way.

6.3.4. Strengths and limitations

6.3.4.1. Fit to data and exposure profile. The model fits the past data well, but the future projections are very sensitive to slight changes in some of the parameters. The HSL 2009 report (Page iv, 52) highlights the following specific limitation:

> "the updated model provides a reasonable basis for making relatively short-term projections of mesothelioma mortality in Britain, including the extent and timing of the peak number of deaths. However, longer-term predictions comprise two additional sources of uncertainty which are not captured within the prediction intervals for the annual number of deaths:
>
> (a) whether the form of the model is valid for more recent and future exposure contexts; and
> (b) if the model is valid in such contexts, the uncertainty arising from the particular choice of the population exposure profile beyond 1978."

Although a further 11 years of data is now available on observed deaths per year since the 2009 model was parameterised, the form of the tail of the exposure curve used in the model continues to have a limited impact on the goodness of fit of the model to historical data. The Working Party has considered this key sensitivity in developing its version of the HSE model, and some of the key results are presented in Section 6.3.5.

6.3.4.2. Complex structure and number of parameters. As can be seen from the formulaic representation of the model, it is quite complex with a considerable number of parameters. This allows the model to be flexible in allowing for different death rates at different ages for different birth cohorts. This differentiates the model from the simple age/birth cohort model where the ratio of death rates at different ages is identical across all cohorts (equivalently that the ratio of rates between birth cohorts is the same at all ages).

Mesothelioma deaths data until the 1990s fitted the key assumption of the simple age/birth cohort model quite closely, but the more recent data shows that the death rates, especially for the most recent birth cohorts, were not behaving consistently. The extent to which different birth cohorts behave differently from each other in the future is key to understanding whether the model is appropriate to project future deaths.

6.3.4.3. Mortality improvements. The model uses ONS population estimates for Great Britain to project the number of mesothelioma deaths. The latest ONS estimates take into account the generally improving trend in longevity and more recent data on immigration and emigration.

The large sample of mesothelioma claims data that the Working Party has previously collected illustrates that the exposed population, on average, are experiencing heavier mortality than the Great British population at large. Specifically, adjustments to population equivalent mortality assumptions (for comorbid conditions as smoking and hypertension) are typically made in the estimation of life expectancy for future loss calculations in mesothelioma claims.

If the exposed population does not enjoy the same level of improvements in longevity as the population as a whole, then there will be a tendency for the model to over-project the future mesothelioma deaths. This is because, if the mortality differential continues in the future, the

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exposed population will form a decreasing relative proportion of the overall population. A projected mesothelioma death rate per unit of overall population based on past data applied to an overall future population projection would then tend to over-estimate the number of future mesothelioma deaths.

6.3.4.4. Immigration and emigration. Immigration and emigration trends have the potential to cause divergence from the ONS population projection used in the model and therefore impact the numbers of predicted deaths. Immigration increases the number of mesothelioma deaths predicted by the HSL model as immigration increases the population in the future at old age ranges. If immigrants develop mesothelioma as a result of exposure outside of the UK, they are unlikely to be eligible to make a claim on UK EL policies. Therefore, immigration could artificially increase the predicted number of future claims on UK EL policies.

Emigration, on the other hand, decreases the number of mesothelioma deaths predicted by the HSL model as emigrants could have been exposed to asbestos in the UK in the past but will not form part of the UK population estimates from which future deaths are calculated. Therefore, emigration has the potential to artificially decrease the number of future claims on UK EL policies. In this case, however, there is additional uncertainty as to the likelihood that a person emigrating from Great Britain having been exposed to asbestos as part of their employment in Great Britain and then going on to develop mesothelioma, would make a claim on UK EL policies.

If net migration is small, the effects of immigration and emigration will broadly cancel each other out in the overall future population estimates. However, without considering in detail the proportions of people exposed to asbestos and the ages of people entering/leaving Great Britain the effects on future claim numbers are difficult to quantify.

6.3.4.5. Deaths at older ages. In the 2009 paper, the Working Party found that the fit of the model to older age bands was improved by introducing a cap on the increase in the *k*-factor term with time from exposure. This cap was introduced in the Working Party parameterisation as an adjustment to the HSE model, and the starting point of the cap was chosen to be 60 years from exposure.

As discussed above, for the 2019 update to their model parameters, the HSE have also chosen to adopt this capping approach, due to concerns that the model is over-predicting deaths at older ages compared to more recent experience. The HSE included the time from exposure at which the cap applies as a parameter in the model, and found the best fit to data to given by introducing the cap at 52 years from exposure.

There is relatively little data to model how mesothelioma may develop at very old ages, which increases the uncertainty of projections for deaths above age 80. This age band assumes a greater importance in the later years of the projection, with over 55% of all estimated future deaths between ages 20–89 from 2021 being at above age 80.

Any clearance of asbestos fibres from the lungs over time should decrease the risk at older ages. The half-life term was introduced into the HSE model to capture the fact that asbestos fibres can be broken down in the lung and removed from the body, and over time this may serve to diminish the propensity to develop mesothelioma. In their parameterisation of the model the SHE have set the half-life factor to 1,000,000, in other words there is deemed to be no half-life effect, as this was found to give the best fit to the data over all ages. Whilst this may be entirely appropriate for younger ages, if there is a half-life effect, clearly this would be more significant for the 80+ year olds.

Based on discussions with the HSE, the application of *k*-factor capping is viewed as the preferable way to adjust the model to avoid over-projecting deaths in older age bands. Figure 33 demonstrates the impact on the fit of the model results to deaths data of introducing the *k*-factor capping.

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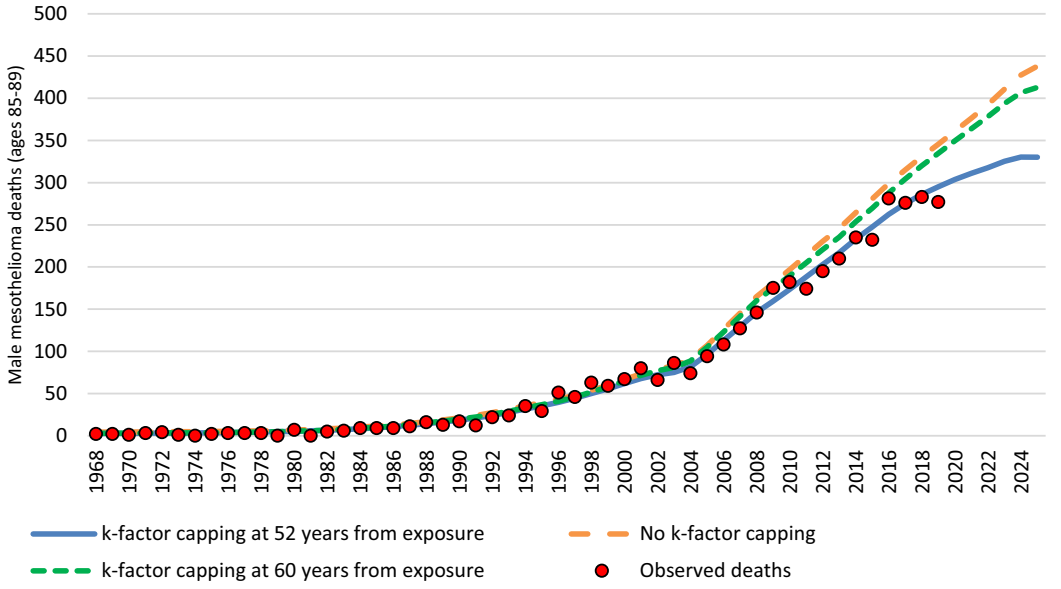


Figure 33. HSE 2019 projections for GB male mesothelioma deaths at ages 85–89.

Figure 33 shows that the old form of the HSE model with no capping of the *k*-factor term consistently over-predicts the number of deaths between ages 85–89 in the more recent deaths data. Applying the cap at 60 years, as in the 2009 Working Party adjustment to the HSE projection, slightly reduces the effect but the model continues to over-predict for this age range. The final graph shows that applying the cap at 52 years from exposure gives a much closer fit to the observed deaths in this age range.

6.3.4.6. Deaths over the age of 90. As noted above, the HSE model is used to predict future deaths for ages 20 to 89, with an uplift applied to allow for deaths at ages 90 and above. This approach is taken due to the sparsity of data at above age 90, along with the observed tendency for the model to over-predict deaths at older ages compared to recent data.

The HSE model including the uplift factor predicts that approximately 14% of deaths from 2021 to 2060 will be at age 90 or above. In recent years to 2018, approximately 5% of observed deaths have occurred at ages 90 or above (see Section 6.3.5.5). The use of methodologies other than the uplift approach adopted by the HSE, including outputting the full model results from the HSE model fitted over ages 20–94, can give significantly different results for the number of future deaths at above age 90.

Insurance claims at older ages are subject to even greater uncertainty, relating to the propensity for individuals at these ages to make a claim. However, given that average costs per claim at these ages tend to be lower, the impact of the issue on overall insurance market claim costs will be mitigated to some extent. Section 6.3.5.5 includes a sensitivity analysis of different approaches to model deaths at above age 90.

6.3.5. Key sensitivities of assumptions

Like any model the parameters are subject to uncertainty. This section focuses on the key parameters in the HSE model:

- Exposure – by year and age
- Population

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- Loading for deaths at age 90 and above
- Half-life and *k* factor (captures the increasing risk in developing mesothelioma since time from first exposure)

6.3.5.1. Exposure by year. The exposure parameters capture the impact of the relative levels of asbestos exposure in the population over time. The HSE index is defined by growth rates (or decline rates when negative) in multiples of ten years, starting 65 years before the peak year and ending 25 years after. The peak year is also a fitted parameter in the model. As the fitted peak year is 1964, this means that the HSE index fits a growth rate for the years 1899, 1909, ... 1989. The growth rate for intermediate years is obtained using linear interpolation.

The exposure index is particularly uncertain post 1989. In this period there are not enough deaths to date with which to fit a parameter in the HSE model, owing to the long latency of mesothelioma.

The HSE previously estimated that, in order for the mesothelioma projections model to predict the correct level of mesothelioma mortality in the long term[2] the value of the population exposure index in the year 2000 should be approximately 4.2% of the peak. The arguments for this are set out in the Regulatory Impact Assessment (RIA) for the revised Control of Asbestos at Work Regulations. Though uncertain, this assessment therefore provides a single more recent point on the exposure profile to inform decisions about the profile from 1989 up to this point, and then on into the future.

The HSE assume that post 1989 exposure decays linearly up to 2000, at which point exposure reflects 4.2% of the peak. By 2055, HSE's assumed exposure decreases to around 0.8% of peak exposure.

The AWP have assumed that exposure post 1989 decays at a constant rate of 15% per year, resulting in exposure in 2000 that is 1.3% of the peak and 2055 exposure of zero. The impact of this change to the HSE model is to reduce the number of projected future (post 2018) deaths by c.3,500. The rationale for this adjustment is:

- The fit of the model improves in younger age groups (under age 60).
- The time horizon for the claims forecast is 2060, after which zero insurance claims are assumed. The HSE model results in 172 non-background deaths in 2060, compared to 32 non-background deaths in the adjusted model. The adjustment reduces the step change from 2060 to 2061, which improves the internal consistency of the projection.
- The level of exposure after 1989 is particularly uncertain as there are currently few deaths caused by exposure in this period, so the assumption is difficult to calibrate. The Working Party considers that various regulations and changes in the law effected in the 1980s and early 1990s justify a steeper decrease in exposure, namely:
  - A ban on the use, import and supply of crocidolite and amosite asbestos from 1 January 1986.
  - 1987 Control of Asbestos at Work Regulations, introduced to protect workers from fibre exposure when working with asbestos containing materials.
  - 1990 Control of Asbestos in the Air Regulations, preventing and reducing environmental pollution by Asbestos.
  - Ban on Chrysotile in 1999.
  - 2002 Control of Asbestos at Work Regulations, which oblige businesses to identify and mange asbestos in their properties.

[2]As implied by a separate exercise to predict the long-term risks arising from estimated numbers and levels of exposure within different groups of the current population based on a specific dose-response model.

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Figure 34 shows the HSE exposure index (Central scenario 2) alongside two other alternatives considered by the Working Party and the 2009 selection.

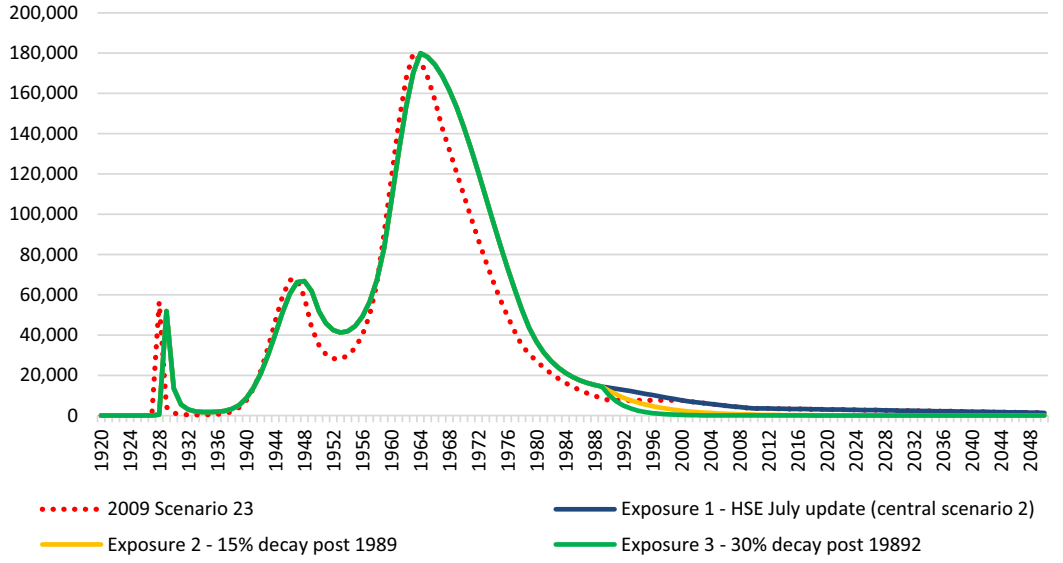


Figure 34. Exposure by year (1925 – 2020 shown only).

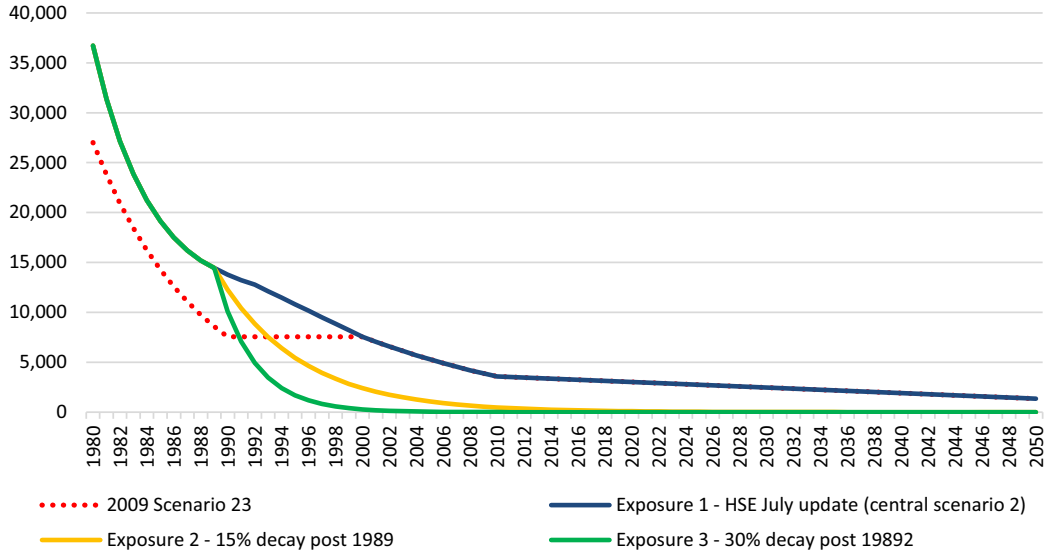


Figure 35. Exposure by year (1989 – 2020 shown only).

The exposure index as shown in Figure 34 has a similar shape to the previous 2009 parameter set, although the peak year has shifted from 1963 to 1964. Figure 35 shows the later years of Figure 34. The exposure index is fitted in conjunction with the other parameters. It should be noted that the HSE/HSL have adopted a cap on the *k*-factor in their 2019 model update, which will impact the fit of the exposure index and therefore any comparison to the 2009 index.

Table 21 shows the impact of selecting different exposure indices. In the tables that follow the HSE 2019 model is shaded.

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Table 21. Exposure by year sensitivities

Exposure Index	All other Assumptions	Peak Year	Peak Number	Projected Deaths 2019–2050	RMSE	Projected Deaths 2051–2060
2009 Scenario 23	Working Party 2009	2015	1,912	30,042	62.1	NA
Exposure 1 – HSE July 2019 update	HSE 2019	2014	2,030	30,440	34.1	2,203
Exposure 2 – 15% decay post 1989		2014	2,027	28,174	34.4	906
Exposure 3 – 30% decay post 1989		2014	2,025	27,029	34.8	572

The RMSE is similar for the 3 parameter sets, which is not surprising given the relatively small influence post 1989 exposure has on deaths projected up to 2018. Table 21 also shows that the number of future deaths is sensitive to the parameter set, with total deaths in the 2019–2060 period ranging from 27,602 (Exposure 3) to 32,643 (Exposure 1).

6.3.5.2. Exposure by age. Age-specific exposure potential parameters allow the exposure to differ by age. There are nine parameters including the baseline (set to 1) for ages between 20 and 29. Other values are set for the following ages:

- 0 to 4 (pre-school).
- 5 to 15 (school age).
- 16 to 19 (school to work transition).
- 30 to 39, 40 to 49, 50 to 59, 60 to 64 (work to retirement transition).
- 65 plus (retired).

Figure 36 shows the value of the age-specific parameters selected by HSE in their 2009 and 2019 models.

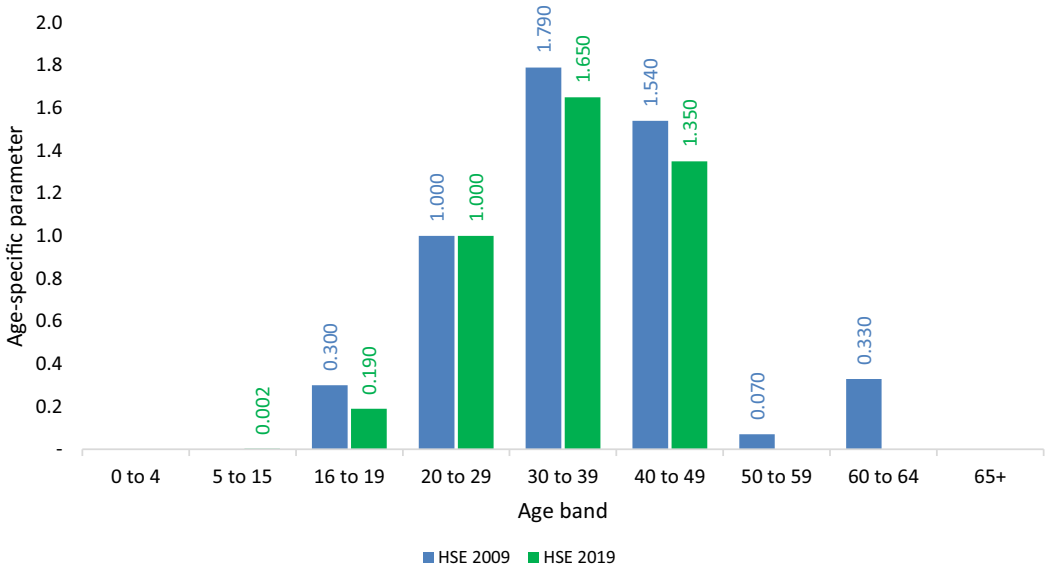


Figure 36. HSE 2009 and 2019 age-specific exposure parameters.

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It should be noted that the 2009 Working Party assumptions matched the HSE 2009 parameters, except the parameter was set to zero for age 50 and over. In their 2019 update, HSE have also set the age-specific exposure to zero for age 50 and over.

Table 22 shows the impact of changing the age-specific exposure assumptions within the model.

Table 22. Exposure by age sensitivities

Exposure by Age Parameters	All Other Assumptions	Peak Year	Peak Number	Projected Deaths 2019 – 2050	RMSE
HSE 2009	HSE 2019	2014	2,028	30,498	34.4
2009 Scenario 23		2014	2,031	30,543	34.3
HSE 2019		2014	2,030	30,440	34.1
Set ages 20 to 49 to one and all others to zero		2015	2,063	31,541	35.6

6.3.5.3. Population. The HSE model uses estimates of the population of Great Britain to project the number of mesothelioma deaths. There is uncertainty surrounding the following key areas of the population estimates in the model:

- Improving longevity.
- Immigration and emigration.
- Deaths at older ages.

Table 23 shows the impact of using three different ONS projections. Please note that the latest HSE/HSL projections (and Working Party scenarios by adjusting the HSE model) use the ONS 2016 projections.

Table 23. Sensitivities to the population assumption

Exposure by Age Parameters	All Other Assumptions	Peak Year	Peak Number	Projected Deaths 2019 – 2050	RMSE
ONS 2016	HSE 2019	2014	2,030	30,440	34.1
ONS 2006		2015	2,022	30,528	35.5
ONS 2018		2014	2,030	29,756	34.0

Please note that the uncertainty around deaths over the age of 90 is covered explicitly in Section 6.3.5.5.

6.3.5.4. Half-life and k factor. As highlighted in the previous Working Party papers, two of the key parameters are the power relationship, k, between the time since exposure to asbestos and the development of mesothelioma and the half-life, the number of years it takes for asbestos fibres to half in number from the lungs.

The half-life and "k" are closely correlated and cannot be independently estimated. In effect reducing the half-life means increasing the value of k and vice versa. The HSE selected a non-clearance model. This assumes that there is (effectively) no clearance of asbestos fibres from the lungs. Through the statistical methods the HSE have used to parameterise the model they have found that:

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(a) the fit of the model improved as the half-life was increased; and
(b) the half-life is infinitely large and that there is no clearance of asbestos once inhaled.

The HSE have kept the half-life factor consistent with their 2009 assumption, namely 1,000,000 years. Independent epidemiological evidence suggests that after a brief exposure to asbestos, the risk of developing mesothelioma increases in proportion to a power of time, probably in the range 2 to 3. However, there is uncertainty about exactly what value *k* and the half-life should take.

A lower value of the *k* factor reduces the number of deaths estimated by the model. There are several studies, including "Sixty years on: the price of assembling military gas masks in 1940" (J C McDonald, J M Harris, G Berry, 2006) which discuss evidence that asbestos (in this paper, crocidolite) is gradually removed from the lungs. The study traced deaths from a particular cohort of workers exposed to asbestos. It found statistically significant evidence relating to an absence of mesothelioma cases at longer times from exposure, compared to those expected i.e. that the mesothelioma incidence rate did not continue to increase at older ages, indeed that there was evidence that, in the cohort under consideration it actually fell.

Therefore, the results provide support to the proposition that the mesothelioma incidence rate does not continually increase with increasing time since exposure. However, there are other studies such as Berman, DW & Crump, KS (2008) "Update of Potency Factors for Asbestos-Related Lung Cancer and Mesothelioma" (Ref: 54) that suggest an increasing mesothelioma incidence rate at older ages is appropriate[3]. There is, therefore, still uncertainty around both the clearance of asbestos from the lungs, and the most appropriate track' for mesothelioma incidence rates by age.

In the 2009 paper, the Working Party found that the past fit of the projection model was improved by incorporating a cut-off to the *k* factor. At the time this finding was discussed with the HSE. In their 2019 update the HSE have also incorporated a cut-off to the *k* factor in their model, commencing at age 52.

Table 24 shows the details the effect of changing the half-life and *k* factor within the model.

Table 24. Half-life and *k* factor sensitivities

Half-life Assumption	*k Assumption*	All Other Assumptions	Peak Year	Peak Number	Projected Deaths 2019 – 2050	RMSE
1,000,000	2.47 (capped at 60)	HSE 2019	2016	2,026	34,032	34.7
1,000,000	2.547 (capped at 52)		2014	2,030	30,440	34.1
1,000,000	2.547		2016	2,066	36,208	39.5
1,000,000	2		2014	1,821	29,392	109.8
34	3		2016	1,992	33,047	38.6

6.3.5.5. Loading for deaths in those aged 90 and over. The 2009 Working Party paper projected deaths up to age 89 but noted that deaths in males aged 90 and above could have a significant effect and potentially increase the projection of future deaths. The HSE 2019 update includes an explicit allowance for deaths in this category, through a load that is applied to the projected deaths at ages 89 and under. This load varies by year, starting at 5% in 2018 and increasing linearly to a maximum of 15% in 2050. HSE derived the load by fitting a linear regression model to the observed ratio of deaths in males aged 90 and over to deaths in males aged 89 and under. Two

[3]This paper proposes a lower k-factor of 2 and is focused on the overall relationship between risk and time since exposure rather than the relationship at longer time intervals specifically.

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sensitivities to this assumption have been produced by varying the slope parameter in the HSE fit. The three projections are shown in Figures 37 and 38 zooms in on years 2010 to 2018.

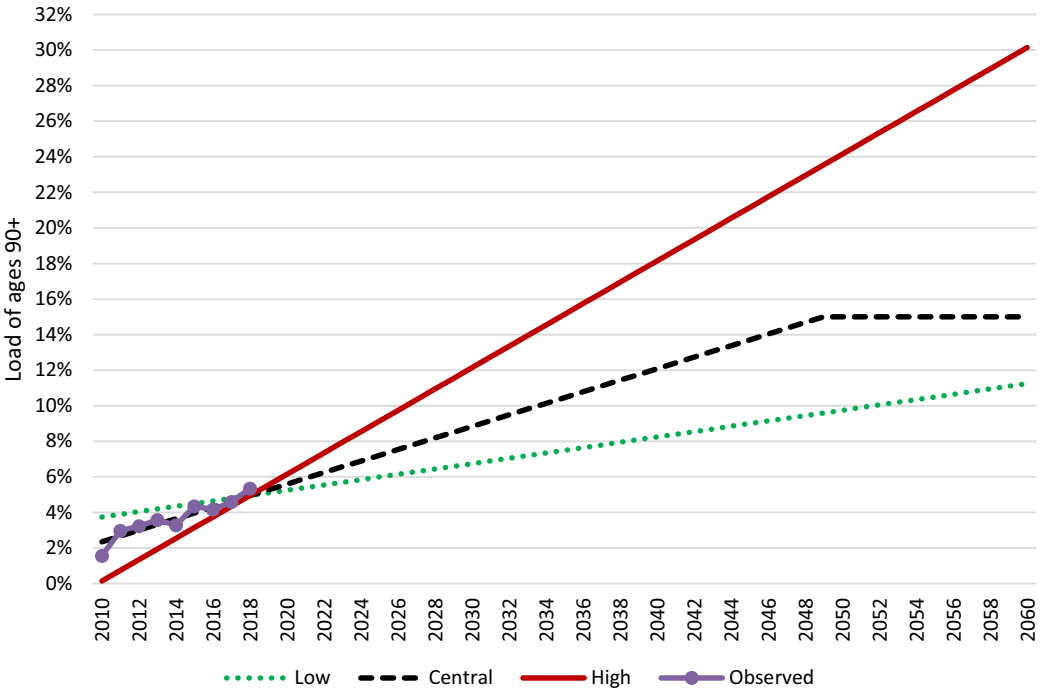


Figure 37. 90+ loading: central (HSE 2019) and two sensitivities.

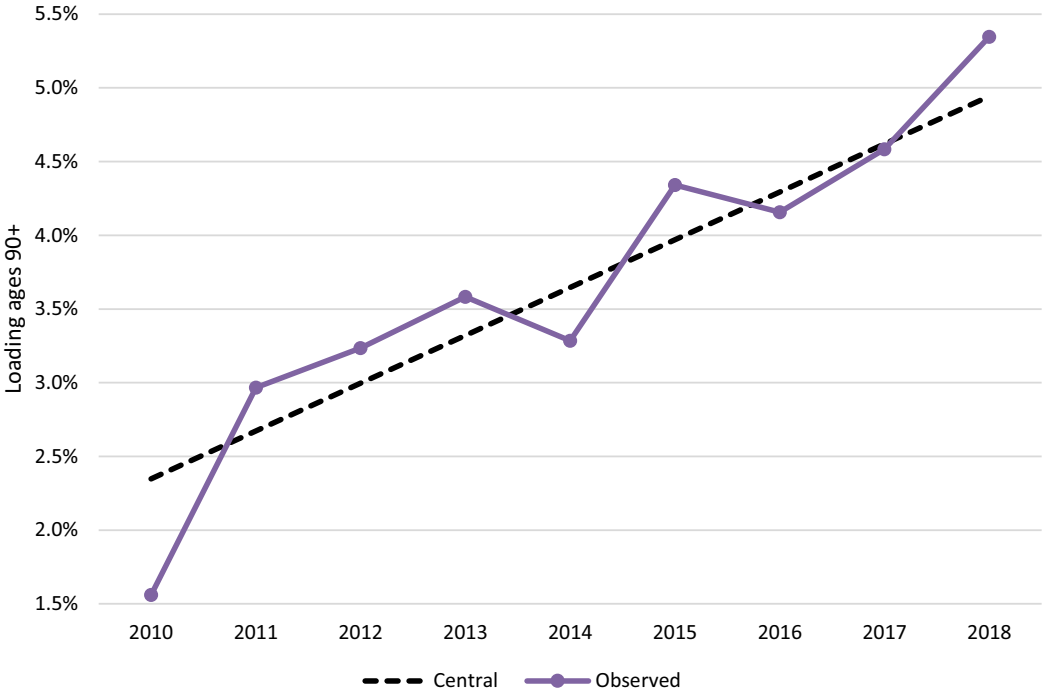


Figure 38. 90+ loading: central (HSE 2019) (2010 to 2018 only).

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Table 25 details the three sensitivities for allowing deaths over the age of 90+.

Table 25. Sensitivities to the load for age 90 and above

Loading for Ages 90+	All other Assumptions	Projected Deaths 2019 – 2050	Projected Deaths 2051 – 2060	RMSE
Low: Increase by 0.15% per year to cap of 15%	HSE 2019	1,834	95	14.0
Central: Increase by 0.3% per year to cap of 15%		2,346	136	8.7
High: Increase by 0.6% per year to cap of 15%		3,157	245	17.1

The three sensitivities provide a range of deaths, at ages 90 and over, of 1,929 to 3,402 (over years 2019 to 2060). We note that the RMSE metric relies on relatively few observations and that the load observed to date is relatively small compared to the projected future load. 0 demonstrates the divergence between the loading projected for each parameter set as the linear trend is extrapolated over a 40-year time horizon.

6.3.6. Working party assumptions

The Working Party has produced a spreadsheet replication of the HSE model and considered alternative assumptions to those used by the HSE, some of which are included in the sensitivity analysis set out in the previous section.

In their 2019 update to the model parameterisation, the HSE adopted two of the changes the Working Party made to their model in the 2009 paper. These are the inclusion of the capping of the increase in the *k*-factor term in the model, as discussed in the previous sections, and also the removal of any age-specific exposure adjustments after age 49. The latter change has little impact on the modelled result. The HSE also adjusted the exposure curve post-1978 to have a smoother reduction curve rather than being a straight-line reduction, which again moves the assumptions more in line with the Working Party's 2009 model approach.

As a result of these changes to the HSE model, there are fewer adjustments to the structure and parameters in the alternative scenarios included in the spreadsheet replication of the model, when compared to the model accompanying the 2009 paper.

The main adjustments considered are to the form of the exposure curve after 1989, and the uplift for deaths at above age 90. Both assumptions have little relevant data for parameterisation, and limited impact on the goodness of fit to historical data. The sensitivity of the model result to these assumptions is covered in the previous section.

The spreadsheet replication of the model referred to in Appendix C includes three Working Party 2020 parameter sets.

- **Adjusted HSE: 1 (High):** This is a replication of the HSE 2019 parameterisation for ages 20 to 89 using the same parameter set. By default, in the spreadsheet model the loading approach for deaths above age 90 is set to "High". To replicate the HSE result over all ages, this loading approach should be set to "Central", which uses the same uplift factors as calculated by the HSE.
- **Adjusted HSE: 2 (Central)**: This parameter set gives a mid-estimate which uses the HSE parameter set with a faster reduction in exposure after 1989 (the 15% decay approach described in Section 6.3.5) and applies the equivalent uplift for deaths at above age 90 to the HSE approach.
- **Adjusted HSE: 3 (Low):** This parameter set gives a lower estimate which applies a faster reduction in exposure based on a 30% decay assumption, and also applies a lower uplift for deaths at above age 90. Both of these sensitivities are discussed further in Section 6.3.5.

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Figure 39 shows male GB mesothelioma actual deaths compared these three adjusted HSE models.

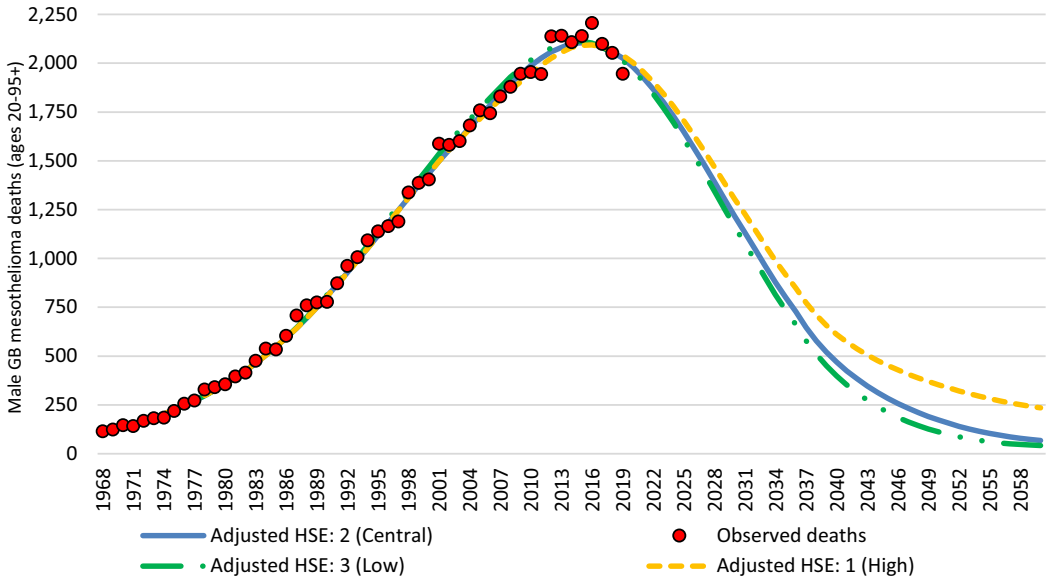


Figure 39. HSE model: selected scenarios (including background).

Figure 40 details the heat map of male GB mesothelioma actual deaths and the deaths projected under the Adjusted HSE: 2 (Central) parameter set for ages 20 to 89.



Figure 40. Heat map for male GB mesothelioma deaths actual (up to 2017) and projected under the Adjusted HSE: 2 (Central) parameter set.

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6.3.7. Guidance to the Practitioner on the HSE model

The Working Party encourages the practitioner to consider the issues and sensitivities outlined in this section and to select their own assumptions. The above should only be considered as guidance as to potential adjustments to the HSE assumptions that could be appropriate. The details of a working spreadsheet model of the HSE methodology containing various parameterisations including that selected by the Working Party as discussed above is given in Appendix C.

The practitioner should also consider the appropriate time period over which to project future deaths and associated insurance claims. In the model updates for this paper, the HSE and the Working Party have both extended the period over which modelled deaths are calculated to 2060, whereas the endpoint of the projection was 2050 in the 2009 paper. Note that the updated HSE projection published in 2019 ends in 2050 for consistency with their prior published results.

Once deaths arising from background exposure are stripped out, the remaining number of deaths per year is non-zero in 2060, and therefore further extending the projection would increase the number of projected deaths. The practitioner should consider an appropriate end point for their projection depending on the materiality to the projection of claims arising from deaths in later years, together with any adjustments which may be made to the exposure parameters, for example cutting off exposure earlier than the HSE model for the British population as a whole.

Further considerations for the practitioner in using the replication of the HSE model are covered in Section 13.

6.4. Age-Birth GLM Model

In March 2013, María Martínez-Miranda, Bent Nielsen, and Jens Nielsen (Ref: 52) developed a model for estimating the future number of male mesothelioma deaths. This model used neither an exposure curve nor any population data. Their approach was to use a methodology based around the chain ladder with a "GLM" to estimate the parameters at each Age and Birth year. Their 2013 paper states that they (Page 3, Section 2, Ref: 52):

> "suggest a new method for inference and forecasting which does not require known exposure. This is useful for an application such as mesothelioma mortality where the number of people exposed to asbestos is unknown. This can serve as a relatively simple benchmark for models with constructed exposure measures".

It should be noted that they only project deaths from birth cohorts from 1966 and prior, due to the limited data points for the cohorts post this period.

Their paper entitled "Inference and forecasting in the age-period-cohort model with unknown exposure with an application to mesothelioma mortality" (2013) used male mesothelioma deaths data up to 2007 and resulted in a peak number of deaths in 2018 of 2,094 males aged between ages 25 and 89.

In September 2015, they updated their projections taking into account the most recent deaths up to 2013. These updated projections can be found in the report entitled "A simple benchmark for mesothelioma projection for Great Britain" (2015) (Ref: 55). These revised projections resulted in a peak number of deaths in 2017 of 2,079 males aged between ages 25 to 89. Comparing these to the latest HSE/HSL projections, which used the same data, the Nielsen et al model has the peak one year later and about 3% higher.

Figure 41 details Nielsen et al.'s 2013 and 2015 projections against the actual deaths.

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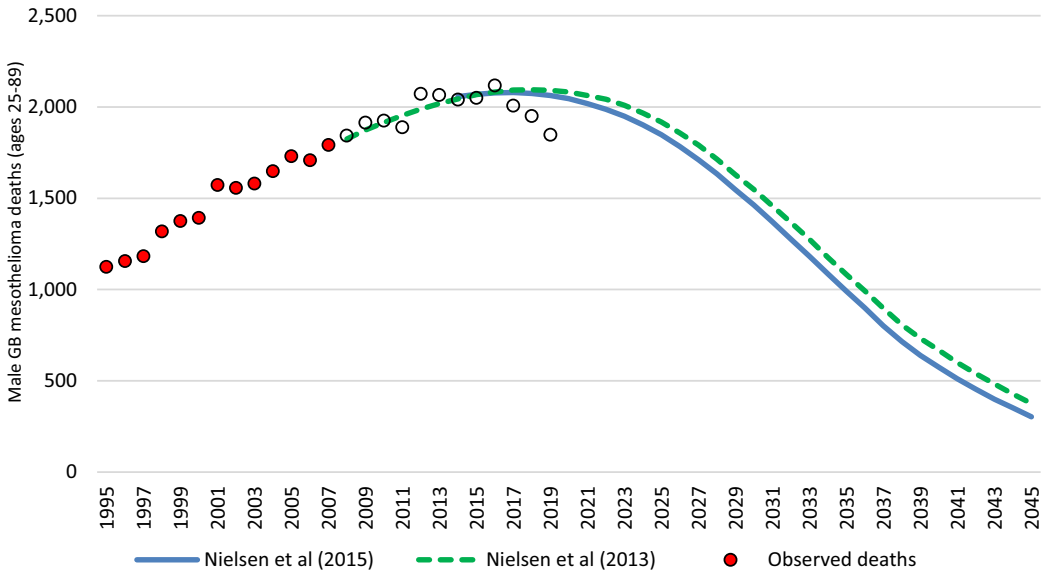


Figure 41. Nielsen et al. male mesothelioma projections against observed deaths.

6.4.1. Structure

Actual mesothelioma deaths by single age at death (<25 to 95+) and year of death (ranging from 1968 to 2013) were provided from the ONS register. The year of birth is calculated by subtracting the age of death from the year of death.

The Nielsen et al. model has two limitations on the scope of the prediction of male deaths due to the scarcity of data. These are:

(1) No deaths for ages below 25. Between the years 1968 to 2013 there were only 7 male deaths for ages below 25 (The HSE/HSL model predicts deaths from age 20); and
(2) No deaths for years of birth after 1966. For the years of birth 1967 and post there were 45 male deaths in Great Britain up to 2013. This decision was based on (a) the limited data that makes estimating the parameters for these birth cohorts very uncertain and (b) the limited asbestos exposure for those birth cohorts.

Given the number of deaths below the ages of 25 the first limitation is in statistical terms insignificant. The second limitation far more significant in terms of future predictions. The HSE model addresses this through the extrapolation of the fitted exposure curve.

Nielsen et al. use the R package *apc* (Ref: 56), developed for their work, to fit parameters using Poisson regression for each age and year of birth. Not all of the parameters are significant at the 5% level, and Nielsen et al. do not attempt to group ages/birth years to improve significance, nor consider smoothing the parameters over age/year of birth. This leads to volatile parameter estimators where data is sparse, for example more recent years of birth (see Figure 43)

The formula used by Nielsen et al. for estimating the number of mesothelioma deaths at age A, in year T ($F_{A,T}$) is:

$$F_{A,T} = e^{\alpha_0 + \beta_A + \gamma_{T-A}}$$

Where, α_0 is the intercept, β_A is the coefficient relating to age A and γ_{BY} is the coefficient relating to birth year, BY.

Nielsen et al. also consider having period (i.e. report year) parameters within their model. When comparing the results of an Age-Period-Birth model against an Age-Birth model, they found that the

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Age-Period-Birth model was a better fit, but not significantly so given the increase in the number of parameters. Therefore, they adopted the simpler model structure of the Age-Birth model.

6.4.2. Parameters

Figures 42 and 43 detail the coefficients relating to age and birth years (β_A and γ_{BY}, respectively) used by Nielsen et al.

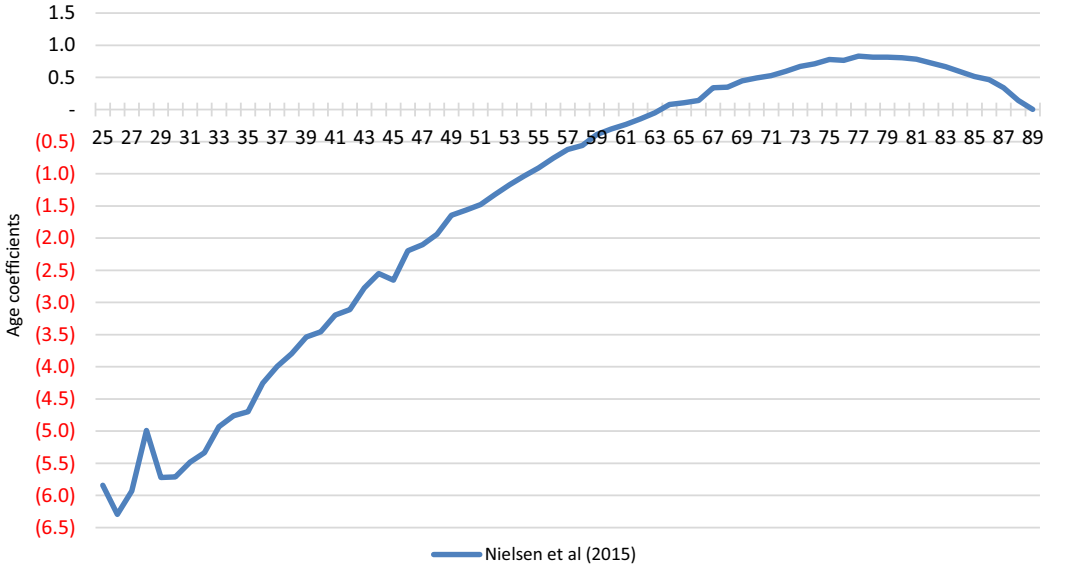


Figure 42. Nielsen et al. age-related coefficients.

Note that Figure 42 shows the modelled pattern of deaths as opposed to the death rate. The age coefficients are broadly in-line with the Working Party's expectations. The number of mesothelioma deaths increases with age up to a maximum around the late 70s at which point the reducing age population and the plateauing of the risk start to reduce deaths by age.

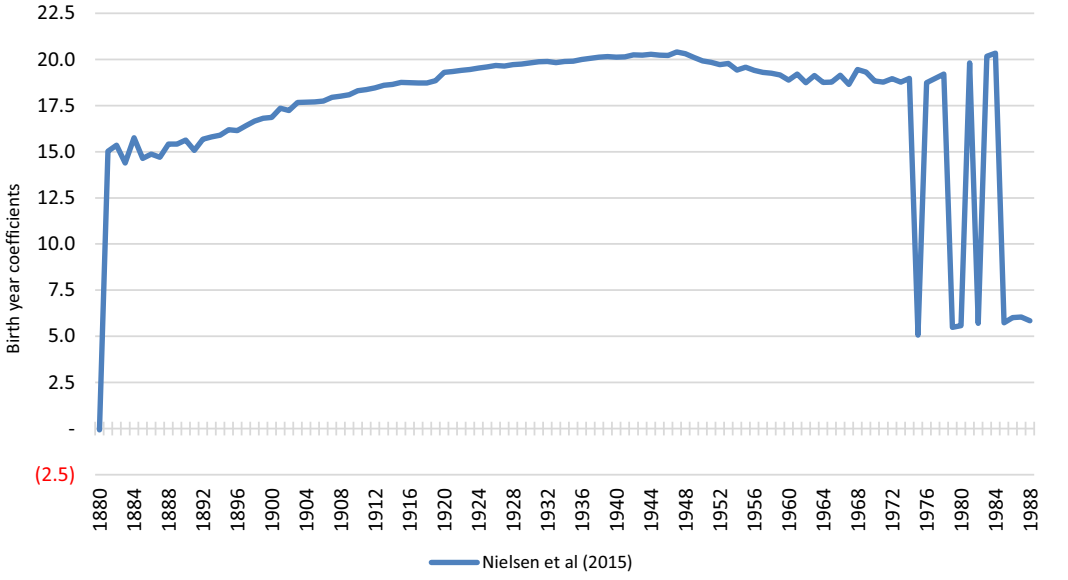


Figure 43. Nielsen et al. birth year-related coefficients.

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The birth year coefficients are broadly in-line with the Working Party's expectations: the risk of mesothelioma increases to the mid-1940s (considering the peak of asbestos imported into the UK was around the late 1960s). As before Figure 43 shows the modelled pattern of deaths as opposed to the death rate. Overlaying population would show that the risk of developing mesothelioma has reduced more sharply since the peak cohort.

The birth year coefficients become more volatile pre-1890 and post-1960 due to the lack of actual deaths from those years.

6.4.3. Strengths and limitations

The GLM Age-Birth model is in many ways similar to the birth cohort model used in the 2009 paper, but without using future populations, and so many of its strengths and limitations are the same.

6.4.3.1. Fitting the historical experience. The model fits the past data well, but the future projections are very sensitive to slight changes in some of the parameters.

Nielsen et al. limited their results to the 1966 and prior birth cohorts so that they were not making assumptions on limited data.

6.4.3.2. Design. The model has a reasonably simple structure and is therefore easy to understand and communicate. Increases/decreases in the age/birth year coefficients result in increase/decreases in the predicted deaths.

6.4.3.3. Number of parameters. The model has just 3 types of parameters, which means the model has less than 200 individual parameters (when considering every age and year). This is less than the HSE/HSL non-clearance model.

Parsimony is an undoubted virtue in a prediction model, with transparency and a focus on parameters that significantly impact the fit. Moreover, grouping or curve fitting the age and birth/cohort parameters would result in a smaller parameter set still.

On the other hand, the design of the HSE model explicitly allows for the shape of the age pattern to change by birth cohort. Nielsen et al. decided that a calendar parameter (which in effect captures this) didn't improve the fit enough to justify an augmented model. Nevertheless, conceptually, the concept that the pattern of asbestos exposure of someone born in 1960 will have been different from that of someone born in 1940 and therefore that the age profile of their risk of dying from mesothelioma should also differ, is, in the view of the Working Party, a compelling one.

Further, the HSE/HSL model explicitly models background deaths, allowing for specific treatment in relation to insurance coverage. The GLM model does examine background deaths.

6.4.3.4. Exposed population. One of the key strengths of the model is that the user does not need to develop any assumptions around the number of people exposed to asbestos and the level of that exposure.

However, this also makes it difficult to investigate:

- Changing estimates of future longevity.
- Immigration and emigration.
- Possible variations between the longevity of the exposed population and the longevity of the population as a whole.

6.4.4. Key sensitivities of assumptions

Like any model, the parameters are subject to uncertainty. This section focuses on the following key sensitivities within the GLM Age-Birth model:

- Update for an extra year of data by using the latest mesothelioma deaths data.
- The impact of removing the cut-off point for birth year.

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- The impact of increasing the age range of the model from 25–89 to 25–95+.
- Changing the age-related coefficients.
- Changing the birth year-related coefficients.

The Working Party has taken a pragmatic approach to selecting sensitivities to the key parameters of the GLM Age-Birth model. Instead of trying to get the best historical fit to the past deaths, given the shape of the age and birth year parameters, the Working Party has used curve-fitting techniques on the GLM estimated age and birth year parameters focusing on the overall shape of the deaths projected by those parameters against reasonable expectations of future deaths.

6.4.4.1. Updating for new deaths data. Nielsen et al.'s latest projection uses deaths data up to 2013. Table 26 and Figure 44 detail the effect of using the 2018 dataset for estimating future deaths.

Table 26. GLM Age-Birth model: using 2017 data and cut-off year 1966

	Ages 25–89		
Data	Peak Deaths	Peak Year of Deaths	Deaths 2019 to 2050
Nielsen et al.	2017	2,079	34,446
2018 data	2017	2,069	34,017

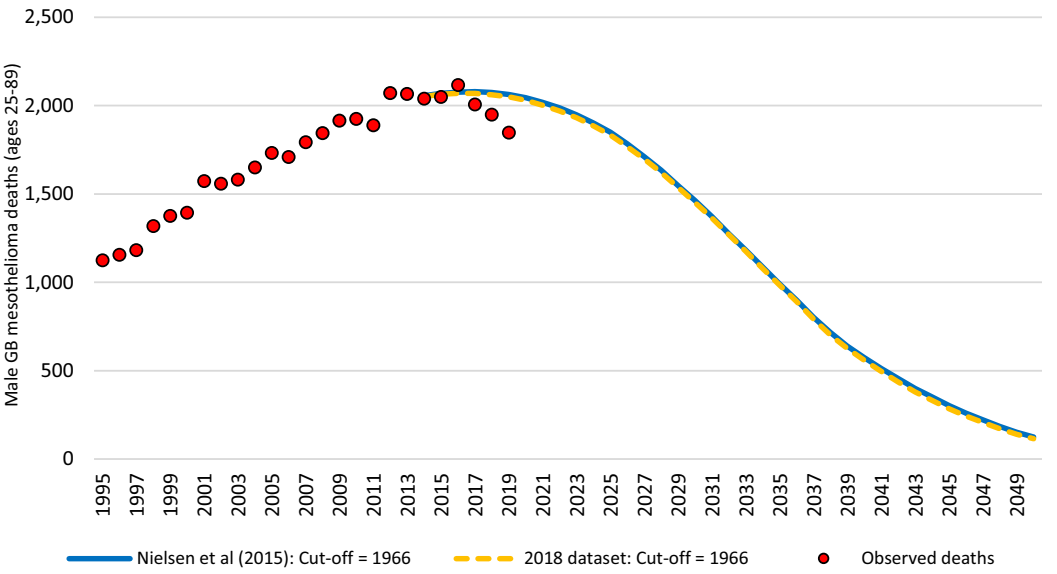


Figure 44. GLM Age-Birth model: using 2018 data.

As shown by Table 26 and Figure 44 the additional year of data has a limited movement from Nielsen et al., when the cut-off is applied.

6.4.4.2. Birth year cut-off. As discussed earlier, Nielsen et al. chose to project male deaths for birth years 1966 and prior, due the scarcity of data. Table 27 and Figure 45 detail the effect of changing the birth year cut-off for estimating future deaths (i.e. calculating deaths for birth years 1967 and afterwards based on the model parameters). Unless otherwise stated, all the other parameters used will be the same as Nielsen et al.

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Table 27. GLM Age-Birth model: birth year cut-off sensitivities

	Ages 25–89		
Birth Year Cut-Off	Peak Deaths	Peak Year of Deaths	Deaths 2019 to 2050
Nielsen et al.	2017	2,079	34,446
2018 dataset: Cut-off = 1966	2017	2,069	34,017
2018 dataset: No Cut-off	2017	2,084	40,035

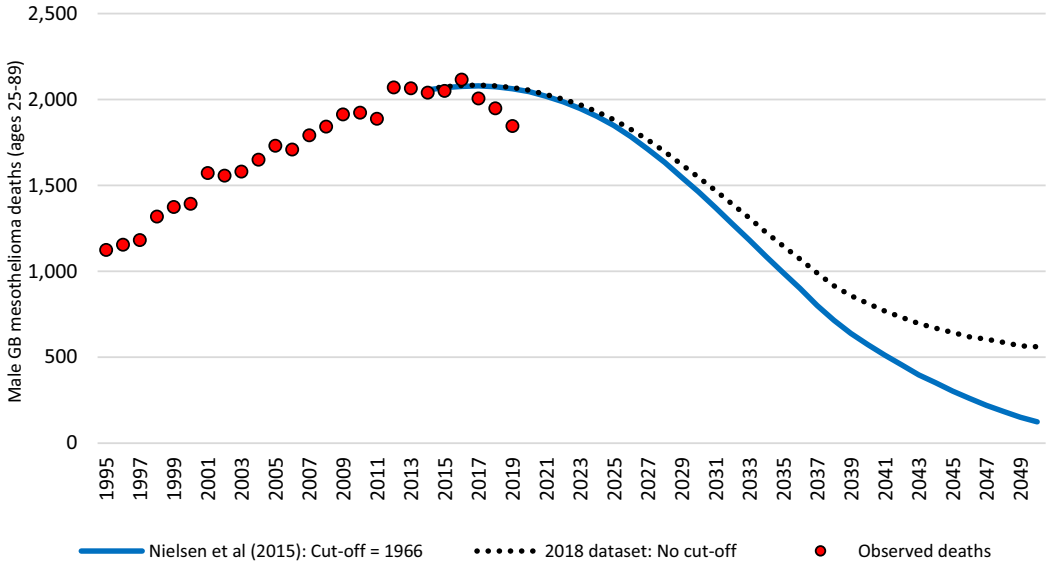


Figure 45. GLM Age-Birth model: birth year cut-off sensitivities.

6.4.4.3. Increasing the age range. The Nielsen et al. model only projects deaths in males between the ages of 25 and 89. This in part recognises the sparseness of the data for the 90+ age band and to align the approach with the HSE/HSL non-clearance model.

The number and proportion of male deaths from 90+ year olds has been increasing. As a number of data points are now available for this age band, the Working Party decided to extend the model to include the deaths at this age band. Note that insurance claims from 90+ year olds are subject to even greater uncertainty, given the propensity of individuals at this age to make a claim as discussed further in Section 7.

The Working Party decided not to extend the model to include ages under 25 due to the: (i) small historical volumes of deaths from these ages, (ii) limited likelihood of deaths from these ages in the future and (iii) the limited likelihood of these deaths relating to EL claims.

Table 28 and Figure 46 detail the effect of including the age bands 90 to 95+. Note that this involves re-running the GLM process and produces new α_0 and γ_{BY} coefficients as well as β_A coefficients.

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Table 28. GLM Age-Birth model: extending the age range

	Ages 25–89			Ages 25–95+		
Age Range	Peak Deaths	Peak Year of Deaths	Deaths 2019 to 2050	Peak Deaths	Peak Year of Deaths	Deaths 2019 to 2050
Nielsen et al.	2017	2,079	34,446	n/a	n/a	n/a
2018 dataset: Cut-off = 1966	2017	2,070	34,046	2017	2,154	37,893
2018 dataset: No Cut-off *(Unchanged 2018)*	2017	2,085	40,065	2017	2,168	43,912

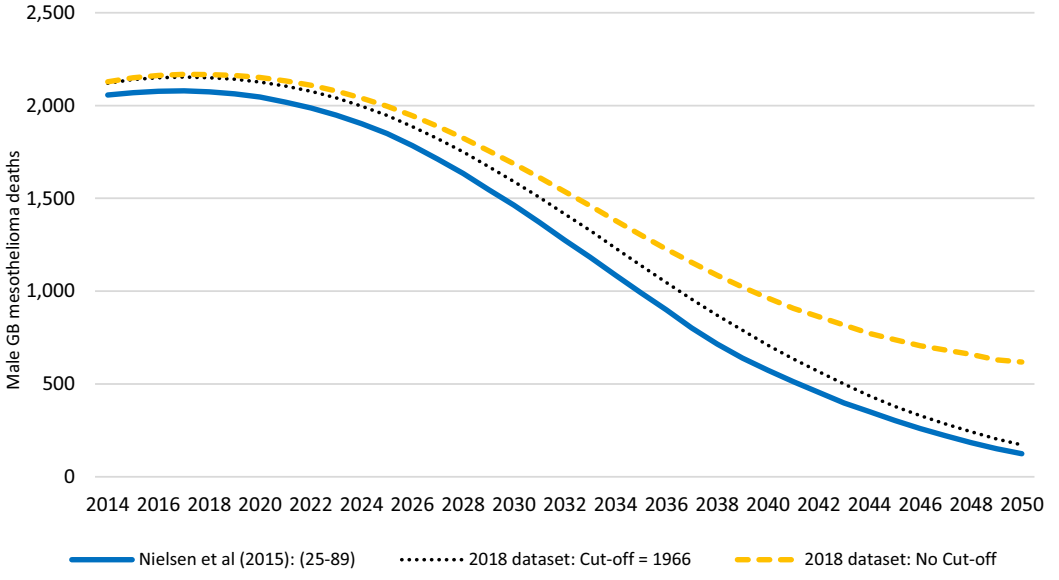


Figure 46. GLM Age-Birth model: extending the age range.

6.4.4.4. Changing the age coefficients. Figure 47 details the different age coefficients (for ages 25–95+) used to highlight the sensitivity around these parameters (with the α_0 and γ_{BY} as per the Pure GLM for ages 25–95+):

1. Smoothing all parameters by fitting a 3rd order polynomial on ages 25–95+.
2. Smoothing all parameters by fitting a 6th order polynomial on ages 35–91 and making the following adjustments (i) for ages 29 and younger the parameters to be equal to parameters at age 30, (ii) the 88 to 95+ parameters to be 0.9, 0.8, 0.55, 0.35 0.15, −0.12, −0.45, and 0, respectively.

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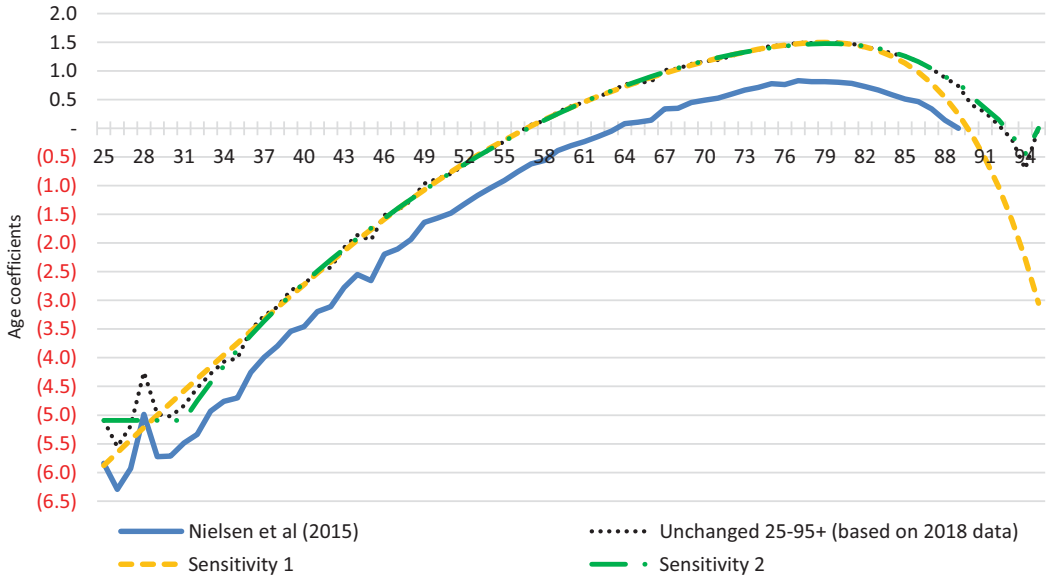


Figure 47. Age-related coefficient sensitivities.

Table 29 and Figure 48 detail the effect of changing the age coefficients (for ages 25–95+). Please note that all the other parameters, apart from the Nielsen et al. (2015) parameters, are based on the 2018 dataset with no birth year cut-off.

Table 29. GLM Age-Birth model: age-related coefficient sensitivities

	Ages 25–89			Ages 25–95+		
Age Parameter Sets	Peak Deaths	Peak Year of Deaths	Deaths 2019 to 2050	Peak Deaths	Peak Year of Deaths	Deaths 2019 to 2050
Nielsen et al.	2017	2,079	34,446	n/a	n/a	n/a
2018 dataset	2017	2,085	40,065	2017	2,168	43,912
Sensitivity 1	2017	2,027	38,120	2017	2,058	39,475
Sensitivity 2	2017	2,085	40,134	2018	2,178	44,376

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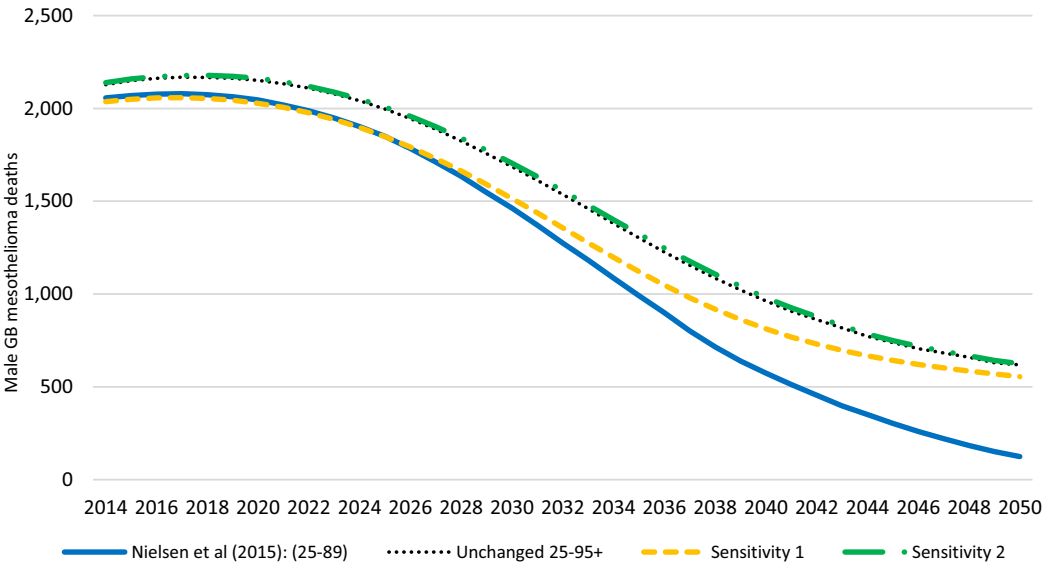


Figure 48. GLM Age-Birth model: age-related coefficient sensitivities.

6.4.4.5. Changing the birth year coefficients. The birth year coefficients post-1966 are key parameters in how the mesothelioma deaths will run-off post the peak year.

Figure 49 details the different birth year coefficients used to highlight the sensitivity around these parameters (with the α_0 and β_A as per the Pure GLM for ages 25–95+):

1. Smoothing all parameters by fitting a 4th order polynomial on the birth years 1916–1966.
2. Taking the GLM parameter but applying a straight-line decay from birth year 1959 (decreasing at 0.19 per birth year).
3. Smoothing all parameters by fitting a 3rd order polynomial on the birth years 1881–1945.

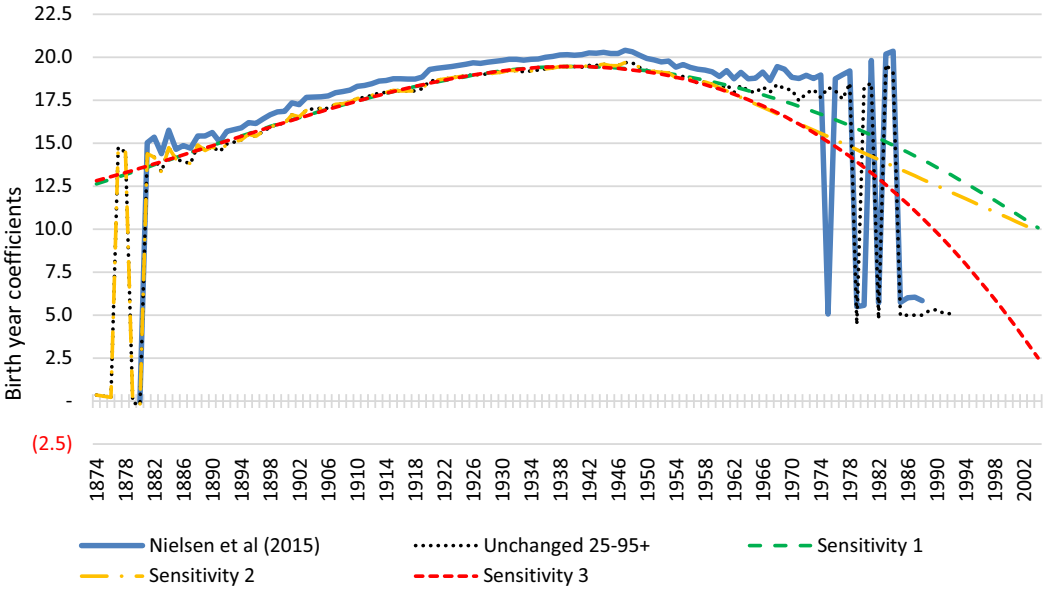


Figure 49. Birth year-related coefficient sensitivities.

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Table 30 and Figure 50 detail the effect of changing the birth year coefficients (for ages 25–95+). Please note that all the other parameters, apart from the Nielsen et al. parameters, are based on the 2018 dataset with no birth year cut-off.

Table 30. GLM Age-Birth model: comparison working party and Nielsen et al.

Model	Age Coefficients	Birth Year Coefficients	Birth Year Cut-Off	Peak Year Of Deaths	Peak Deaths	Deaths 2019 to 2050
AWP (25–95+)	Sensitivity 2	Sensitivity 1	n/a	2016	2,142	39,001
*AWP**	*Sensitivity 2*	*Sensitivity 4*	*n/a*	*2015*	*2,061*	*34,817*
Nielsen et al	Pure GLM	Pure GLM	1966	2017	2,079	34,446

Please note that the intercept for all the models in the table above has not be changed for the data driven GLM output
*Using the metrics on ages 25–89 only to allow comparison to Nielsen et al

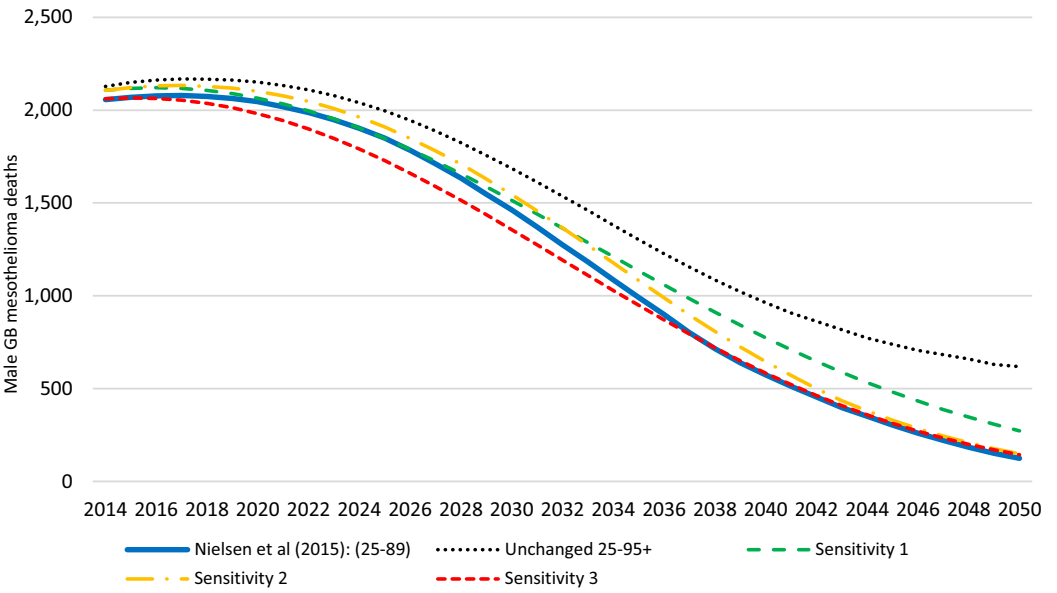


Figure 50. GLM Age-Birth model: birth year-related coefficient sensitivities.

6.4.5. Working party assumptions

The Working Party has made some changes to the assumptions used by Nielsen et al. (2015). Nielsen et al.'s approach was to use a pure GLM processes although whether the assumptions implied by this approach are applicable to future experience is uncertain.

We have considered alternative assumptions, some of which the Nielsen et al. have not considered. These alternative assumptions and the use of an additional year of data have given alternative parameters that are described in Section 6.4.4.

While parameterisations can be used to improve the fit, there are still a variety of outcomes for the projected number of mesothelioma deaths both higher and lower than those produced by Nielsen et al. Due to the considerable uncertainty in the selection of assumptions, the Working Party has adopted a pragmatic approach, changing the assumptions with a focus on considering the results for the future predicted mesothelioma deaths.

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A summary of the Working Party's selected assumptions on the GLM Age-Birth model compared to Nielsen et al. is given in Table 31, and the assumptions and some of the considerations made in the selection are given in Section 6.4.5.1.

Table 31. GLM Age-Birth model: comparison working party and Nielsen et al.

Model	Age Coefficients	Birth Year Coefficients	Birth Year Cut-Off	Peak Year of Deaths	Peak Deaths	Deaths 2019 to 2050
AWP (25–95+)	Sensitivity 2	Sensitivity 1	n/a	2016	2,142	39,001
*AWP**	*Sensitivity 2*	*Sensitivity 4*	*n/a*	*2015*	*2,061*	*34,817*
Nielsen et al	Pure GLM	Pure GLM	1966	2017	2,079	34,446

Figure 51 details the Working Party's selected assumptions on the GLM Age-Birth model against the observed male mesothelioma deaths for ages 25–95+.

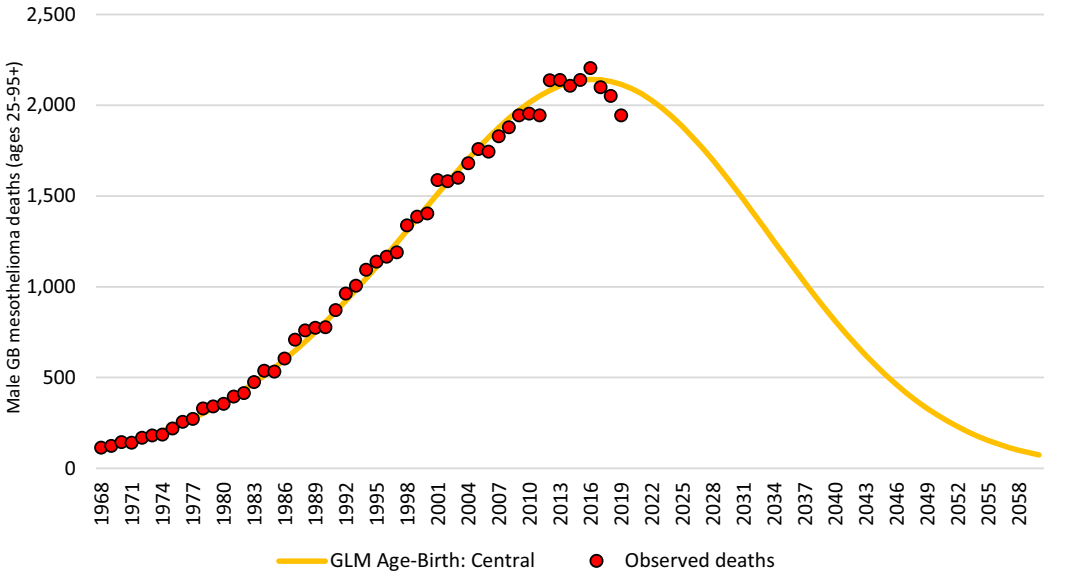


Figure 51. GLM Age-Birth model: selected Central scenario.

6.4.5.1. Rationale. The Working Party has taken a pragmatic approach to selecting parameters for the GLM Age-Birth model. Instead of trying to get the best historical fit to the past deaths, given the benchmark nature of the GLM Age-Birth model, the Working Party looked to keep any changes simple and smooth the coefficients within the model.

For the age coefficients, the Working Party felt that the deaths from ages 90+ did not fit the recent experience and given that scarcity of the data at these ages (and the possible under reporting of deaths at these ages in the past) that the trends in the prior ages should be used to estimate the coefficients for 90+ ages.

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For the birth year coefficients, the Working Party fitted a polynomial up to the point where Nielsen et al. felt that the coefficients were unreliable.

In reviewing the selected age and birth year coefficients, the Working Party has considered:

- How likely the data used by the GLM function is to be complete and accurate.
- How the overall shape of the curve compares to the actual deaths experience and whether the resulting projection could be considered reasonable to a layman and an expert on mesothelioma.
- How the projected deaths by birth year compares to the imports of asbestos into the UK and actual deaths experience.
- How the projected deaths by age compares to the actual deaths experience.
- How the average age of the projected deaths progresses.
- How the projected heat maps of male mesothelioma deaths compare to the actual deaths experience and the future pattern by age-birth year and age-death year (Figure 52).



Figure 52. Heat map for male GB mesothelioma deaths actual (up up to 2018) and projected under the selected Central parameters for the GLM Age-Birth model).

6.4.6. Alternative GLM age-birth model parameters

To provide some measure of the uncertainty around the parameters used by the GLM Age-Birth model the Working Party has constructed two sets of alternative parameterisations. These alternative parameters provide an understanding of the uncertainty in the model parameters.

The Working Party has constructed a low scenario based on lower age-related coefficients for ages 85+ and lower birth year-related coefficients for years 1965 and onwards. The high scenario has been constructed based on higher age-related coefficients for ages 85+ and higher birth year-related coefficients for years 1965 and onwards (see Figures 53, 54 and 55).

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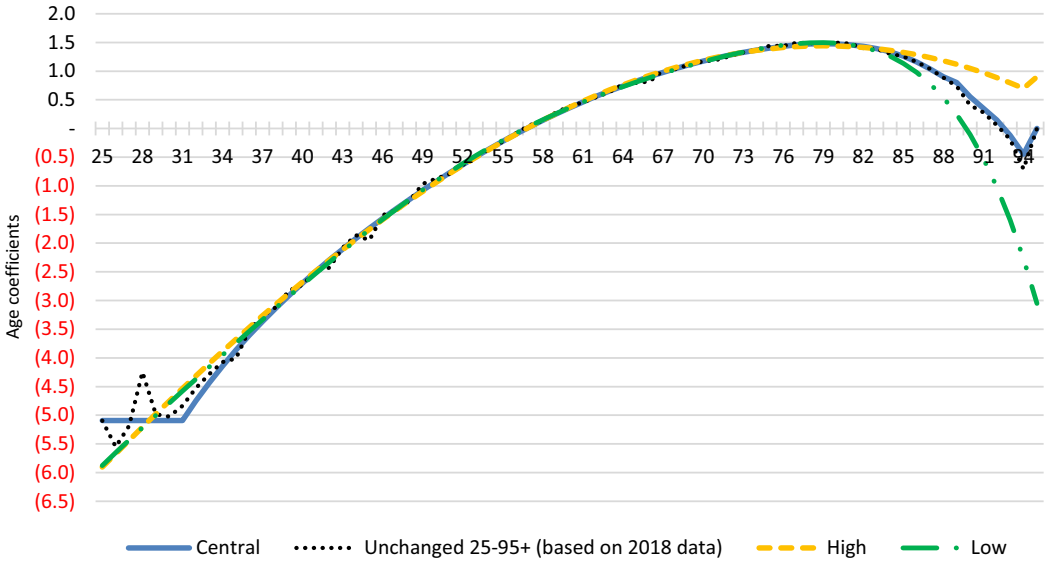


Figure 53. Age-related coefficient – Low, Central and High scenarios.

The change in age parameters for the low and high scenarios is focused around the ages where there is more limited data and therefore increased uncertainty around those age parameters. Attention has been focused on the older ages, as these will make up a greater projection of future deaths than the deaths at younger ages.

The low scenario represents a future where the deaths for ages 85+ will be lower than currently reported. Whereas the high scenario represents a future where the deaths for ages 85+ will be at greater levels than currently reported.

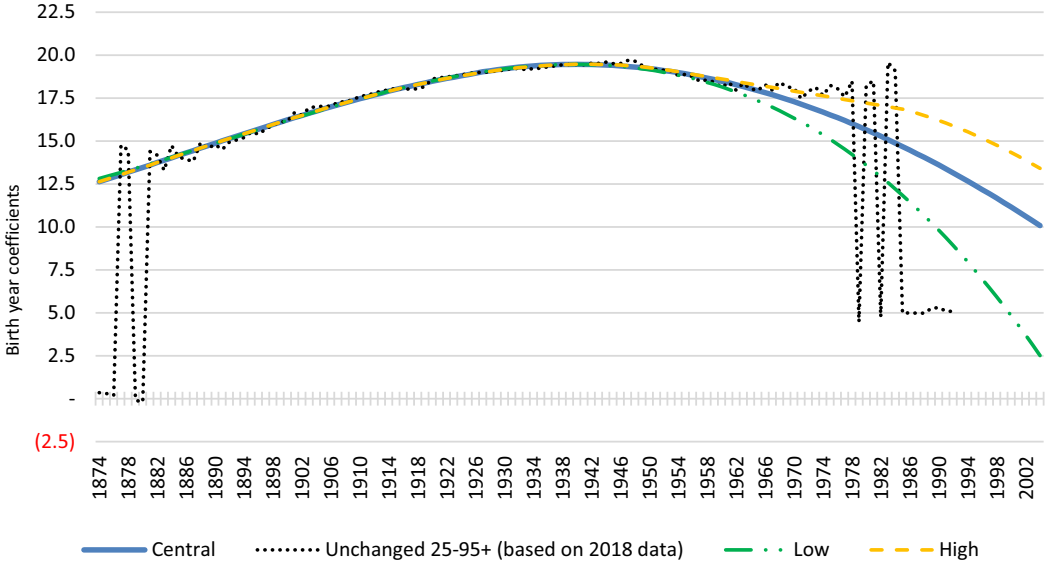


Figure 54. Birth year-related coefficient – Low, Central and High scenarios.

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The change in birth year parameters for the low and high scenarios is focused around the birth year where there is more limited data and therefore increased uncertainty around those birth year parameters. Attention has been focused on the older birth years, as these will make up a greater projection of future deaths than the deaths at later birth year.

The low scenario represents a future where the deaths for birth years 1965+ will be lower than currently reported, whereas the high scenario represents a future where the deaths for birth years 1965+ will be at greater levels than currently reported.

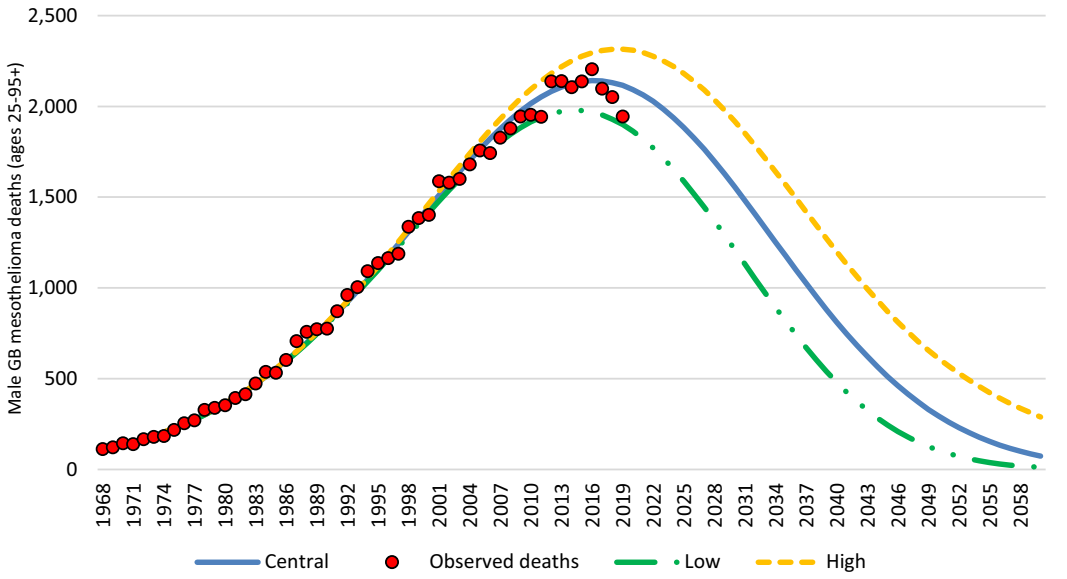


Figure 55. GLM Age-Birth model: selected scenarios.

The ranges produced from these low and high scenarios provide a potential range of outcomes but by no means provide an upper or lower bound. Practitioners may wish to consider or use the alternative parameterisations depending on the nature of the specific situation.

6.5. Comparison of Key Outputs

In the 2009 paper, the Working Party considered 5 different death projections ranging from the Latency model to the Birth Cohort model. Table 32, details how the key outputs for the 2009 GB male mesothelioma deaths projections compare to the mesothelioma projections in this paper.

Table 32. GB male mesothelioma projection key outputs: 2009 and 2020 (up to ages 89)

Model	*2009 to 2050 Deaths*	2019 to 2050 Deaths	Peak Deaths	Peak Year of Deaths	Ratio*
2009 – HSE/HSL (2009)	*55,878*	36,469	1,977	2016	18.4
2009 – Adjusted HSE	*48,911*	30,042	1,912	2015	15.7
2009 – Latency	*36,557*	18,660	1,862	2009	10.0
2009 – Birth Cohort	*90,038*	64,492	3,060	2022	21.1
2009 – Alternative Birth Cohort	*65,414*	43,006	2,418	2022	17.8

(*Continued*)

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Table 32. (*Continued*)

Model	*2009 to 2050 Deaths*	2019 to 2050 Deaths	Peak Deaths	Peak Year of Deaths	Ratio*
2020 – HSE/HSL (2019)†	*50,317*	30,440	2,030	2014	15.0
2020 – Adjusted HSE: 2 (Central)	*48,024*	28,174	2,027	2014	13.9
2020 – Adjusted HSE: 3 (Low)	*46,857*	27,029	2,025	2014	13.3
2020 – Adjusted HSE: 1 (High)	*50,317*	30,440	2,030	2014	15.0
2020 – GLM Age-Birth: Central	*55,030*	34,817	2,061	2015	16.9
2020 – GLM Age-Birth: Low	*47,415*	28,186	1,952	2014	14.4
2020 – GLM Age-Birth: High	*61,436*	40,749	2,123	2017	19.2

*Ratio of 2019 to 2050 deaths to the peak level of deaths.
†Figures shown are based the Working Party replication of the HSE/HSL model. HSE/HSL 2019 published figures include deaths to age 94.

The 2019 HSE/HSL model projects approximately 10% fewer deaths at up to age 89 over the 2009 to 2050 range compared to the 2009 HSE/HSL model. Although the peak of the 2019 projection is significantly higher at 2,030 deaths in 2014, compared to the prior projection of a peak at 1,977 deaths in 2016, the shortening of the tail in the 2019 projection more than compensates for the higher peak. The 2019 HSE/HSL model is more similar to the Working Party 2009 Adjusted HSE projection, but the tail of the newer projection is shorter again due to the earlier capping of the exponent of time from exposure in the revised model.

The results of the Adjusted HSE: 2 (Central) from the 2020 model are similar in total deaths, peak year and shape of the tail of the projection to the 2020 GLM model Low scenario, although the GLM projects a lower number of deaths at the peak of the projection. The GLM Age-Birth: Central scenario projects more deaths than the projections based on the HSE model, due to its longer run-off.

6.6. Working Party Selected Death Projections

As in 2004 and 2009, the Working Party considers the model structure used by the HSE/HSL to be the most appropriate model structure to use to project future mesothelioma deaths, although the Working Party has made some changes to the selected underlying assumptions.

The Working Party has also looked at an alternative model structure in the Age-Birth GLM model used by Nielsen et al. Again, the Working Party has made some changes to the selected underlying assumptions used by Nielsen et al.

While the Working Party has produced its UK EL Insurance Market cost of asbestos-related claims using its own parameterisation of the HSE/HSL and Age-Birth GLM models and the HSE/HSL (2018), these only provide a potential range of outcomes but by no means provide an upper or lower bound. Practitioners may wish to consider or use the alternative model structures and alternative parameters to the two models discussed in this paper, depending on the nature of the specific situation (as discussed in Section 13.2).

6.6.1. Guidance to the practitioner

The Working Party encourages practitioners to consider the issues and sensitivities outlined in Sections 6.3 and 6.4 to select their own model and assumptions.

The above should only be considered as guidance as to potential adjustments to assumptions that could be appropriate.

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6.6.1.1. Other projections. There are a number of other publicly available mesothelioma death projections, that practitioners could also consider in their work.

For example, Cancer Research UK, has mesothelioma male and female projections for the UK using an age-period-cohort model (Ref: 57) developed by Smittenaar et al. in their paper entitled "Cancer Incidence and Mortality Projections in the UK Until 2035" (Ref: 58).

These projections for the UK have male mesothelioma deaths peaking in 2022 (2,359 deaths) and female mesothelioma deaths peaking in 2024 (476 deaths)

Figures 56 and 57 detail their male and female UK mesothelioma actual and projected deaths against the latest HSE actual GB deaths.

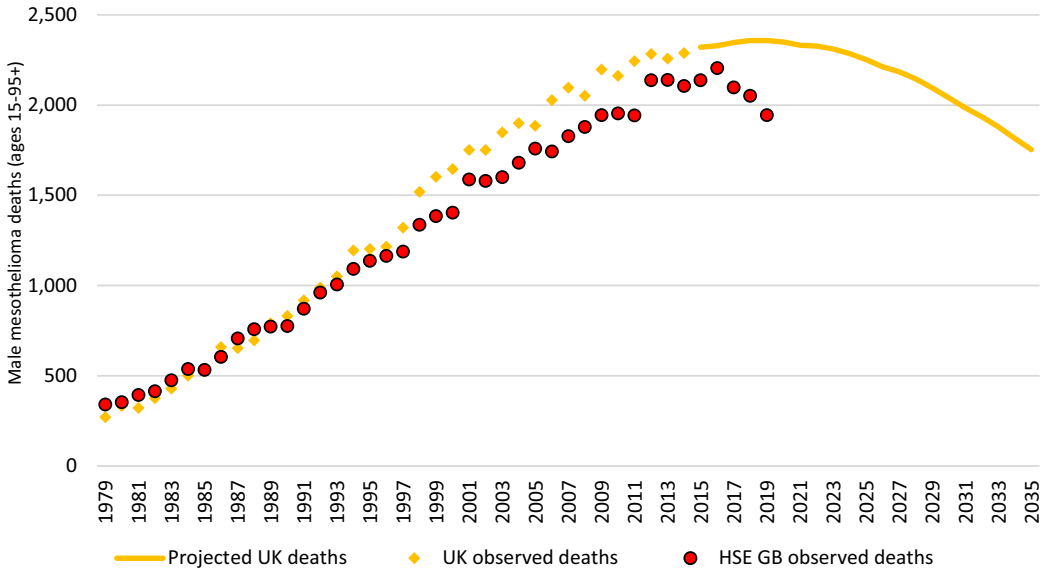


Figure 56. Cancer Research UK: male UK mesothelioma deaths.

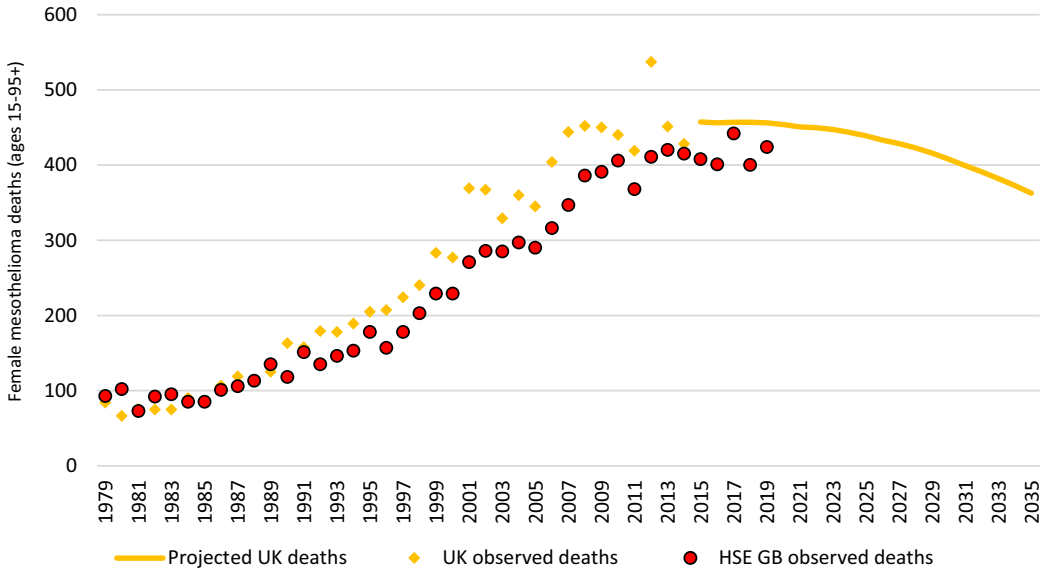


Figure 57. Cancer Research UK: female UK mesothelioma deaths.

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Please note that there are differences between the "observed" deaths (i.e. GB deaths in the HSE data plus the Northern Ireland deaths from the HSENI data compared to Cancer Research UK figures) the cause of these differences is unknown.

The Working Party has not produced a comprehensive list of all the publicly available mesothelioma death projections.

7. Estimating Mesothelioma Claimants

In order to take the number of GB mesothelioma deaths (estimated by the mesothelioma models) and calculate the number of Male and Female UK EL Insurance Claims, the Working Party has applied assumptions this year for:

- The propensity of GB mesothelioma sufferers to make an insurance claim, with assumptions set separately for males and females. (Note: CRU data now allows the propensity to claim to exclude Government mesothelioma claims); and
- The proportion of claims from Northern Ireland (to uplift the estimates from GB to UK).

This compares to the 2009 assumptions of:

- The propensity of GB male mesothelioma sufferers to make a claim;
- The proportion of Female to Male claims;
- The proportion of claims from Northern Ireland; and
- The proportion of Government claims.

Comparing the modelled insurance claimants with the insurance claims survey data allows the Working Party to calculate the number of insurance claims per claimant.

7.1. Recap on 2009 Assumptions

The Working Party produced five scenarios on the propensity of GB male mesothelioma sufferers to make a claim including Government claims (see Figure 58). These scenarios varied the propensity by each age band, but each of these scenarios the age bands for 74 and younger were grouped and assumptions set in aggregate:

- Scenario 1: Each age band stays constant at the 2008 level
- Scenario 2: Ratios across all age bands increase for ten years. The rate of increase each year is a (decaying) proportion of the increase in the previous year
- Scenario 3: As scenario 2 but rates continue to increase to 2050
- Scenario 4: Within ten years, the claimant death ratio in each age band reaches 90% of the theoretical maximum assuming 13% of sufferers remain unable to claim. As in scenarios 2 and 3 the rate of increase in each age band decays exponentially
- Scenario 5: Within five years, the claimant death ratio in each age band reaches 100% of the theoretical maximum assuming 13% of sufferers remain unable to claim. Increases are linear.

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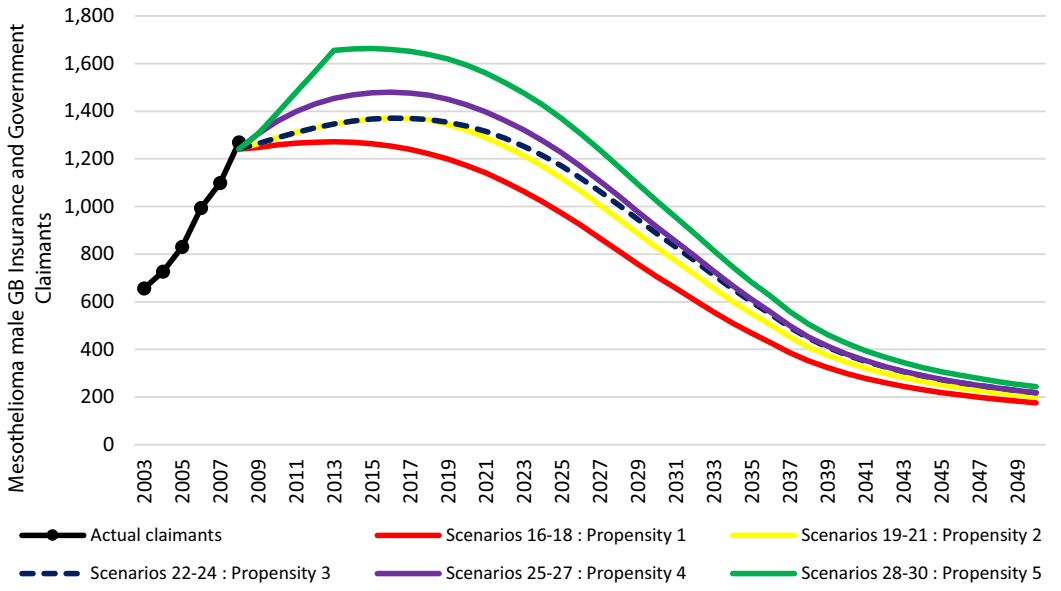


Figure 58. Propensity to make a claim from 2009 using the adjusted HSE model (2009).

Table 33 details the 2009 market estimate calculations to estimate the number of UK EL Insurance Market mesothelioma claimants and the claims to claimant ratio (see Section 3.3.1.2 for more details).

Table 33. 2009 claims to claimant ratio

Report Year	UK EL Insurance Market Claims (Ex Nils)*	CRU Male GB Claimants (Ex Nils and Government)	Female (to Male) Percentage	GB Estimated Claimants	Northern Ireland (to GB) Percentage	Estimated UK Claimants	Claims to Claimant
2003	1,540	547	0.8%	551	3.1%	568	2.7
2004	1,584	605	1.5%	615	3.2%	634	2.5
2005	1,723	692	1.1%	700	2.3%	716	2.4
2006	1,931	828	1.5%	841	2.9%	865	2.2
2007	2,086	915	2.4%	937	2.0%	956	2.2
2008	2,411	1,095	3.2%	1,130	2.2%	1,154	2.1
Future (2009 and onwards)			**5.0%**		**2.3%**		

*The Working Party grossed up the 2009 Survey data assuming the survey covered 80% of the market and that there is an ultimate nil rate of 21%.

7.2. Compensation Recovery Unit (CRU)

7.2.1. Background

The CRU, part of the DWP, works with insurers, solicitors and DWP customers to recover amounts of social security benefits paid where a compensation payment has been made. The CRU is responsible for recoveries in England, Scotland and Wales. A separate unit, reporting to the Department for Social Development in Northern Ireland, is responsible for collection of recoveries in Northern Ireland.

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When an insurer is notified of a claim, a standard claim form must be completed within 14 days of notification and submitted to the CRU. This form is not an admission of liability and is completed for all claims, including those that may not eventually succeed. The CRU should therefore be informed of all asbestos-related claims giving rise to compensation, whether from the insurance industry or the Government.

Table 34 outlines the data provided by the Department for Work and Pensions to the Working Party under a Freedom of Information (FOI-0574 or "2015 CRU Data") request. The data includes the mesothelioma claims recorded by the CRU between 1 January 2007 and 31 December 2015.

A later FOI request for updated CRU data as at 31 December 2016 was rejected (and the rejection confirmed by an independent review) as the estimated cost of complying would exceed the appropriate limit. The Working Party understands that previous DWP staff who had extracted the data at 31 December 2015 are no longer available, and the DWP are currently training up new staff. After further FOI rejections, the Working Party was finally able to obtain an additional CRU data extract covering the period 1 April 2016 to 31 October 2019, with a reduced data request that satisfied the CRU's cost constraints (FOI-32865 or "2019 CRU Data"). The CRU data was broken down by the following categories in Table 34, with the comment for data field items Anonymised Customer Number to Claim Status provided by the CRU:

Table 34. Mesothelioma claims recorded by the CRU

Data Field	Comment	Data to 31/12/2015 Provided 23/2/2016	Data to 31/10/2019 Provided 11/11/2019
Anonymised Customer Number	This will enable you to group multiple claims for each customer	✓	✓
IP's Sex	Male or Female	✓	✓
IPs Age at Claim	The customer's age at the time the claim was recorded by the CRU	✓	✓
IPs Age at Death	The customer's age at death where provided by the compensator	✓	✓
Country	We have interpreted the Country using the postcode prefix for the customer based on the details provided by the compensator	✓	χ
Type	State or None State – If the Compensator, Compensators Representative or Policy Holder is a Government Department (both central and local), Local Authority, NHS, National Industry or Possible National Industry the claim is classified as State.	✓	χ
Month	The month the claim was recorded by the CRU	✓	See Claim recorded date
Calendar Year	The calendar year the claim was recorded by the CRU (i.e. January to December)	✓	See Claim recorded date
Claim Recorded Date	The date the claim was recorded by the CRU	χ	✓
Liability Type	The liability type of the individual claims as advised by the Compensator	✓	✓

(*Continued*)

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Table 34. (*Continued*)

Data Field	Comment	Data to 31/12/2015 Provided 23/2/2016	Data to 31/10/2019 Provided 11/11/2019
Claim Status	The current claim status as at 18th January 2016. This claim status is subject to change throughout the life of a claim if further settlement notifications are received by the Compensator	✓	✓
AA	Attendance Allowance	✓	χ
CAA	Constant Attendance Allowance	✓	χ
DLAC	Disability Living Allowance (DLA): Care	✓	χ
DLAM	Disability Living Allowance (DLA): Mobility	✓	χ
DMPS	Diffuse Mesothelioma Payments Scheme	✓	χ
ESAC	Employment and Support Allowance (ESA): contribution-based	✓	χ
ESAI	Employment and Support Allowance (ESA): income related	✓	χ
ESDA	Exceptionally Severe Disablement Allowance	✓	χ
IB	Incapacity Benefit	✓	χ
IIDB	Industrial Injuries Disablement Benefit	✓	χ
IS	Income Support	✓	χ
MESO	Diffuse mesothelioma payments (2008 Scheme)	✓	χ
PIPL	Personal Independence Payment (PIP): Living component	✓	χ
PIPM	Personal Independence Payment (PIP): Mobility component	✓	χ
OCAB	Old Case Act Benefit	✓	χ
PWCA	Pneumoconiosis Workers' Compensation Act 1979 (PWCA)	✓	χ
REA	Reduced Earnings Allowance	✓	χ
Total	Total of all benefits AA to REA	✓	χ

This 2015 CRU database contains information on 22,319 mesothelioma claims reported to the CRU between 1 January 2007 and 31 December 2015, and details the value of recoveries (split by benefit type) for each claim as at 23 February 2016.

The 2019 CRU database contains information on 10,406 mesothelioma claims reported to the CRU between 1 April 2016 and 31 October 2019 as at 11 November 2019.

In 2009, the data the Working Party used was on the following basis:

- Claimant (not claims)
- Financial years, April to March (not calendar year)
- Only one-way grouping of data (i.e. Claim Status, Age, Liability Type, etc. but not combined).

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The Working Party therefore had to make assumptions around the (i) withdrawal rate, (ii) Government share, and (iii) proportion notified in the first quarter. These are detailed in Appendix J.

The latest CRU data received (detailed in Table 35) is on a calendar year basis and in a more detailed format. As a result, more detailed assumptions can be made to estimate the claimant death ratios and the proportion of CRU claimants relating to only public liability.

Table 35. Value of benefits recovered by the CRU for mesothelioma claims reported between 1 January 2007 and 31 December 2015

Benefit Code	Benefit Name	CRU Recovery £
PWCA	Pneumoconiosis Workers' Compensation Act 1979	113,330,504
IIDB	Industrial Injuries Disablement Benefit	46,615,535
MESO	Diffuse mesothelioma payments (2008 Scheme)	22,980,017
AA	Attendance Allowance	10,471,578
CAA	Constant Attendance Allowance	5,945,395
DLAC	Disability Living Allowance: Care	4,486,031
DLAM	Disability Living Allowance: Mobility	3,522,320
ESDA	Exceptionally Severe Disablement Allowance	2,675,419
ESAC	Employment and Support Allowance: contribution-based	1,314,931
IB	Incapacity Benefit	848,676
PIPL	Personal Independence Payment: Living component	428,854
PIPM	Personal Independence Payment: Mobility component	358,479
DMPS	Diffuse Mesothelioma Payments Scheme	78,484
OCAB	Old Case Act Benefit	68,747
ESAI	Employment and Support Allowance Income Related	63,976
IS	Income Support	13,861
REA	Reduced Earnings Allowance	3,937
Total		**213,206,743**

In total, the CRU has recovered over £200 m of benefits in respect of mesothelioma claims notified to the CRU between 1 January 2007 and 31 December 2015.

7.2.2. Multiple claims

By aggregating the data by the "Anonymised Customer Number", it is possible to produce a database of CRU mesothelioma claimants rather than claims. Where a claimant has more than one data field classification, a protocol has been developed to allocate the claimant to an

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appropriate data field entry. This uses the hierarchies in Tables 36 and 37 so that, for example, a claimant with live (1), settled (2), and withdrawn (3) claims is allocated live (lowest number takes precedence) claim status

Table 36. Aggregating CRU data fields protocol order: CRU 2015

IP's Sex	No.	Order:
M	20,694	1
F	1,625	2
Grand Total	22,319	

Liability Type	No.	Order:
EMPLOYER	21,621	1
PUBLIC	523	2
OTHER	142	3
CLIN NEG	3	4
(blank)	30	5
Grand Total	22,319	

Claim Status	No.	Order
LIVE	4,912	1
SETTLED	13,361	2
WITHDRAWN	4,046	3
Grand Total	22,319	

Type	No.	Order:
NON-STATE	18,172	1
LOCAL AUTHORITY	1,125	2
NATIONAL INDUSTRY	837	3
POSSIBLE NATIONAL INDUSTRY	152	4
NHS	296	5
GOVT DEPT	1,733	6
blank - to check	4	7
Grand Total	22,319	

Country	No.	Order:
ENGLAND	18,701	1
SCOTLAND	1,975	2
WALES	898	3
NORTHERN IRELAND	7	4
CHANNEL ISLANDS	6	5
ISLE OF MAN	3	6
Not Known	729	7
Grand Total	22,319	

Table 37. Aggregating CRU data fields protocol order: CRU 2019

Sex	No.	Order:
M	9,684	1
F	722	2
Grand Total	10,406	

Liability Type	No.	Order:
EMPLOYER	10,129	1
PUBLIC	167	2
OTHER	95	3
CLINICAL NEGLIGENCE	2	4
MOTOR	4	5
(blank)	9	6
Grand Total	10,406	

Claim Status	No.	Order
LIVE	4,715	1
MID-SETTLEMENT	57	2
SETTLED	3,943	3
WITHDRAWN	1,691	4
Grand Total	10,406	

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Using these aggregation protocols, it is possible to convert the CRU claims database into a claimant database.

This reduces the 2015 CRU database from 22,319 claims to 15,023 claimants, and the 2019 CRU database from 10,406 claims to 6,344 claimants.

The 15,023 claimants in the 2015 CRU Data are split by sex, type and liability type as shown in Table 38 (13,721 male and 1,302 female). The 6,344 claimants in the 2019 CRU Data are split by sex and liability type as shown above (5,817 male and 527 female).

Table 38. Split of CRU claimants by sex, liability type and type

Sex	Male				
2015 CRU Data	Liability Type				
Type	EMPLOYER	PUBLIC	CLIN NEG	OTHER	Grand Total
NON-STATE	11,218	81		49	11,348
LOCAL AUTHORITY	522	30		10	562
NATIONAL INDUSTRY	522	7		3	532
POSSIBLE NATIONAL INDUSTRY	56				56
Sub-Total	12,318	118	-	62	12,498
GOVT DEPT	1,079	15		5	1,099
NHS	116	3	1	2	122
(blank)	2				2
Grand Total	13,515	136	1	69	13,721

Sex	Female				
2015 CRU Data	Liability Type				
Type	EMPLOYER	PUBLIC	CLIN NEG	OTHER	Grand Total
NON-STATE	783	153		16	952
LOCAL AUTHORITY	118	30	1	5	154
NATIONAL INDUSTRY	18	15		1	34
POSSIBLE NATIONAL INDUSTRY	2				2
Sub-Total	921	198	1	22	1,142
GOVT DEPT	68	26		2	96
NHS	61	1		2	64
Grand Total	1,050	225	1	26	1,302

2019 CRU Data	Liability Type				
Sex	EMPLOYER	PUBLIC	CLIN NEG	OTHER	Grand Total
Male	5,749	28	1	39	5,817
Female	443	74	-	10	527
Grand Total	6,192	102	1	49	6,344

7.2.3. Government claims

The 2009 Working Party modelled male mesothelioma deaths, and then applied a propensity to claim that reflected Insurance and Government claimants combined. The 2009 Working Party then made the explicit assumption that the Government proportion was 20% for all claims (except for 2008 in which the proportion was 16%). The more detailed CRU data now available allows the

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Working Party to estimate the propensity to claim for insurance claimants only, removing the requirement for an explicit Government proportion to be estimated.

CRU data indicates for years 2007 through to 2013 the proportion CRU claims or claimants matched to Type "Govt Dept" was fairly stable just below 5%, followed by a jump in Government notifications in 2014 and 2015 to nearer 20% (see Figure 59). This pattern appears similar for CRU claims or claimants by gender (see Figure 60).

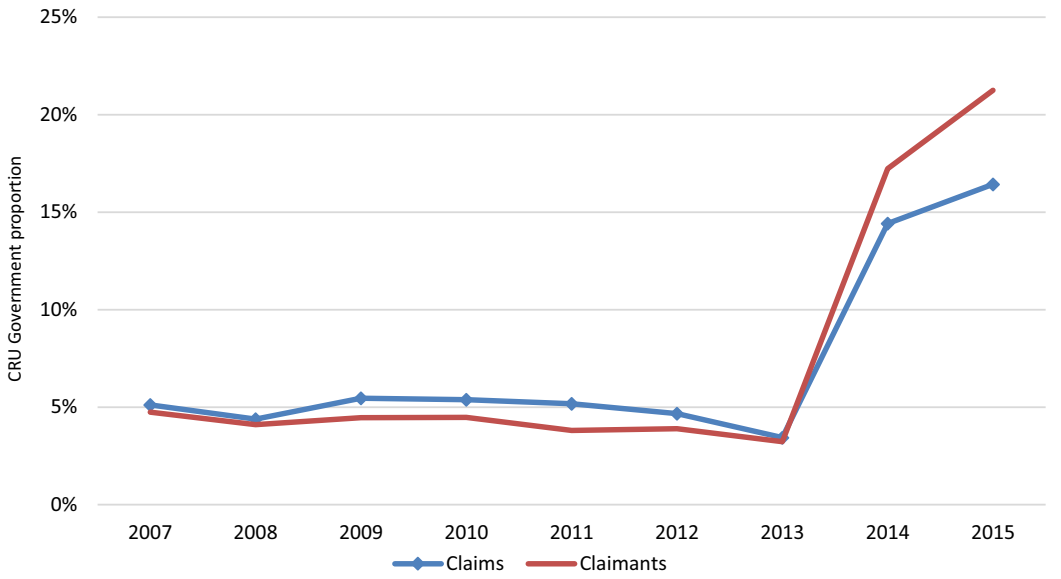


Figure 59. CRU Government proportion by number of claims and claimants.

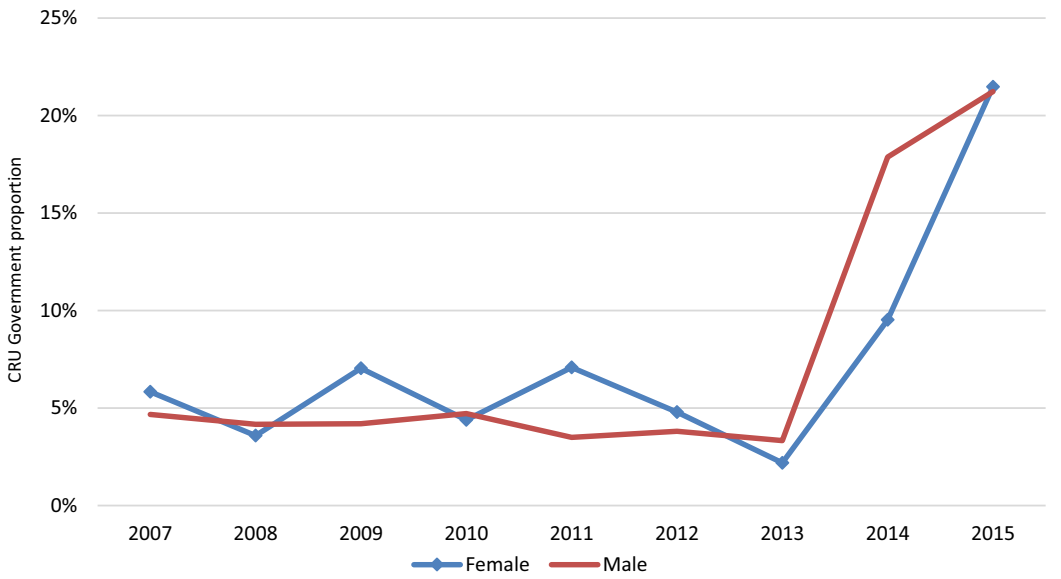


Figure 60. CRU Government proportion by number of claimants by gender.

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There has been an increase in the number of claimants registered with the CRU in 2014 and 2015. This increase appears to correspond with the increased number of notifications of Type "Government Department". Correspondence with the CRU confirmed that registrations from the Diffuse Mesothelioma Payment Scheme ("DMPS") are allocated to this type. In short, the DMPS now registers with the CRU as a compensator and the commencement of the DMPS in 2014 led to a significant increase in CRU registrations from previous years.

Removing Government Department claimants appears to result in a consistent level of claimants to the CRU for years 2007 to 2015, at around 1,500 claimants per year (see Figure 61). That is, the level of non-government mesothelioma claimants appears consistent over the last 9 years.

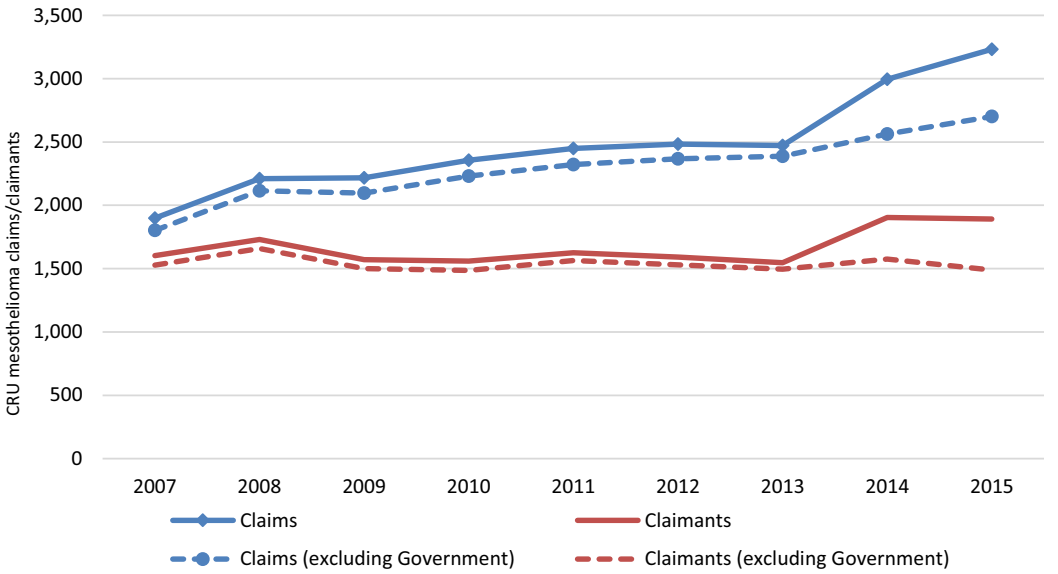


Figure 61. CRU mesothelioma registrations by calendar year (includes withdrawn).

CRU data indicates that there are approximately 640 additional government claimants in total in years 2014 and 2015. Diffuse Mesothelioma Payment Scheme statistics published on 13 July 2016 indicate approximately 690 applications received in the first two calendar years 2014 and 2015.

7.2.4. Withdrawn claims

In the 2009 Market Estimates the 2009 Working Party calculated that 10% of registrations with the CRU are withdrawn without settlement (for all liability types). For future registrations, 10% had been assumed.

Analysis by gender on the CRU data indicates a higher withdrawal rate for females at around 32% compared to a male withdrawal rate of around 10%.

To estimate the ultimate number of settled CRU claimants by report, it is necessary to estimate the number of live claimants that will be withdrawn in the future. For Males (Table 39), the Working Party has assumed 10% of live CRU claimants will be withdrawn.

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Table 39. Male CRU claimant future withdrawals*

Report Year	Live	Mid-Settlement	Settled	Withdrawn	Total CRU Claimants	Withdrawn %	Withdrawn/ (Settled and Mid-Settled and Withdrawn) %
2007	*12*		*1,303*	*155*	*1,470*	*10.5%*	*10.6%*
2008	*17*		*1,270*	*214*	*1,501*	*14.3%*	*14.4%*
2009	*34*		*1,236*	*134*	*1,404*	*9.5%*	*9.8%*
2010	*41*		*1,243*	*117*	*1,401*	*8.4%*	*8.6%*
2011	*116*		*1,226*	*127*	*1,469*	*8.6%*	*9.4%*
2012	*233*		*1,086*	*109*	*1,428*	*7.6%*	*9.1%*
2013	*398*		*884*	*109*	*1,391*	*7.8%*	*11.0%*
2014	*836*	*1*	*812*	*86*	*1,735*	*5.0%*	*9.6%*
2015	*1,335*		*365*	*19*	*1,719*	*1.1%*	*4.9%*
2016	350	14	840	125	1,329	9.4%	12.8%
2017	585	13	858	113	1,569	7.2%	11.5%
2018	894	6	614	91	1,605	5.7%	12.8%
2019	1,008	2	196	40	1,246	3.2%	16.8%
Total	**5,859**	**36**	**11,933**	**1,439**	**19,267**	**7.5%**	**10.7%**

*Based on CRU data for Sex = Male, Liability Type = EMPLOYER, *2015 CRU Data 2007–2015*, 2019 CRU Data 2016–2019.

For Females (Table 40) the Working Party has assumed 32% of live CRU claimants will be withdrawn.

Table 40. Female CRU claimant future withdrawals*

Report Year	Live	Mid-Settlement	Settled	Withdrawn	Total CRU Claimants	Withdrawn %	Withdrawn/(Settled and Mid-Settlement and Withdrawn) %
2007	*0*		*61*	*21*	*82*	*25.6%*	*25.6%*
2008	*2*		*93*	*58*	*153*	*37.9%*	*38.4%*
2009	*3*		*74*	*38*	*115*	*33.0%*	*33.9%*
2010	*5*		*67*	*37*	*109*	*33.9%*	*35.6%*
2011	*12*		*65*	*34*	*111*	*30.6%*	*34.3%*
2012	*19*		*64*	*34*	*117*	*29.1%*	*34.7%*
2013	*44*		*45*	*19*	*108*	*17.6%*	*29.7%*
2014	*70*		*42*	*18*	*130*	*13.8%*	*30.0%*
2015	*104*		*21*	*2*	*127*	*1.6%*	*8.7%*
2016	28	3	56	23	110	20.9%	28.0%
2017	56		42	17	115	14.8%	28.8%
2018	67	1	33	10	111	9.0%	22.7%
2019	89		13	5	107	4.7%	27.8%
Total	**499**	**4**	**676**	**316**	**1,495**	**21.1%**	**31.7%**

*Based on CRU data for Sex = Female, Liability Type = EMPLOYER, *2015 CRU Data 2007–2015*, 2019 CRU Data 2016–2019.

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Assuming a future withdrawal rate on live CRU claimants enables an estimate of the ultimate number of settled CRU claimants by report year to be estimated.

7.2.5. Gender

Overall, the CRU claimant data for notifications 2007–2015 indicates there about 8 female claimants for every 100 male claimants. There is a relatively high female to male ratio for Claimants from NHS at 52.6%, and for Local Authority at 22.6% (Table 41).

Table 41. CRU female claimant ratio by source type 2007–2015

Type	CRU Female Claimants	CRU Male Claimants	Female to Male Ratio
NHS	61	116	52.6%
Local Authority	118	522	22.6%
Non-State	783	11,218	7.0%
Government	68	1,079	6.3%
National Industry	20	578	3.5%
Total	**1,050**	**13,513**	**7.8%**

After adjusting for withdrawals, the female: male ratio has been fairly stable for notification years 2007 to 2019 (Table 42).

Table 42. CRU insurance claimant ratio by year*

Report Year	CRU Female Claimants	CRU Male Claimants	Female:Male ratio
2007	*61*	*1,314*	*4.6%*
2008	*94*	*1,285*	*7.3%*
2009	*76*	*1,267*	*6.0%*
2010	*70*	*1,280*	*5.5%*
2011	*73*	*1,330*	*5.5%*
2012	*77*	*1,296*	*5.9%*
2013	*75*	*1,242*	*6.0%*
2014	*90*	*1,565*	*5.7%*
2015	*92*	*1,567*	*5.9%*
2016	78	1,169	6.7%
2017	80	1,398	5.7%
2018	80	1,425	5.6%
2019	74	1,105	6.7%
Total	**1,019**	**17,242**	**5.9%**

*Based on CRU data for Liability Type = EMPLOYER, Future Live claims assumed to withdraw 32% Female, 10% Male. *2015 CRU Data 2007–2015*, 2019 CRU Data 2016–2019.

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Excluding the high and low female CRU percentages in 2007 and 2008, the female CRU claimant ratio has been stable at between 5.5% and 6.7%.

Figure 62 compares the female:male ratio from Table 42 to that obtained from the latest Working Party's market survey data.

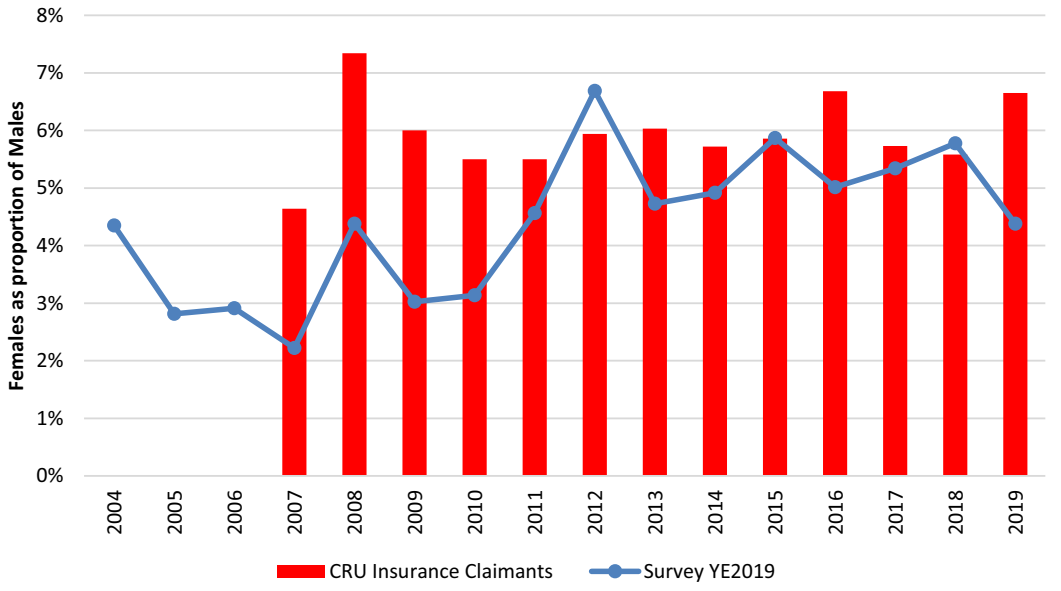


Figure 62. Mesothelioma: female as proportion of Males by Report Year.

There does not appear to be any obvious increasing/decreasing trend in the percentage of female CRU claimants by report year. The level of CRU female claimants compares well with the Working Party's market survey data, where the mesothelioma data by gender is available.

See Appendix F for the detail behind the Working Party's selected ratio of female to male claimants used in the EL Insurance Market estimates.

7.2.6. Average age

Comparing the average age of a claim from the CRU data (Liability Type = EMPLOYER, Sex = M&F) with the Working Party's latest market survey data indicates a similar increasing trend, with the CRU data having a slightly lower average age value.

Over the period 2009 to 2018 both the CRU and the latest Working Party's market survey data indicate an average age increase of around 0.4 years per year (Figure 63).

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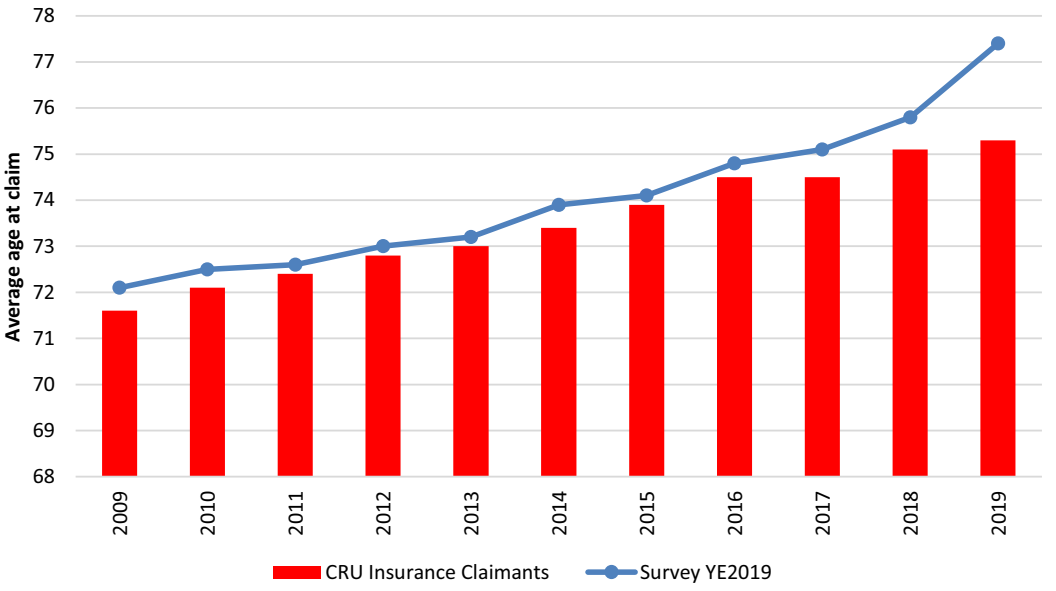


Figure 63. Mesothelioma: average age of claim.

It should be noted however, that the average age in the latest Working Party's market survey data for the 2019 report year has increased more than historic trends would indicate, giving an average age of 77.4 years (an increase of 1.6 years on the 2018 average age of 75.8 years). This increase is worth tracking for future reviews, to determine if the latest Working Party's market survey data for report year 2019 is a one-off or the start of a trend.

7.2.7. CRU claims to claimant

The CRU male claims to claimant ratio appears low, especially for earlier years, compared to Working Party survey data and expert views that indicate around 2 to 2.5 claims per claimant (see Appendix G for more details).

Although the Anonymised Customer Number was in a different format between the 2015 CRU data and 2019 CRU data (combined with a 3 month gap in available data 1 January 2016 – 31 March 2016), it was possible to match claims to claimants over the two datasets with the help of an intermediate FOI Request that provided a list of CRU mesothelioma claims from 1 April 2016 to 31 March 2019 for which the Anonymised Customer Number matched the 2015 CRU database.

7.3. Propensity to Make a Claim

Comparing the number of CRU mesothelioma claimants to the number of mesothelioma deaths (as recorded by the HSE) it is possible to estimate a propensity to claim ratio.

Previous analysis undertaken by the Working Party indicated that the propensity to claim substantially increased from 2004 to 2007.

7.3.1. Assumptions

In order to calculate a propensity to make a claim ratio, from the CRU data, the Working Party has had to make the following assumptions:

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1. The proportion of open claims that will be withdrawn (See Section 7.2.4)
2. The gross up factor for 2016 to allow for claimants notified from 1 January 2016 to 31 March 2016 (2019 CRU database is from 1 April 2016 to 31 October 2019)
3. The gross up factor for 2019 to allow for claimants notified from 1 November 2019 to 31 December 2019 (2019 CRU database is from 1 April 2016 to 31 October 2019)
4. Adjustment in 2016 to reflect that some claimants may match to the missing claimants in the first quarter of 2016
5. Adjustment to 2019 CRU database to remove Diffuse Mesothelioma Payment Scheme claimants
6. Adjustment to 2019 CRU database to remove non-insurance claimants (Government and NHS) (See Section 7.2.3)
7. The relationship between the CRU record year and the HSE year of death.

Figure 64 shows the impact after grossing up years 2016 and 2019 and then applying the adjustments in steps 4 to 5 on the male CRU claimants.

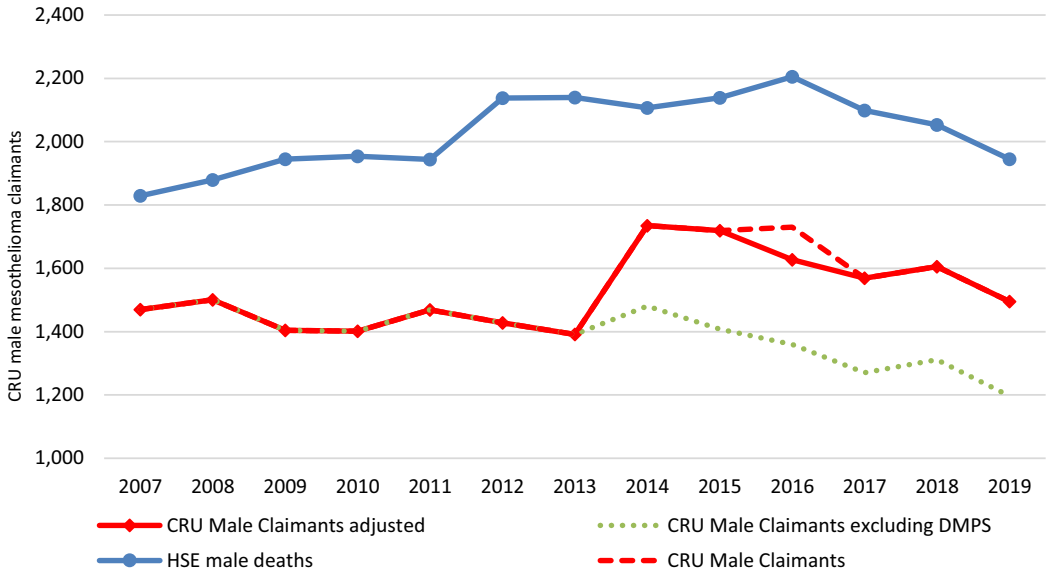


Figure 64. Mesothelioma: male CRU claimants adjustments.

7.3.2. CRU year to year of death

In the Working Party's analysis of the propensity of a mesothelioma sufferer to make a claim, the number of CRU claimants was compared to the number of HSE deaths.

The CRU data identifies the month and year that mesothelioma disease claims are registered by the CRU between 1 January 2007 and 31 October 2019. The HSE mesothelioma deaths uses the date of death.

In the analysis it would be preferable to match CRU claimants on a consistent basis to HSE deaths. This would involve adjusting either:

(1) CRU data from registration year to year of death, or
(2) HSE data from year of death to CRU registration year

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In 2009, the simplification that "CRU registration year" = "HSE death year" was used.

The latest Working Party's market survey data does give some indication of the claimant status (living/deceased) of the claimant at the time the claim is made, for about 1,000 claims per year (Figure 65).

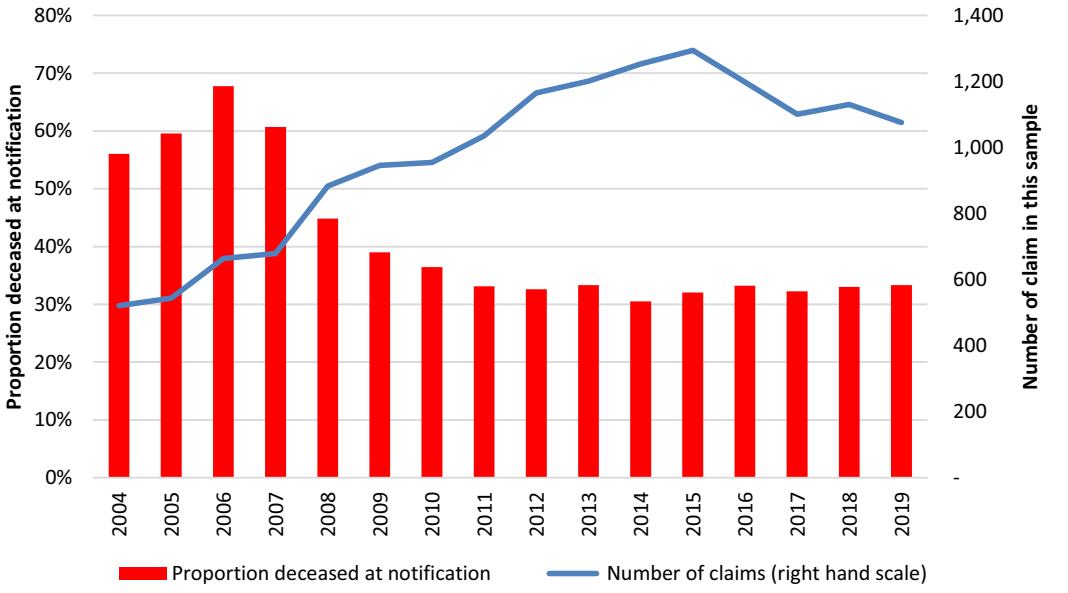


Figure 65. Survey data, proportion of mesothelioma claimants deceased at the time the claim is made.

The latest market survey data indicates that the proportion of mesothelioma claims that are from deceased claimants at the time the claim is made has been reducing since 2006.

For the most recent years 2014 to 2019, the proportion of mesothelioma notifications that are deceased at the time the claim is made has been fairly stable at around a third of claims.

7.3.3. Analysis of CRU claimants against GB deaths

Previous analysis indicated that the propensity to claim appears to decrease with age.

Comparing updated CRU claimants to mesothelioma deaths by gender indicates the following propensity to claim for years 2007 to 2019. The numerator is the estimated ultimate number of settled CRU EL claimants ("Liability Type" = Employer, "Type" = Non-State, Local Authority, National Industry or Possible National Industry). The ultimate number of settled male claimants was estimated as 100% of claimants with "Claim Status" = Settled plus 90% of claimants with "Claim Status" = Live (average Withdrawn rate of 10% assumed to apply to Live claimants). The denominator for the ratio is the number of deaths as reported by the HSE each year. At the time of analysis, the HSE had published deaths in Great Britain up to 2017, with deaths in 2018 and 2019 being estimated from the HSE deaths model.

Figures 66 and 67 are based on the assumption that the registration year of claim is equal to the year of death, Section 7.3.4 discusses this assumption further.

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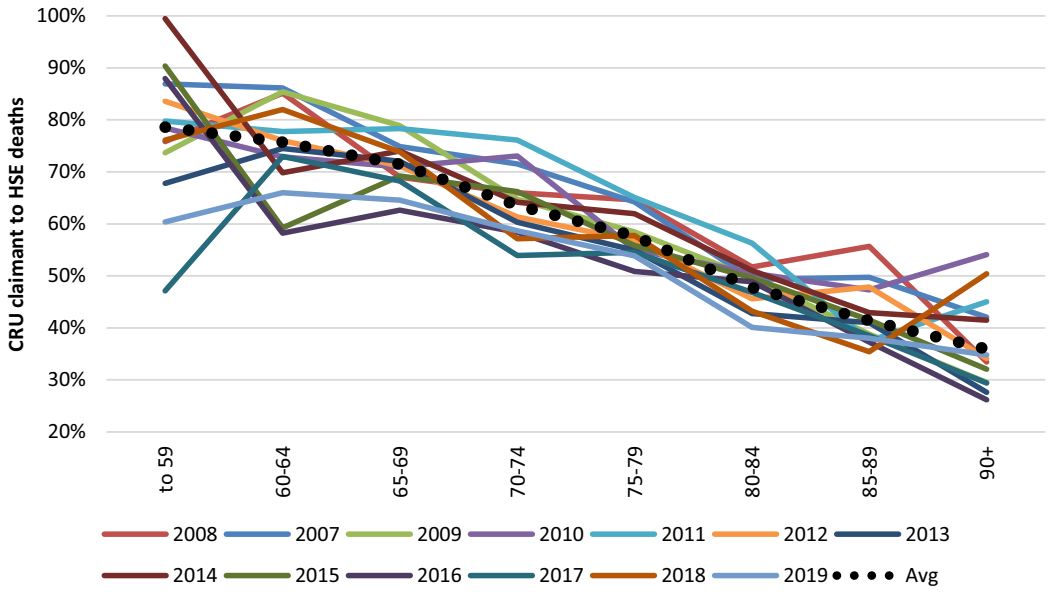


Figure 66. Male CRU claimants to HSE deaths ratio.

The male claimant to death ratio appears to reflect a fairly stable pattern of decreasing propensity to claim for older ages.

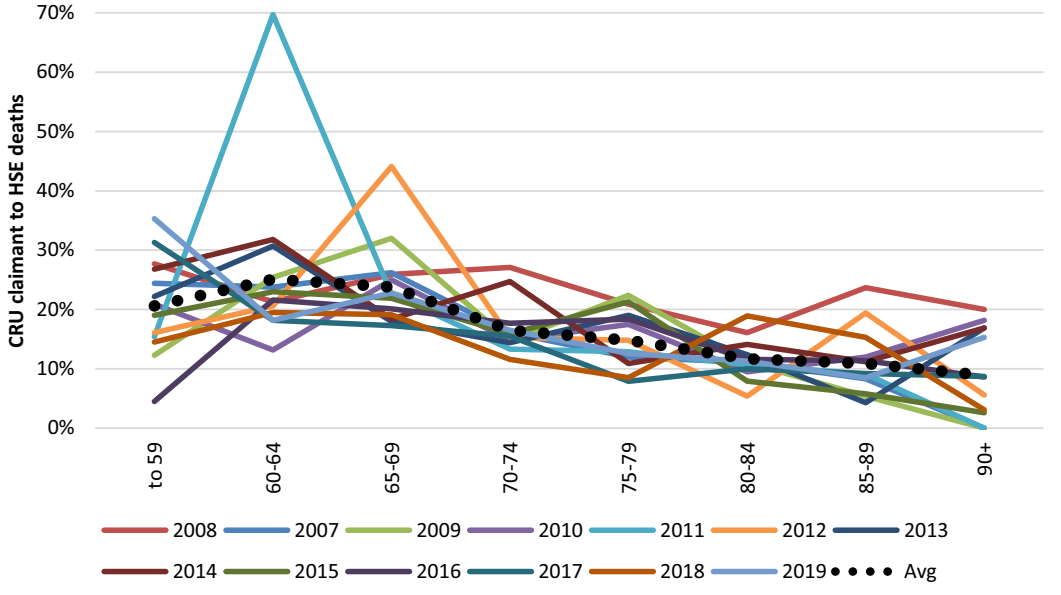


Figure 67. Female CRU claimants to HSE deaths ratio.

The female claimant to death ratio appears substantially lower than the male ratio and is more volatile due to the reduced numbers involved.

To estimate the cost of future mesothelioma claims to the UK EL Insurance Market, the Working Party decided to apply a loading for females to the modelled male cost using a similar approach to that used in 2009.

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7.3.4. Changing year relationship

The 2009 Working Party assumed the "CRU registration year" = "HSE death year". The impact of adjusting the CRU year and HSE year of death has been investigated as follows:

(1) HSE year of death = CRU registration year
(2) HSE year of death = CRU registration year +1
(3) HSE year of death = CRU registration year +2
(4) Adjustment to reflect 68% live CRU registrations. This adjustment assumes 5% of CRU registration die in the year before registration, 55% die in the same year as the CRU registration, 30% die in the year after registration and 10% die two years after registration. Assuming 50% of CRU registrations in the same year of death are alive, this corresponds to an overall 68% level of CRU registrations being alive at time of registration, consistent with the survey data.

Figure 68 shows the comparison of these different assumptions using CRU male registrations between 2007 and 2019 and GB male mesothelioma deaths between 2006 and 2021.

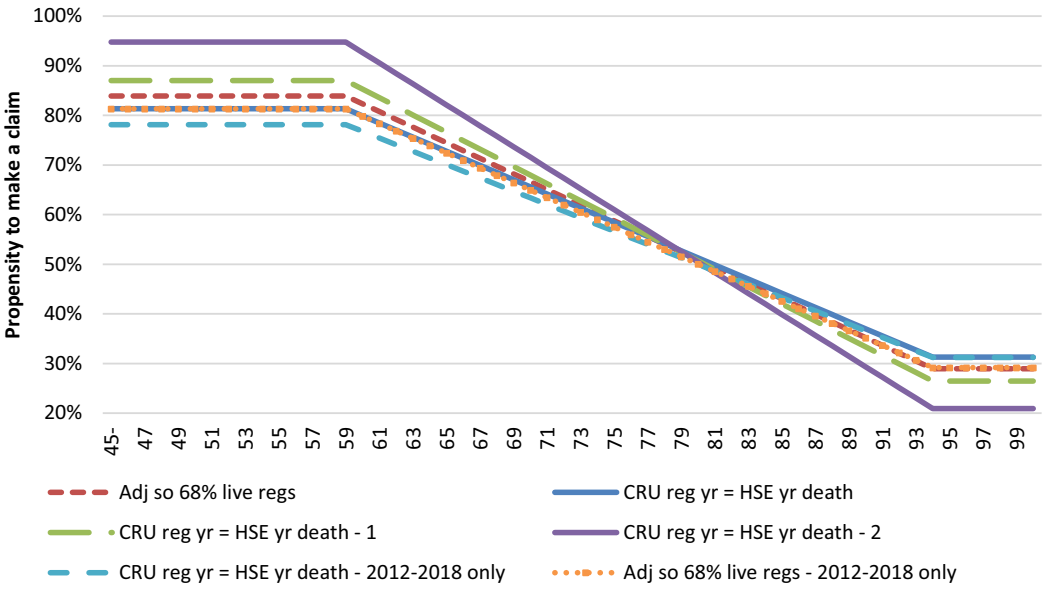


Figure 68. Propensity to claim: impact of adjusting HSE year of death to CRU registration year.

From age 60 onwards there appears to be a general agreement that the propensity to claim decreases fairly linearly for older age bands. Although there remains a difference in the propensity to claim for the younger ages up to age 59, this uncertainty will have a reducing impact on future projections as the percentage of deaths aged 59 or lower is now around 3% and reducing.

For the central estimate male propensity to claim scenario, the Working Party decided to fit a line to the adjustment with 68% live claimants averaged over years 2012 to 2018. This gives a propensity to claim of 81.33% for age 59 and under, dropping to 29.18% for age 94 and over, a gradient of −1.49% per year of age. This selection reflects the percentage of live claimants consistent with the survey data and averaged over the 7 years 2012–2018, excluding 2019 where the CRU data was incomplete.

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It should be noted however that each scenario produces very similar results at age 80, around which the scenarios appear to pivot.

7.3.5. Comparison to 2009 work

The 2009 propensity to claim scenarios were estimated for 5-year age bands and included Government claimants assumed to be at 20%. However, adjusting for the Government share it is possible to compare the 2009 propensity to claim assumption used in the mid scenario (referred to as "AWP3: Proportionate increases for 50 years, eligible ratio to 75% in 10 years") for years 2009 and 2019 to the current central estimate scenario in Figure 69:

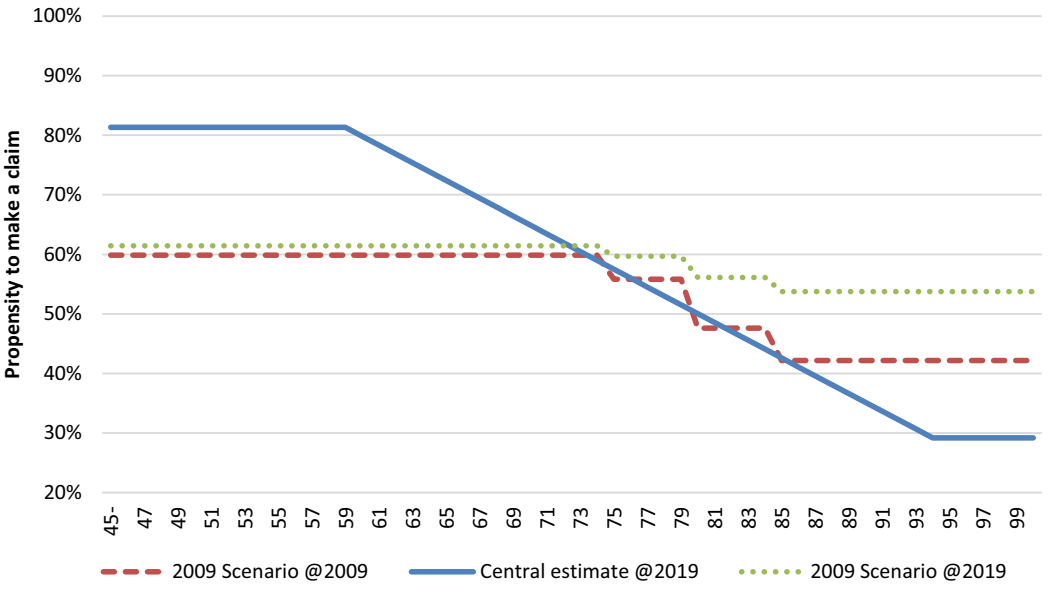


Figure 69. Comparing propensity to claim scenarios.

Two features stand out:

- The age range over which the claim propensity is estimated is considerably wider than that assumed in the previous study; and
- The 2019 central estimate is similar to the 2009 scenario at 2009 between ages 74 and 86. This supports the view that propensity has not increased in the intervening 10 years.

7.4. Predicting the Future

Previously it was clear that claimant death ratios had risen 2004 to 2007 and there had been structural changes in the process, which served to increase the ratio. Since 2007, the CRU data appears to indicate that this increase has not continued, with the number of mesothelioma claimants each year appears to have remained fairly stable.

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Interpretation of recent developments and estimation of the future is necessarily subjective and judgemental and will, for an individual insurer, depend on several factors including that insurer's own recent experience and reserving approach. We have not attempted to limit the scope of judgement that each insurer may wish to make.

7.4.1. Other issues

In creating claimant death ratios as the ratio between the number of claimants and the number of deaths, there is an implicit assumption that the date of claim and date of death are fairly close. The reality is that claims are made at varying times between diagnosis and three years (statute of limitations) after death. Changes in the rate of pre-death diagnosis may have the impact of bringing some claims forward, so that claims are temporarily accelerated relative to deaths. This could cause a temporary increase in the claimant death ratio that levels off after the rate of pre-death diagnosis reaches a steady state.

7.5. Possible Future Scenarios

Predicting future propensity for a mesothelioma sufferer to make an insurance claim ("PtC") ratios is fraught with difficulty. Nevertheless, in order to illustrate the impact on the potential insurance cost of mesothelioma claims, the Working Party has put forward four scenarios as detailed in the tables for future age banded claimant PtC ratios.

These scenarios may assist in the projection of future liability. They are by no means intended to cover all possible future experience. For example, a fixed claimant death ratio across all age bands together (as suggested by the original Working Party paper) is one of many possible alternatives. We have not attempted to prescribe the basis on which claimant death ratios are estimated.

Note that the scenarios outlined below are for male claimants in Great Britain excluding Government claims.

As per the assumption made by the 2009 Working Party, it is clear that there is a reducing propensity to claim by age. The 2009 Working Party assumed in scenarios 2 to 5 that the absolute propensity to claim at a given age would increase over time. However, the updated data does not support this, and in more recent years it appears that the propensity to claim has been reducing slightly.

7.5.1. Central estimate scenario

For the central estimate selection, the propensity to claim for 2019 is based on a linear fit through ages 60 to 93 of the average propensity to claims over CRU notification years 2012 to 2018. This leads to a propensity to claim of 81.33% for age 59 and under, dropping to 29.18% for age 94 and over, a gradient of −1.49% per year of age (see Figure 70).

It is assumed that the propensity to claim is the same for all future calendar years. As the average age of mesothelioma sufferers increases over time, the aggregate propensity to make an insurance claim will decrease under this scenario.

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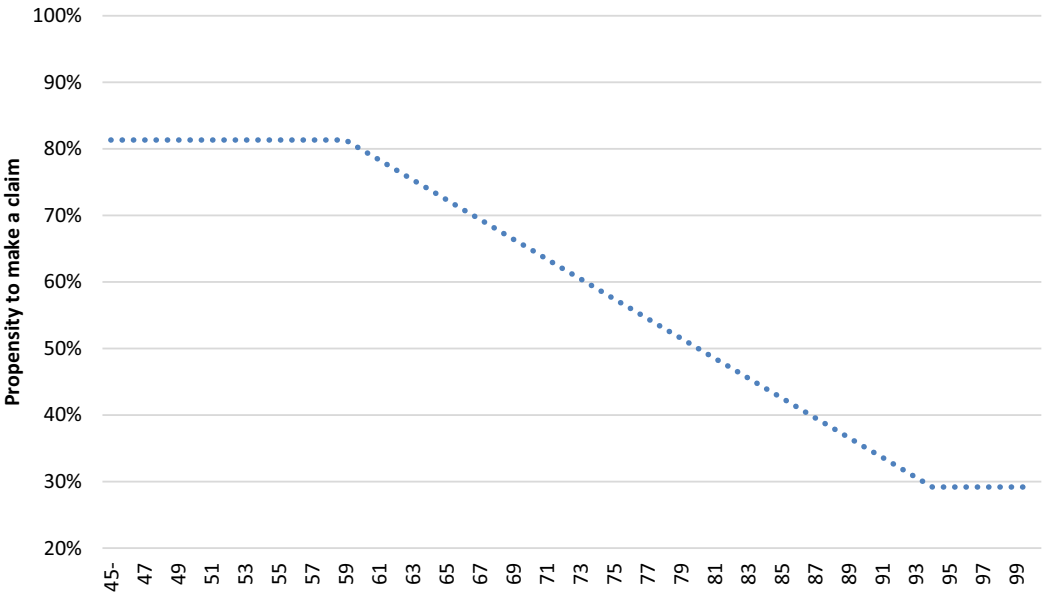


Figure 70. Male Scenario central estimate: claimant death ratio assumptions by age.

7.5.2. Low scenario

The low estimate starts with the same 2019 position as the central estimate, but allows for the recent trend of reducing propensity to claim to continue at its current rate of around 1% per annum (additive) for the next 5 years and then to remain flat.

7.5.3. High scenario

The high estimate we have starts with the same 2019 position as the central estimate, but applies an age translation factor of 50%, meaning that the propensity at age A is equal to the propensity in the previous year at age A – 50% (so in 2 years an 80 year old will be as likely to claim as a 79 year old is now). This gives a propensity to claim which increases by individual age for future calendar years compared to the current calendar year.

7.5.4. Jump scenario

The jump estimate we have starts with the same 2019 and 2020 position as the central estimate, but applies an increase over the next five years so that the propensity to claim for the older ages 60+ increase to the age 59 and under level of 81%.

This scenario is designed to represent a step change in the propensity to claim over a short period, similar to the increase in propensity to claim experienced between the 2004 and 2009 Working Party papers.

7.6. Industrial Injuries Disablement Benefit

Industrial Injuries Disablement Benefit ("IIDB") is a weekly allowance provided on a "no fault" basis to people suffering from a recognised employment-related condition, provided that they can demonstrate that they were employed.

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Sufferers can claim IIDB if they were employed in a job or were on an approved employment training scheme or course that caused the disease. The scheme covers more than 70 diseases, including the following asbestos-related diseases:

1. Pneumoconiosis (asbestosis);
2. Diffuse mesothelioma;
3. Primary carcinoma of the lung with asbestosis;
4. Primary carcinoma of the lung without asbestosis but where there has been extensive occupational exposure to asbestos in specified occupations; and
5. Unilateral or bilateral diffuse pleural thickening.

Sufferers cannot claim IIDB awards if they were self-employed.

The Department of Work and Pensions ("DWP") collects statistics for IIDB awards including nature of condition. Numbers are rounded to the nearest ten (see Figure 71).

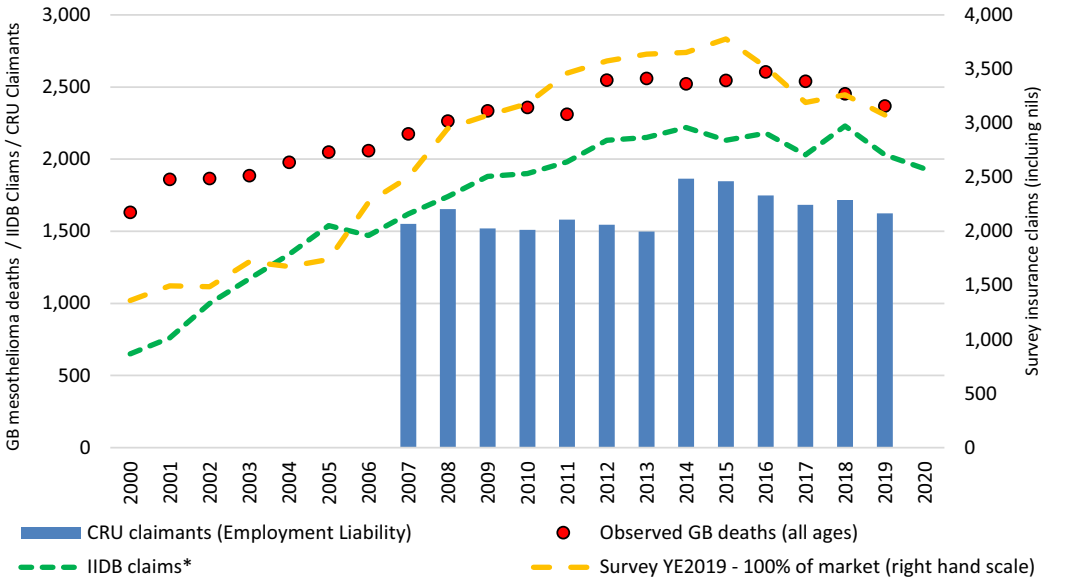


Figure 71. Mesothelioma: GB deaths, IIDB claims, insurance claims and CRU claimants.
*IIDB 1.10 – First diagnosed all assessments. Data till September 2020 (2020 data has been multiplied by 4/3). https://www.goversusuk/government/collections/industrial-injuries-disablement-benefit-quarterly-statistics

There are 2 points of interest regarding the IIDB claims data:

1. Over the last 5 years (2014 to 2018) the ratio of IIDB claims to male deaths has been broadly consistent at around 85% of deaths; and
2. Over the last 10 years (2010 to 2019) the ratio of IIDB claims to latest Working Party's market survey data of insurance claims has been between 1.5 and 1.8.

Although there will be a broad correspondence between numbers of IIDB awards and numbers of insurance claimants, there are differences:

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- As the IIDB is a "no fault" payment, there may be awards made where no employer is deemed liable for exposure and therefore there is no EL claim.
- Where mesothelioma is diagnosed after death, no IIDB award will have been made; however, it is possible (as long as the claim is made within three years of death) that there will be an insurance-related claim.

Due to these differences, the Working Party has not investigated this data further, preferring to use the detailed CRU data.

7.7. Northern Ireland

HSE death statistics cover England, Wales and Scotland to give total Great Britain figures. To estimate the cost of mesothelioma claims for the UK EL Insurance Market, it is necessary to include an allowance for Northern Ireland ("NI").

The Northern Irish HSE publish the number of asbestos-related deaths in NI by registration year (but no split by age or sex), which indicates about 45 mesothelioma deaths per year or approximately 2% of Great Britain.

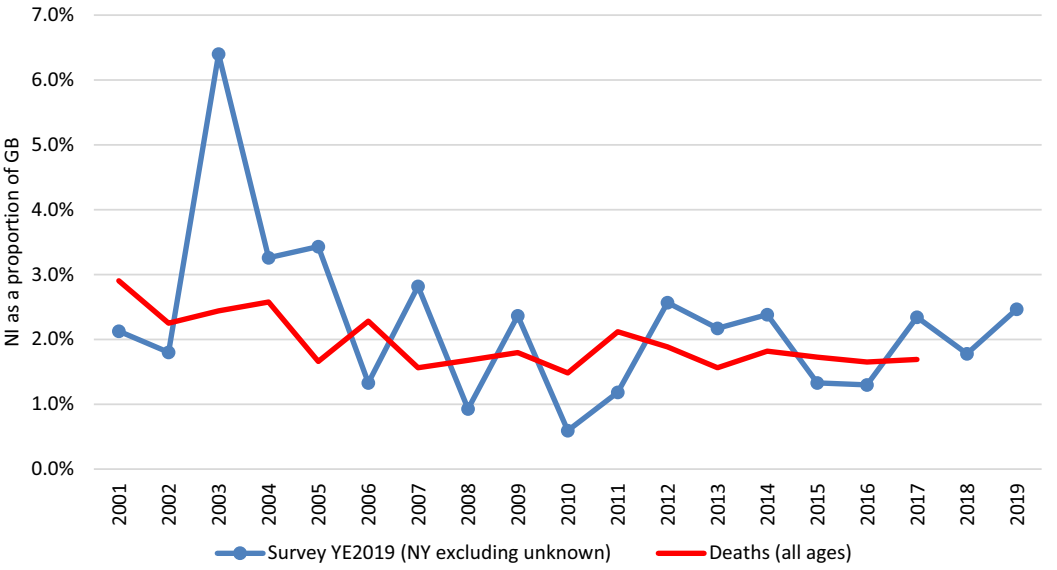


Figure 72. Northern Ireland deaths/claims as percentage of Great Britain deaths/claims.

Figure 72 appears to indicate that, if anything, the proportion of Northern Irish mesothelioma deaths (to GB) appears to be stable at around 1.75%.

This trend in deaths is consistent with the latest Working Party's market survey data, where the mesothelioma country data is available.

See Appendix F for the detail behind the Working Party's selected ratio for Northern Ireland used in the UK EL Insurance Market estimates.

7.8. Claims per Claimant

By comparing the estimated number of mesothelioma claims from the UK EL Insurance Market to the number of mesothelioma claimants, it is possible to estimate the number of claims per claimant (see Table 43).

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Table 43. Claims to claimant ratio

Report Year	UK EL Insurance Market Claims (Including Nils)*	Current Nil Claims Percentage	Selected Nil Claims Percentage	GB Estimated Claimants (Ex Withdrawn and Government)	Northern Ireland (to GB) Percentage	Estimated UK Claimants	Claims to Claimant
2007	2,500	25.0%	25.0%	1,290	1.56%	1,310	1.4
2008	2,953	23.0%	23.0%	1,306	1.68%	1,328	1.7
2009	3,071	24.0%	24.0%	1,274	1.80%	1,297	1.8
2010	3,180	26.0%	26.0%	1,279	1.48%	1,298	1.8
2011	3,460	26.0%	26.0%	1,340	2.12%	1,368	1.9
2012	3,575	28.0%	28.0%	1,315	1.88%	1,340	1.9
2013	3,637	29.0%	29.0%	1,256	1.56%	1,276	2.0
2014	3,654	30.0%	30.0%	1,346	1.63%	1,368	1.9
2015	3,778	28.0%	28.0%	1,275	1.73%	1,297	2.1
2016	3,519	27.0%	27.0%	1,196	1.65%	1,216	2.1
2017	3,190	23.0%	28.5%	1,130	1.75%	1,150	2.0
2018	3,263	16.0%	28.5%	1,165	1.75%	1,185	2.0

*The Working Party grossed up the YE2019 survey data assuming the survey covered 80% of the market.

Since 2010 the estimated claims to claimant ratio has been fairly stable between 1.9 to 2.1 claims per claimant.

8. Estimating Mesothelioma Average Costs

This section details how the Working Party has derived its future average mesothelioma claimant costs and how this compares to previous estimates in 2009.

The Working Party has used the 2009 average claimant cost model, updating the underlying assumptions based on the experience to date. The Working Party was not able to access a more recent sample of mesothelioma claims costs. Therefore, the Working Party reviewed the underlying assumptions and sense checked the outputs by head of damage and overall claimant costs against solicitors' and claim handlers' experience.

It is very important to remember that the average claimant cost model is not designed to provide an accurate claimant cost for each year and age, but is designed to understand how the inflation changes over time due to the different components of the award and the increasing average age of mesothelioma sufferers.

8.1. Recap on 2009 Work

The 2009 Working Party had access to a sample of 291 mesothelioma claims settling between 2001 and 2009 from 6 insurers (with most claims settling in 2007 and 2008).

The claim amounts represented the 100% claim value (i.e. the indemnity amount that the claimant receives) and not the respective insurer's share of the claim cost. The sample data did not include legal expenses/costs (for either the claimant or insurer) that would normally be allocated to the claim in addition to the indemnity costs. The 2009 Working Party made an allowance for legal expenses from a separate analysis based on claim handlers' experience.

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The claims sample was made up of a mixture of mesothelioma claims from England, Wales and Scotland, although this mix was not captured in the data.

8.1.1. 2009 approach

The 2009 Working Party modelled costs split into the following heads of damage:

- General Damages (Pain and suffering and "loss of amenity" (PSLA))
- Special Damages (although special damages refer to damages for specific pecuniary loss, the 2009 Working Party used the term to refer specifically to loss of earnings)
- CRU/PWCA Amounts
- Bereavement Award
- Funeral Expenses
- Costs of Care
- Miscellaneous Expenses
- Other costs
- Legal Expenses.

For each head of damage, the 2009 Working Party considered (i) whether they were age dependent, (ii) if they differed depending on whether the claimant was living or deceased at the time of settlement, and (iii) what type of inflation affected them. They then produced average costs for each head of damage by age and for living /deceased claimants for settlement year 2007.

Table 44 details the assumptions applied for each of the different heads of damage.

Table 44. 2009 mesothelioma average claimant costs summary

Head of Damage	Age Related	Living /Deceased Differential	Inflation Type
General Damages	Yes	No	Court
Special Damages	Yes	Yes	Wage
PWCA	No	No	RPI
CRU	Yes	Yes	RPI
Bereavement Award	No	Yes	RPI
Funeral Expenses	No	Yes	RPI
Costs of Care	No	No	Wage
Miscellaneous Expenses	No	No	RPI
Other costs	No	No	Wage
Legal Expenses	Yes	No	Wage

8.1.1.1. 2009 settlement pattern. Since the sampled data was on a settled basis and the projected number of claims on a reported basis, the 2009 Working Party assumed that on average, it takes 2 years from the year of notification for claims to settle.

From the sample data, it was observed that in general, the settlement lag was shorter for those claimants alive at the time of settling their claim compared to those who were deceased.

8.1.1.2. 2009 living/deceased claimants. The data did not contain a specific indicator as to whether the claimant was living or deceased at the time of settlement. The 2009 Working Party decided that the best

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proxy was to classify as deceased any claimant with a non-zero bereavement award. They assumed that the mix between living and deceased claimants remained a constant 50:50 split over time.

8.1.2. 2009 future scenarios

The 2009 Working Party produced three mesothelioma cost scenarios by considering the future inflation by each type. Table 45 details the future inflation assumptions used in 2009 and the overall inflation effect.

Table 45. 2009 inflation assumptions p.a

Inflation type	Inflation Scenario 1 (Low)	Inflation Scenario 2 (Mid)	Inflation Scenario 3 (High)
RPI	1.5%	2.5%	3.5%
Wage (RPI + 1.5%)	3.0%	4.0%	5.0%
Court (RPI + 2.0%)	3.5%	4.5%	5.5%
Average p.a. (2009–2050)*	**2.8%**	**3.8%**	**4.8%**

*Using scenarios 21, 22 and 23 for low, central and high, respectively, i.e. AWP adjusted HSE model and propensity scenario 3: Proportionate increases for 50 years, eligible ratio to 75% in 10 years.

8.1.3. 2009 sense checks

The 2009 Working Party conducted two sense checks on their average cost assumptions:

1. Comparing the modelled settled claimant costs in the period 2007 to 2009 to the actual claimant costs in the data sample
2. Comparing the modelled settled claimant costs in 2008 against their survey data on the average non-nil insurance claim reported in 2006 (i.e. assuming it takes 2 years for claims to settle) and assuming a claims to claimant ratio of 2.2.

These sense checks allowed the 2009 Working Party to conclude that the parameterisation of the model was reasonable.

8.2. Expert Views

The Working Party has surveyed a number of claims handlers and solicitors for their views in 2016 on (i) the average number of claims per mesothelioma sufferer, (ii) the proportion of claims that settle while the mesothelioma sufferer is still alive, and (iii) the average cost of a mesothelioma claim.

Table 46 details the results from the expert survey.

Table 46. Expert views in 2016 (prior to discount rate change)

Area	Mean	Median	Interquartile Range
Claims per claimant	2.5	2.3	2.0 to 3.0
Settle with sufferer alive	52%	60%	55% to 65%
*Average claim – Living claimant**	*£225,000*	*£212,000*	*£215,000 to £229,000*
*Average claim – Deceased claimant**	*£249,000*	*£249,000*	*£245,000 to £252,000*
Average claim (assuming 60% living)*	£235,000	£233,000	£227,000 to £238,000

*Rounded to the nearest thousand (60% used as median expert view)

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Note that the average costs are based on an Ogden discount rate of 2.5% (which was the Ogden discount rate at the time of getting experts' views), and average costs are weighted by UK jurisdiction using the proportion of mesothelioma deaths by UK jurisdiction.

8.3. 2009 Model versus Experience

Figure 73 details the estimated average costs from the Working Party's 2009 Scenario 23 against the data from the latest survey (YE2019). Note that the survey data is based on notification year, and therefore, the more recent years are not fully settled: over 50% of claims are open on notification years 2018 and 2019.

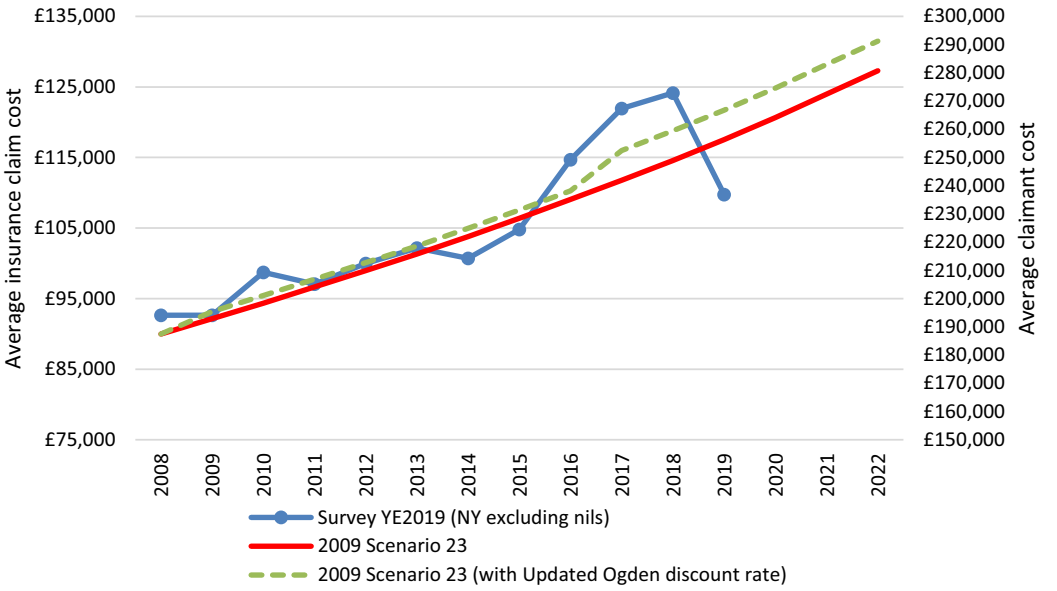


Figure 73. 2009 model (claimant) versus survey (claim): notification year.

The 2009 Working Party's Scenario 23 is a reasonable fit to the latest survey data. It is noteworthy that in years 2014 to 2018 the slope of the survey data is much steeper than predicted by the 2009 Scenario 23. This could be a reflection of the reduction in Ogden discount rate, which increased claim costs; Scenario 23 assumed a stable 2.5% p.a. discount rate. The drop in claim costs in the last year of the survey data will have been affected by credibility, because only a small proportion of claims notified in 2009 would have been settled in 2009. It is possible that smaller, less complicated claims settle quicker and only these claims are captured in that data point. Little credibility can be placed on this 2019 data point.

Comparing the average mesothelioma claimant cost based on the experts' views in 2016 against the result from the Working Party's 2009 Scenario 23 (of £235 *k*), the figures are broadly similar although the 2009 Scenario 23 is higher than the experts view.

8.4. 2020 Average Cost per Claimant

The Working Party has not been able to access a more recent sample of mesothelioma claims costs, and consequently has updated the underlying assumptions based on the experience to date.

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8.4.1. Adjustments to 2009 work

The changes to the 2009 assumptions are listed in the following sections.

Figure 74 details the impact of updating each assumption in turn from those in the 2009 model to the current parameterisation, whilst holding the long-term RPI assumption of 2.5% steady for the central scenario (using the male deaths and other claim number-related assumptions from Scenario 23 in 2009).

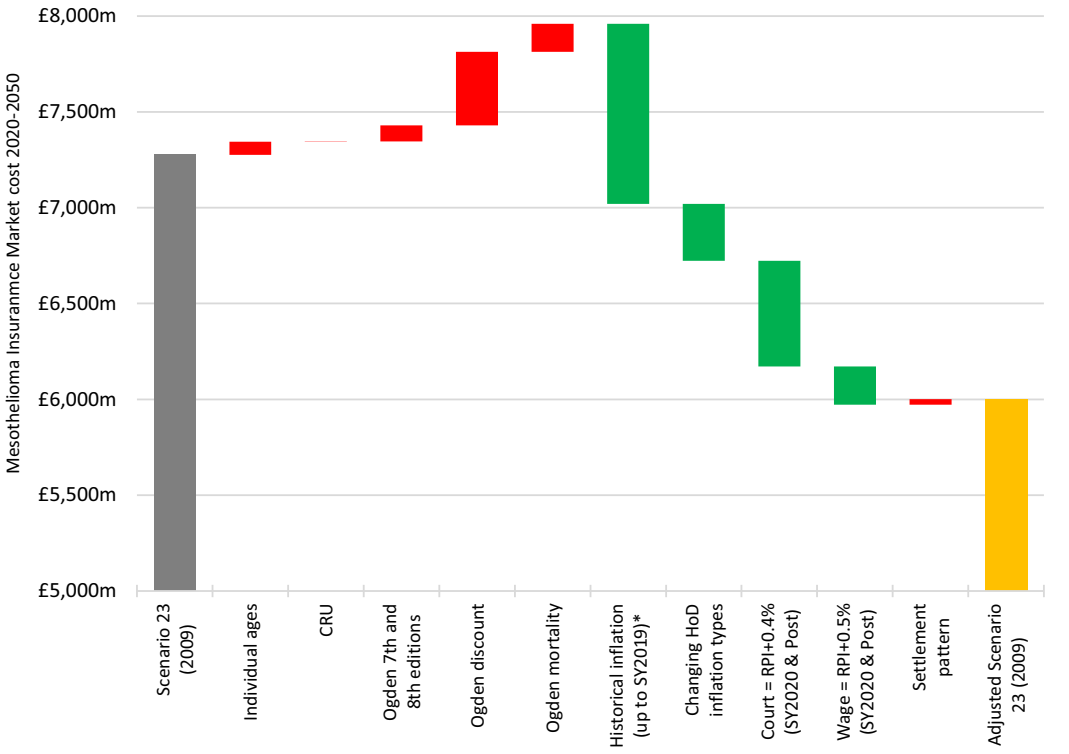


Figure 74. Total mesothelioma cost movement (2020–2050 and ages 20–89) from 2009 Scenario 23.
*From SY2007 to SY2019, the average per annum RPI increased from 2.5% to 3.0%, Court inflation reduced from 4.8% to 2.7% and Wage inflation reduced from 4.0% to 3.5%

8.4.1.1. Individual ages. An average cost per age approach has been applied, whereas the 2009 average cost model applied an average cost per age band.

8.4.1.2. CRU costs for 2007. The Working Party has updated the spread of CRU costs by age for deceased claimants, by setting the cost at age 86 and above to be equal to the costs at age 85. The 2009 assumptions produced negative deceased CRU costs for ages 97 and over.

Given that the 2009 estimates only used ages 20–89 these negative costs would not have affected the 2009 market estimate.

8.4.1.3. Ogden. The Working Party has updated the Ogden multipliers used on future loss by:

1. **Editions**: Updating for the latest editions of the Ogden tables (Ref: 59) published since 2009, namely the 7th edition from settlement year 2011 and the 8th edition from settlement year 2020. The 8th edition incorporated the ONS's National Life Statistics for 2016–2018

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published in late 2019. These showed that improvements in life expectancy are slower than was anticipated in the 2008 data underpinning the 7th edition, and multipliers in the new tables are therefore generally lower than before, especially for losses after retirement age.

2. **Discount rate:** Updating for the changes to the Ogden discount rate since 2009 for England and Wales. The discount rate was changed from 2.5% p.a. to minus 0.75% from settlement year 2017 and then to minus 0.25% from settlement year 2019. The model assumes no future changes to discount rates. Therefore minus 0.25% is assumed from 2020 onwards. The selection of a future discount rate is based on the current legislation around the discount rate for personal injuries (see Section 5.2.22 for more details). The Working Party acknowledges that this could change in the future but considers future legislation on the discount rate used in Ogden multipliers outside of its scope of work. It also appreciates that the Ogden discount rates are different for Scotland and Northern Ireland. At the time of writing, the discount rate in Scotland was minus 0.75%, and in Northern Ireland it was minus 1.75%. It was decided to select the rate applicable to England and Wales because the majority of mesothelioma claims arise in this part of the UK. Scenario tests were run to illustrate the impact of higher and lower discount rates. These scenario tests can be found in Table 47. Practitioners can select different rates in the model to estimate the impact for their own purposes.
3. **Mortality changes:** Estimating the future Ogden multipliers at successive four-year intervals by assuming that the projected changes in male life expectancy according to the ONS's 2018-based national population projections (Ref: 60) are borne out. This approach allows for improvements in general population mortality in the future. A long-term mortality improvement rate of 1.2% p.a. was assumed beyond the end of the ONS' projection period. The Working Party has also modelled a low scenario where the Ogden multipliers are updated every five years and a high scenario where they are updated every three years. These changes in the average cost model bring the assumptions underpinning the Ogden rate factors consistent with the assumptions underpinning the population estimates in the mesothelioma deaths model. Life expectancy may not increase at the rates currently projected by the ONS, but the projection of alternative longevity scenarios was considered beyond the scope of the Working Party.

The movements between the different editions of the Ogden Tables on ages 65 to 90 are set out in Appendix H.

The Working Party has kept the 5-year adjustment previously applied to take into account the relatively lower life expectancy of mesothelioma claimants compared to the average UK population, assuming they did not develop mesothelioma. For example, a claimant aged 70 should use the standard factor for a person aged 75. This adjustment addresses the assumption that in the absence of mesothelioma, a typical claimant's underlying health and other socio-economic factors would contribute to a lower life expectancy than the UK average. The Working Party notes that this assumption aligns with public expert views (Ref: 61).

Given the uncertainty around how the discount rates and the mortality rates used in the Ogden tables will change in the future, the Working Party has developed the following sensitivities (Table 47) to show the impact these factors have on the total undiscounted cost of mesothelioma claims for the UK.

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Table 47. Ogden sensitivities

Mesothelioma Estimate	2020–2060	2020–2060 Impact	2020–2060 % Impact
Scenario 5*	**£4,376 m**	**n/a**	**n/a**
Discount rate is −1.75% from SY2020	£4,530 m	+£154 m	+3.5%
Discount rate is 0% from SY2020	£4,375 m	(£1 m)	(0.0%)
No mortality improvements	£4,307 m	(£69 m)	(1.6%)
Mortality improves according to CMI_2019_M [1.5%] : 100% NLT16-18 (E&W M) (at 1 January 2017)†	£4,394 m	+£18 m	+0.4%

*2020 scenario, based on Adjusted HSE: 2 (Central) Deaths with Central Propensity scenario and Central Average Cost/ Inflation scenario.
†CMI 2019 Mortality Projections Model with a long-term rate of 1.5% p.a. using the base table ONS National Life Tables 2016-2018 for England & Wales.

8.4.1.4. Settlement pattern. The Working Party felt that the simple settlement used in 2009 was no longer appropriate to capture the impact of changes in the Ogden factors, particularly the adoption of the 8th edition tables. Table 48 shows the updated the settlement pattern used within the model, based on the data from the year-end 2017 market survey (which had settlement pattern data).

Table 48. Settlement pattern

Year to Settle	Payment Pattern
0	14.0%
1	27.5%
2	24.5%
3	16.0%
4	9.0%
5	4.5%
6	3.0%
7	1.0%
8	0.5%

Please note the new settlement pattern has a similar mean term (2.1 years) as the 2009 pattern (2.0 years).

8.4.1.5. Court inflation. The average cost model projects general damages increases (set under the JC Guidelines see Section 5.3.8 for more details) are subject to Court inflation. The JC Guidelines state that compensation levels should increase in line with the Retail Price Index (RPI).

The Working Party has analysed court inflation by comparing the movements in the lower, mid and upper points in the JC guidelines from the 5th (July 2000) to 15th edition (November 2019) against RPI, as shown in the Table 49. Given that few mesothelioma claims will

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attract the 10% *Simmons versus Castle* uplift (see Sections 5.2.15 and 5.3.8.2 for more details) the uplift is not included in the analysis in Table 49.

Table 49. Annual JC guidelines inflation against RPI (p.a.)

Period	Lower Band	Upper Band	Mid-point (Average)	RPI (Ref: 62)	Mid-point *Minus* RPI
Jul-00 to Nov-02	0.0%	8.1%	4.6%	1.9%	**2.7%**
Nov-02 to Sep-04	6.6%	8.8%	7.9%	2.9%	**5.0%**
Sep-04 to Sep-06	3.1%	3.0%	3.1%	3.0%	**0.1%**
Sep-06 to Sep-08	4.7%	4.7%	4.7%	4.4%	**0.4%**
Sep-08 to Sep-10	(18.4%)	1.4%	(5.9%)	1.8%	**(7.7%)**
Sep-10 to Sep-12	19.5%	3.7%	8.6%	4.5%	**4.1%**
Sep-12 to Dec-13	2.4%	2.2%	2.3%	3.1%	**(0.8%)**
Dec-13 to Sep-15	1.9%	2.0%	1.9%	1.8%	**0.1%**
Sep-15 to Sep-17	2.4%	2.4%	2.4%	2.3%	**0.1%**
Sep-17 to Nov-19	3.3%	3.3%	3.3%	3.1%	**0.2%**
Jul-00 to Nov-19	**2.1%**	**4.1%**	**3.3%**	**2.9%**	**0.4%**
Jul-00 to Sep-08	***3.4%***	***6.2%***	***5.0%***	***3.0%***	***2.0%***
Sep-06 to Nov-19	***1.7%***	***2.9%***	***2.4%***	***3.0%***	***(0.6%)***
Sep-08 to Nov-19	***1.2%***	***2.5%***	***2.0%***	***2.8%***	***(0.8%)***

Mostly, the increase in a new edition of the JC guidelines has been broadly consistent across the bands and reasonably in line with the RPI index. Generally, the inflation rate is higher for the upper band compared to the lower band.

Based on the experience between July 2000 and September 2008, the 2009 Working Party, assumed that Court inflation (which affects the general damages part of the claim) was 2% greater than the assumed underlying RPI.

Based on the inflation of the JC guidelines compared to the RPI, from July 2000 to November 2019, the central selection for future Court inflation is RPI plus 0.4%.

The low scenario assumes that Court inflation equals RPI (based on more recent JC guidelines). The high scenario assumes that Court inflation is 0.9% greater than RPI (based on the experience from July 2000 to November 2019, allowing for the 10% uplift).

8.4.1.6. Wage/pensions inflation. The 2009 model applied wage inflation to the following heads of damage:

- Special damages (loss of future earnings)
- Costs of care
- Other costs
- Legal expenses.

Due to the increasingly advanced age of mesothelioma claimants (because of the increasing period of time since exposure), the Working Party believes that pension income is more relevant for loss of future earnings than wages. Furthermore, due to socio-economic class, it was assumed that the state pension would comprise the majority of mesothelioma claimants' pensions. Therefore,

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special damages in the new model increase in line with state pension inflation rather than wages. All of the other heads of damage continue to use wage inflation.

Despite the fact that real wage inflation has been close to zero on average over recent years in the UK, the Working Party did not believe that zero real wage growth was an appropriate future long term assumption to use in the model. The main reason for this is that the vast majority of the wage cost inflation is legal expenses. The increases in solicitors' fees are expected to outstrip CPI.

The central assumption for wage inflation was set at 3.0% per annum (1.0% above CPI).

The state pension triple lock formula continues to operate, whereby it is set at the highest of:

- Consumer Prices Index (CPI)
- Average Weekly Earnings (AWE)
- 2.5% p.a.

The state pension increases for 2020 and 2021 are 3.9% and 2.5%, respectively. The central assumption for 2022+ was set at 3.0% p.a. This is 0.5% above the floor of 2.5% (1.0% above CPI) and is consistent with the increase in wages over the last 20 years.

Low and high scenarios have been provided to give a range of future estimates using 2.5% p.a. and 3.5% p.a., respectively.

8.4.1.7. RPI/CPI inflation. The 2009 model applied RPI inflation to the following heads of damage:

- Costs payable through CRU (including PWCA)
- Bereavement awards
- Funeral expenses
- Miscellaneous expenses

It is generally accepted that RPI is not the best measure of inflation, mainly due to its method of calculation. The Working Party decided to adopt CPI as the inflation index for the heads of damage above.

As described in Section 8.4.1.2, from October 2008, payments made in line with the Pneumoconiosis, etc. (Workers' Compensation) Act 1979 (PWCA) need to be reimbursed by insurers to the state via CRU. As a result, these costs have a net nil impact on insurers. Therefore, the 2020 model no longer projects PWCA costs.

Bereavement awards in England and Wales are set by law and are updated periodically. Although there is no guidance about the rate of increase, CPI appears to be the best match over the last 30 years. Therefore, CPI is used to project future increases in bereavement awards.

The model assumes that 8% of claims originate in Scotland, where bereavement awards are much higher than equivalent awards in England and Wales. The Damages (Scotland) Act 2011, Section 4 allows a claimant to bring a claim for "loss of society", which significantly increased the bereavement awards, approximately doubling them. The model allows for this one-off inflationary impact by applying an additional 40% onto CPI in 2011.

8.4.2. Results

The mesothelioma cost model takes 2007 as its base year, parameterising all of the heads of damage from the 2009 model, which were estimated from the sample of 291 claims (as described earlier in Section 8.1). It then projects forward to the end of 2020 using actual inflation rates appropriate to each head of damage and from that point to 2060 using a range of future inflation types for each head of damage.

Table 50 details the assumptions applied for each of the different heads of damage.

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Table 50. 2020 mesothelioma average claimant costs summary

Head of Damage	Age Related	Living /Deceased Differential	Inflation Type
General Damages	Yes	No	Court
Special Damages	Yes	Yes	State Pension
CRU	Yes	Yes	CPI
Bereavement Award	No	Yes	Bereavement
Funeral Expenses	No	Yes	CPI
Costs of Care	No	No	Wage
Miscellaneous Expenses	No	No	CPI
Other costs	No	No	Wage
Legal Expenses	Yes	No	Wage

There were two explicit adjustments to the 2007 base year values:

- As described in Section 8.4.1.2, CRU costs for deceased claimants became negative at ages 97+ in the 2009 model. The 2020 model sets all ages above age 85 equal to the values at age 85.
- Bereavement awards were increased from £11,000 in the 2009 model to £16,500 to account for an assumed 8% proportion of Scottish claims, where awards tended to be much higher than England and Wales even before the Damages (Scotland) Act 2011.

The Working Party has produced four mesothelioma cost scenarios by considering the future inflation by each type (Table 51). The low and high scenarios assume an immediate and long-term shift in all inflation types lower and higher. The so-called "jump" scenario envisages a periodic increase, or jump, in court inflation of 10.9% and care costs and/or drugs costs of 18.0% in 2021 and every 7 years thereafter.

Table 51. Future inflation assumptions p.a

Inflation type	Low Cost Scenario A	Central Cost Scenario B	High Cost Scenario C	Jump Cost Scenario D
CPI	1.5%	2.0%	2.5%	as per Central
RPI	2.0% *CPI+0.5%*	2.5% *CPI+0.5%*	3.0% *CPI+0.5%*	as per Central
Wage	2.5% *CPI+1.0%*	3.0% *CPI +1.0%*	3.5% *CPI +1.0%*	18.0% in 2021 and every 7 years; all other years as per Central
Pension	2.5% *CPI+1.0%*	3.0% *CPI +1.0%*	3.5% *CPI +1.0%*	as per Central
Court	2.0% *RPI*	2.9% *RPI +0.4%*	3.9% *RPI +0.9%*	10.9% in 2021 and every 7 years; all other years as per Central
Ogden multiplier update interval	5 years	4 years	3 years	as per Central

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Figure 75 details the average claimant costs over time using the central adjusted HSE model with the central mesothelioma propensity scenario (up to age 100).

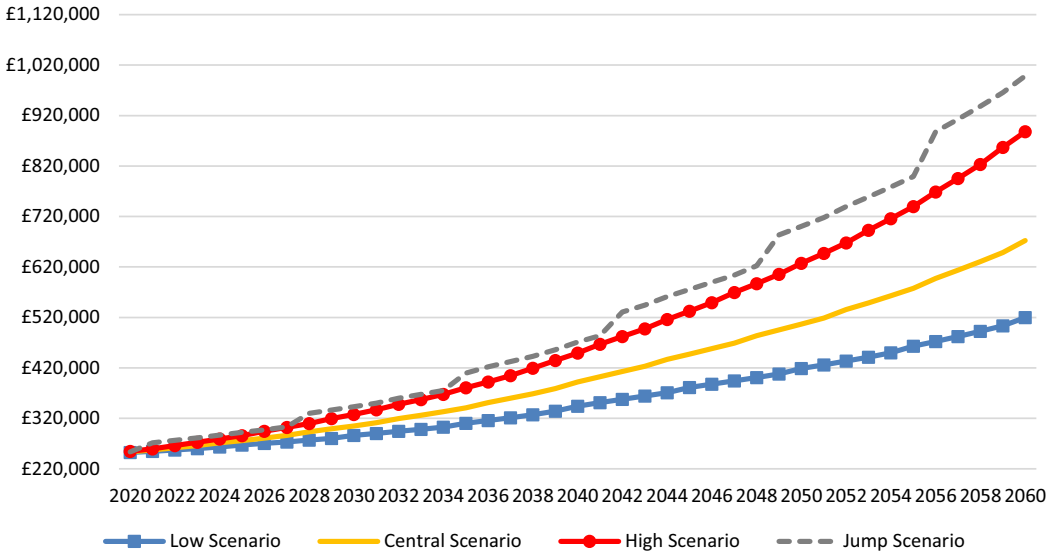


Figure 75. Mesothelioma average claimant costs over time.

Table 52 sets out the market estimate for each scenario.

Table 52. Mesothelioma market estimate 2020–2060 (undiscounted total UK)

Scenario Number	Deaths Model	Propensity Scenario	Average Cost Scenario	Average Inflation Rate p.a.	Undiscounted Mean Term	Market Estimate
2	Adjusted HSE: 2 (Central)	Central	Low	1.9%	11.0 yrs.	£4.0 bn
5			Central	2.5%	11.5 yrs.	£4.4 bn
8			High	3.3%	12.1 yrs.	£4.8 bn
21			Jump	3.5%	12.3 yrs.	£5.1 bn

Whist the Working Party has produced its UK EL Insurance Market cost of mesothelioma claims using its own mesothelioma cost model with different inflation assumptions, these only provide a potential range of outcomes but by no means provide an upper or lower bound. Practitioners may wish to consider or use alternative assumptions depending on the nature of the specific situation (as discussed in Sections 13.4 and 13.5).

8.4.3. Sense checking the results

The Working Party has conducted three sense checks on the results of the mesothelioma average cost model:

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1. Comparing the results from the model for year 2016 (when the discount rate is set to 2.5%) against expert views (see Table 53).
2. Comparing the results from the model against the latest Working Party market survey data (noting that the most recent notification years will include a large proportion of open claims, so the average cost on these years is still subject to change), see Figure 76.
3. Comparing the results from the model against the sample claims data used in the 2009 Paper.

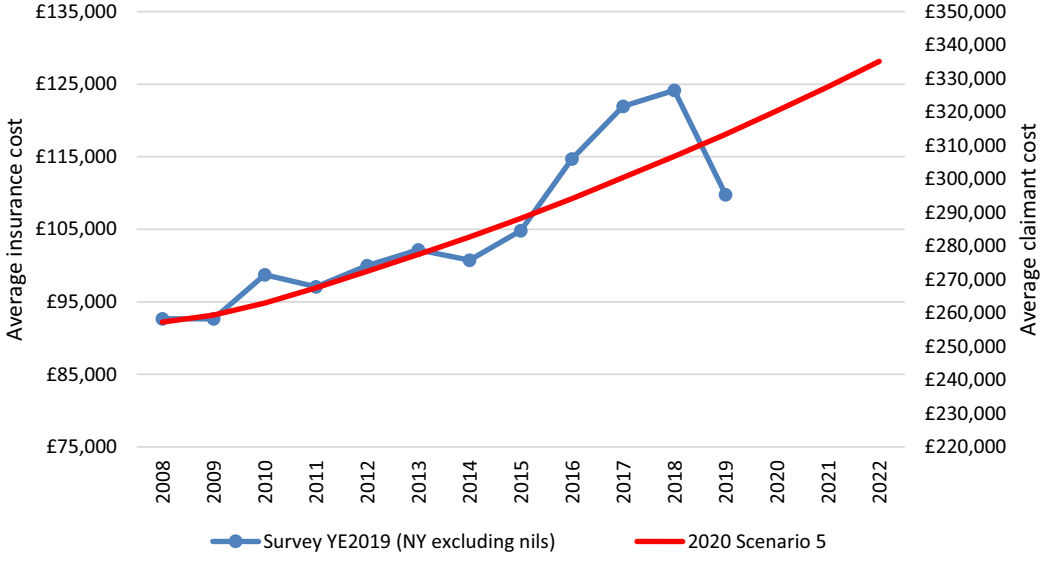


Figure 76. 2020 model (claimant) versus survey (claim): notification year.

Table 53. Expert views in 2016 (prior to discount rate change)

Area	Central (Scenario 5) using discount of 2.5%	Interquartile range*
Average claim – Living claimant	*£208,700*	*£215,000 to £229,000*
Average claim – Deceased claimant	*£256,040*	*£245,000 to £252,000*

*Rounded to the nearest thousand.

Overall, the Working Party believes that the parameterisation of the model is reasonable, and hence the future projected claims costs have been used to derive the mesothelioma EL Insurance Market estimates outlined in Section 9.

8.5. Areas Unchanged

8.5.1. Living/deceased claimants

Mesothelioma claims tend to be higher for deceased claimants due to bereavement awards. This is particularly true for Scottish claims where the awards are significantly higher than in the rest of the UK. Therefore, it is important to estimate the proportion of claimants living and deceased at settlement.

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The ONS (Ref: 63) estimates that for people with mesothelioma in England:

- 45% survive their mesothelioma for 1 year or more after diagnosis
- more than 5% survive their mesothelioma for 5 years or more after diagnosis.

Based on expert views, the Working Party believes that claim notification follows shortly after diagnosis. As set out in Section 8.4.1.4 above, the mean term from claim notification to settlement is assumed to be 2.1 years, which represents a small change in the mean term of 2.0 years from claim notification to settlement from the 2009 model.

There are two sources of information on the proportion living at settlement available to the Working Party, namely the 291 sample policies from 2009 and the annual insurance survey data.

From the 2009 sample data, it was observed that the longer the settlement lag, the more likely the claimant was to be deceased at the time of settling the claim. It was also observed that the proportion living was increasing over time when analysed by reporting year.

This latter observation required further analysis in order to understand how it should be interpreted. The data encompassed claims settled between 1999 and 2009. Claims were only included in the sample if they had been fully settled. Naturally, the claims reported in later years had less time to develop than those reported earlier in the period. Therefore, those claims had shorter settlement lags on average. It was this feature of data capture that had caused the apparent increase in proportion living.

The survey data includes an indicator for alive/deceased at notification and at settlement. However, the majority of claims had indicated "not known". This was particularly true for the indicator at settlement. For example, in the 2020 Survey conducted in 2019, around 85% of the claims had not indicated whether the claimant was living or deceased at settlement. These credibility issues prevented the Working Party from deviating from a simple 50:50 split assumption over time.

It should be noted that expert views indicate that the volume of deceased claimants exceeds those of living claimants. Two reasons are cited:

- first, that life expectancy after a mesothelioma diagnosis remains short
- secondly, that if claimants have dependents their solicitors may advise them to wait because claims are larger for deceased claimants.

On balance, it was decided to retain the 50:50 proportion and allow Practitioners to adjust the model as appropriate.

8.5.2. Immunotherapy

Immunotherapy can be an expensive treatment involving multiple cycles (the cost of two cycles is estimated to be around £70,000 (Ref: 64). Speaking to insurance claims handlers, it has been suggested that, although a number of claims are reported with an expectation of immunotherapy, few claims settle with Immunotherapy costs or those that do rarely have multiple cycles of treatment.

The Working Party's market survey data[4] support this view:

- For mesothelioma claims reported in 2018 and 2019, 9.5% and 7.4% requested immunotherapy treatment for the sufferer, respectively
- For the mesothelioma claims settled in 2018 and 2019, the proportion of settled claims with an agreed settlement on immunotherapy treatment was 2.0% and 3.4%, respectively.

[4]Figures are average weighted excluding those that entered a zero.

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Given the limited data and small proportion of claims that have settled with an agreed settlement on immunotherapy treatment, the Working Party has made no allowance for the cost of immunotherapy treatments (including an increase in the proportion of claims that include an agreed settlement on immunotherapy treatment).

In April 2020, the National Institute for Health and Care Excellence (NICE) issued a bulletin that approved the use of one immunotherapy treatment (nivolumab monotherapy) as a second-line treatment on a short term emergency basis in response to COVID-19 due to the risk of potentially compromising patient immune systems by undergoing chemotherapy treatment. As of 30 June 2021, this was still in place (Ref: 65). Whilst NICE has not currently provided an update on their views about Keytruda as a treatment for mesothelioma, this latest response indicates that NICE is continuing to review immunotherapy treatments for NHS approval.

The Working Party will continue to collect data around immunotherapy through its market survey and recommends that Practitioners should consider the trends seen around immunotherapy when deciding on their own expectations of future mesothelioma average costs.

8.6. Guidance to the Practitioner

The Working Party encourages Practitioners to consider the issues and sensitivities outlined in this section and to select their own approach to modelling mesothelioma average costs and/or developing their own long-term assumptions for the Working Party's average cost model.

Other than the parameters that the Working Party has discussed above, Practitioners should also consider the following, but not limited to, impacts on mesothelioma future average costs:

- Medical advances or changes to current medical treatments
- Legal developments
- Inflation shocks.

Please note that the points below are not the only ones Practitioners should consider when assessing mesothelioma future average costs.

8.6.1. Medical advances: Longevity

Practitioners should consider whether an improvement in longevity for mesothelioma sufferers could change future mesothelioma costs through the following:

- The invention of a new drug which slows the progression of the disease
- A new medical procedure that is able to partially repair the damage caused by mesothelioma
- Early diagnosis due to a screening programme (this would also have profound implications for claim reporting patterns).

Practitioners can look at the improvements in longevity that have occurred, over time, in other cancers, for example (Ref: 66).

- Breast cancer: In 1971–72, a woman diagnosed with breast cancer had a 40% chance of survival for 10 years. By 1990–91 this was 60%, and by 2010–11 it increased to 80%.
- Prostate cancer: In 1971–72, a man diagnosed with prostate cancer had a 37% change of survival for 5 years. By 1990–91 this was 49%, and by 2010–11 it increased to 85%.

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Medical advances are likely to impact costs as follows:

- Until treatments are approved by NICE, the cost of the treatment will likely be borne by the compensator;
- Improvements in life expectancy are likely to reduce special damages and increase the proportion of claims settled with live claimants; and
- Depending on the quality of life conferred, additional care costs may be payable.

8.6.2. Medical advances: Cure

A cure for mesothelioma could be found by:

- The invention of a new drug or procedure which stops and/or reverses the damage caused by mesothelioma; and/or
- The availability of artificial lung transplants.

Whether this would result in a net increase or decrease in the cost of mesothelioma claims depends on how the cost of this cure compares to the cost of death benefits currently payable to claimants, and whether the cost of the cure is borne by the compensator.

8.6.3. Medical advances: Changes to current medical treatments

Practitioners should consider the trends in the current medical treatments offered to mesothelioma sufferers; examples include:

- More claim settling with an agreement of immunotherapy treatment; and
- More cycles of immunotherapy treatment per mesothelioma sufferer, leading to increased costs.

It's worth noting that, if treatments prove successful and are taken up by an increasing proportion of claimants, then it may well be that the treatment is approved by NICE for State funding, although the approval process can be lengthy.

8.6.4. Legal developments: Court cases

Claims have been significantly affected by legal and judicial changes over the last 12 years and may continue to be so in the future.

These can have an immediate impact on liabilities, but they can also lead to secondary consequences that might not be foreseen at the time of enactment. This means that a change in the law can lead to step changes in reserve levels. It is important in considering legal changes to think about the wider impact on claim volumes as well as average costs.

Examples of legal changes affecting reserves include:

- Immediate impact: MoJ announced in March 2015 an increase in UK Court issue fees for larger claims. Court-issued fees on UK asbestos claims are recovered from the compensator, and so this change has an immediate (if relatively small) impact on average costs.
- Secondary consequences: The enactment of LASPO in 2013 led to an influx of "pre-LASPO" claims as solicitors sought to maximise income under the pre-LASPO regime. (Note that this particular example did not apply to mesothelioma claims, as they are outside the scope of the Act).

Consideration should also be given to the reserving basis, particularly where a case is heard successively through the High Court, the Court of Appeal and the Supreme Court.

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Examples of this are IEG v Zurich and Bolton versus MMI and CU Litigation that had different outcomes at the High Court, Court of Appeal and Supreme Court. More detail on these cases is covered in Section 5.2.

8.6.5. Legal developments: UK differences

There are some major differences in how asbestos claims are compensated across the UK, for example Scotland has higher average costs for mesothelioma claims due to loss of society awards. The law in Scotland covering such areas as dependency and limitation also varies from that in England and Wales. In some cases, Scottish awards are determined by precedent rather than statute, Scotland therefore presents a higher continuing risk of changes to mesothelioma awards.

There are also variations in Northern Ireland (for example, pleural plaques are compensable, as they are in Scotland).

There remains a possibility that England could adopt legislation enacted in other parts of the UK, however, the UK Government has no current plans to initiate consultation on the level of awards for wrongful death.

8.6.6. Inflation shocks

There can be one-off inflation shocks and long-term impacts, from:

- **Medical costs** – the cost of drugs/patent legislation, novel drugs on market;
- **Legal** – for example, a requirement for additional carers or components of damage;
- **Macroeconomic/political** – for example, Brexit, the impact of Governments responses to the COVID-19 pandemic; and
- **Default** – Failure of other (re)insurers and/or other compensators/loss of shares.

The mesothelioma cost scenarios developed by the Working Party has used a flat assumption for RPI and CPI for all future years. The Central cost scenario is based on a long-term view of RPI at 2.5% p.a. and CPI 0.5% lower than RPI. Practitioners should consider the short, medium and long term rates of RPI and CPI, especially given the recent increase in RPI from April 2021.

9. Mesothelioma EL Insurance Market Estimates

9.1. Range of Results

To arrive at the estimated number of mesothelioma claimants, the population deaths model described in Section 6 has been combined with the future claimant death ratio (propensity for a mesothelioma sufferer to make an insurance claim) scenarios described in Section 7. This provides an estimate of the number of claimants bringing insurance claims in each future year. The output from the models is split by age and year, which is then fed into the average cost per claim model described in Section 8. The age-specific average costs have then been applied to the number of claimants to determine the UK EL Insurance Market costs in each future year.

The population deaths model provides an estimate for GB male mesothelioma sufferers only. The propensities estimate the proportion of deaths that result in male claimants in GB, excluding claimants that make claims against the government[5] and any claims not related to employment. As a result, the outputs of the model are for future GB male claimants only, and the results need to

[5]Note that this differs to the approach taken in the 2009 AWP model where the propensities were calculated as the fraction of deaths resulting in male claimants in Great Britain, including claimants making claims against the Government. As such, in the 2009 model, a separate assumption was required for the fraction of claims that were made against the Government, which were then excluded from estimates of costs to the insurance industry.

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be scaled up the results to allow for (i) multiple claims per claimant, (ii) female claims and (iii) claims from Northern Ireland.

The adjustments discussed below are included in the results set out in this section and within the appendices.

9.1.1. Claims to claimants

The Working Party has assumed that there are 2 insurance claims for every mesothelioma claimant. This is consistent with experience over the past several years.

Applying this multiplier to the GB male insurance claimants produces an estimate of future mesothelioma insurance claims from males in Great Britain.

9.1.2. Female claims

The survey data collection suggests that female claims as a proportion of male claims have, on average, been just over 5% over the last several years (see Appendix F for more details). The Working Party has assumed that the uplift for female claims is 5.5%.

Applying this uplift to the GB male insurance claims produces an estimate of future mesothelioma insurance claims from both male and female claimants in Great Britain.

9.1.3. Northern Ireland claims

The proportion of mesothelioma deaths in NI to GB has been used to estimate the proportion of mesothelioma claims from NI (see Appendix F for more details). The Working Party has assumed that the uplift for NI claims is 1.75%.

Applying this uplift to the GB male and female insurance claims produces an estimate of future mesothelioma insurance claims from both male and female claimants in the UK.

9.2. Summary of Results

9.2.1. Scenarios considered

As described earlier, there is significant uncertainty surrounding the future emergence of mesothelioma insurance claims in the UK. In order to illustrate the range of possible outcomes, the Working Party has run a range of scenarios for each of the main model components (i.e. deaths, propensity to make an insurance claim and average costs) and has run, in total, 21 combinations of these scenarios in order to illustrate the possible range of outcomes.

With regard to the numbers of deaths, as described in Section 6, three main scenarios based on the HSE/HSL model have been produced: low, central and high. In each case, background deaths have been excluded. In addition, a separate scenario that includes background deaths, decreasing the propensities, has been considered. As an alternative to the HSE/HSL model, three (low, central and high) scenarios based on a GLM approach, also described in Section 7, have been considered.

As described in Section 7, three propensity scenarios (low, central and high), in addition to a Jump scenario, have been developed. Similarly, as described in Section 8, three average cost scenarios (low, central and high), as well as a Jump scenario, have been developed. These scenarios give a broad range of outcomes, with the lowest future Insurance Market cost estimated at £3.3 bn and the highest at £11.0 bn. The scenario outputs by year have been included in Appendix D.

The results of these 21 scenario combinations are for illustrative purposes only. Care should be taken when interpreting the scenario results. They include model selections and assumption sets which, whilst possible, would not be considered appropriate as a best estimate. The scenario results are not intended to define a set of possible outcomes or to indicate any percentiles that may be used in a stochastic range of results. Possible outcomes may fall outside of the range of results

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displayed. The quantification of the distribution of possible results has not been considered within this paper.

9.2.2. Results using the HSE model

The first set of scenario combinations use the Working Party's central deaths model. Table 54 shows 9 scenario combinations, combining each of the low, central, and high propensity and average cost scenarios with the central mesothelioma deaths scenario. As can be seen, these give rise to a range of £3.7 bn to £5.7 bn, with the central scenario showing an industry loss of £4.4 bn.

Table 54. Mesothelioma results 2020–2060 – adjusted HSE model (scenarios 1 to 9)

Mesothelioma UK EL Insurance Market Estimate (£m)		Low Cost Scenario	Central Cost Scenario	High Cost Scenario
Central Death Scenario	Low Propensity Scenario	£3,678 m	£4,004 m	£4,400 m
	Central Propensity Scenario	£4,016 m	£4,376 m	£4,816 m
	High Propensity Scenario	£4,689 m	£5,144 m	£5,705 m

9.2.2.1. Results using the HSE/HSL low and high scenarios. The figures represented in Table 55 show the results of alternative scenario combinations using the low and high deaths scenarios. These are combined with low, central, and high propensity and average cost scenarios. As can be seen, using the high scenarios for all three model components produce a market loss estimate as high as £8.1 bn, whereas using the low scenarios gives a loss of £3.3 bn.

Table 55. Mesothelioma results 2020–2060 – adjusted HSE model (scenarios 10 to 15)

Mesothelioma UK EL Insurance Market Estimate (£m)	Low Propensity and Cost Scenarios	Central Propensity and Cost Scenarios	High Propensity and Cost Scenarios
Adjusted HSE Low Death Scenario	£3,287 m	£3,876 m	£4,934 m
Adjusted HSE High Death Scenario	£4,835 m	£5,885 m	£8,068 m

A further scenario combination, using the HSE/HSL deaths model that includes background deaths (Scenario 16), has been considered. This scenario uses the same exposure decay as the central deaths scenario, Adjusted HSE: 2 (Central). This deaths scenario has been combined with the central propensity and average cost scenarios. However, the propensity across all ages has been scaled down by a constant amount such that the number of claimants in 2020 is consistent with the selection in the central scenario excluding background deaths. This scenario combination results in a market loss of £5.0 bn, compared to £4.4 bn if background deaths are excluded.

9.2.3. Jump scenarios

As discussed in Sections 7 and 8, "Jump" scenarios have been developed for both propensities and for average costs, which allow for, respectively, periodic step increases in propensity to claims and in inflation rates.

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Table 56 shows the outcome of these scenarios when combined, individually, with the central (HSE/HSL based) deaths scenario and the central propensity or average cost scenarios. Table 56 also shows how these results compare to those using the central scenario. As can be seen, the propensity Jump scenario results in a materially higher outcome, over £2.2 bn higher, than using the central scenario. The average cost Jump scenario is also materially higher at £0.6 bn, although less significantly so.

Table 56. Mesothelioma results 2020–2060 – jump scenarios (scenarios 17 to 18)

Mesothelioma UK EL Insurance Market estimate (£m)	Mesothelioma Estimate	Change Compared to Central Scenario
Jump Propensity Scenario	£6,612 m	+£2,236 m
Jump Average Cost Scenario	£5,061 m	+£685 m

9.2.4. Using the GLM age-birth model

The results have been derived using the Working Party Adjusted GLM Age-Birth model for the population deaths. As noted in Section 6, three GLM scenarios (low, central, and high) have been considered. These have been combined with the respective low, central, and high propensity and average cost to produce the range of outcomes shown in Table 57.

Table 57. Mesothelioma results 2020–2060 – GLM Age-Birth model (scenarios 19 to 21)

Mesothelioma UK EL Insurance Market estimate (£m)	GLM Low	GLM Central	GLM High
Combined with corresponding Propensity and Cost Scenarios	£3,788 m	£5,802 m	£11,022 m

Each of the GLM scenarios was scaled such that the number of claimants in 2020 was equal to the equivalent scenario combinations based on the HSE/HSL model. In each case, it resulted in greater Insurance Market cost estimates than using the equivalent HSE/HSL deaths model.

It should be noted that the GLM approach is more simplistic than the HSE/HSL model and, for example, does not have the flexibility to allow explicitly for changing exposures. The GLM model also does not separately estimate background mesothelioma deaths. The strengths and limitations of the GLM model are discussed in more detail in Section 6.4.3.

9.3. Comparison to 2009 Working Party Results

The 2009 Working Party Scenario 23 estimate of the cost to the UK EL Insurance Market for mesothelioma claims notified between 2020 and 2050 was £7.3 bn. The Working Party has now estimated that the undiscounted cost of UK mesothelioma-related claims to the UK EL Insurance Market for the period 2020 to 2060 could be around £4.4 bn. Of this figure, £4.2 bn relates to the period 2020 to 2050, which is £3.1 bn less than the estimate of £7.3 bn for the same period that was presented in the 2009 paper (as per Scenario 23). The estimate made in 2009 did not include periods after 2050.

The key drivers of this reduction are as follows:

1. Although the peak of deaths is higher in the latest projection, the run-off in the tail is faster. This is a combination of changes by the HSE/HSL to their model parameters, including the

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age cap on the *k* factor that the Working Party modelled in their 2009 estimate, and the removal of deaths predicted by background exposure (as these are unlikely to result in a successful EL claim).
2. The use of a static propensity of mesothelioma sufferers to make an insurance claim by age band, which reduces the claims in the tail of the projection. This is based on the evidence from the Compensation Recovery Unit (CRU), which shows a reducing propensity by age over the last 6 years.
3. Lower average costs, principally due to the reduced court inflation on general damages.

Table 58 gives an approximate analysis of change from the 2009 Scenario 23 estimate to the 2012 Scenario 5 estimate (i.e. central HSE deaths scenarios combined with central propensity and average costs scenarios).

Table 58. Mesothelioma analysis of change between 2009 and 2020 estimates

Mesothelioma UK EL Insurance Market Estimate	2009–2050	> = 2020	Impact (£)	% impact
2009 – Scenario 23	**£10,104 m**	**£7,275 m**	**n/a**	**n/a**
Change in Propensities			−£1,431 m	−19.7%
Change in deaths			−£644	−8.9%
Change in average costs			-£1,243 m	−17.1%
Other changes			+£79 m	+1.1%
Include deaths >89			+£165 m	+2.3%
Extend to 2060			+£174 m	+2.4%
2020 – Scenario 5		**£4,376 m**	**−£2,899**	**−39.8%**

9.3.1. Scenarios

The 2009 Working Party produced 75 mesothelioma scenarios, by combining the 5 mesothelioma death projections, 5 prosperity scenarios and 3 inflation scenarios. This resulted in a range of mesothelioma UK EL Insurance Market estimates from £2.5 bn to £25.0 bn (for the years 2020 to 2050).

In contrast, the 21 scenario combinations considered in this paper give a range of £3.3 bn to £11.0 bn. A direct comparison of these ranges is not possible, given the greater number of scenario combinations considered in 2009, including scenarios using 5 different deaths models.

Nevertheless, a narrowed range would be expected, given that actual experience in the intervening period has not been as extreme as the scenarios at the lower and upper ends of the range from 2009, making such scenarios no longer plausible.

10. Estimating UK EL Non-Mesothelioma Claims

The Working Party has estimated the UK EL Insurance Market cost for the following non-mesothelioma diseases: lung cancer; asbestosis and pleural thickening; and pleural plaques. Asbestosis and pleural thickening claims have been combined together for the purposes of projecting. This is based on the similarity of their claim characteristics, and that in recent years the claim types have been used interchangeably. For each of the disease types an average cost per claim methodology has been used.

For each disease type the Working Party has constructed a range of scenarios:

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- Three claim number scenarios have been constructed based on scaling the 3 mesothelioma deaths scenarios based on the HSE model (i.e. the Working Party adjusted HSE Scenarios 1 to 3 scenarios). These scenarios are referred to as Scenarios 1 to 3, with Scenario 2 being the central scenario and Scenarios 1 and 3 being alternative lower and higher scenarios, respectively. A fourth claim number scenario based on the Working Party's previous projections has also been produced. In the case of lung cancer and asbestosis and pleural thickening, scenario number 2 from the Working Party's 2009 report has been used, and for pleural plaques (relating to Scottish and Northern Irish exposures) scenario number 2 from the Working Party's 2004 projections for pleural plaque claims has been used. In all cases, claim number projections have been scaled to the most recent experience (and in the case of the pleural plaque projection, the pattern has been shifted forward).
- Three average cost scenarios, based a range of starting average costs with inflation at 1%, 3%, and 5% per annum, have been crested. These are referred to as scenarios A, B, and C, with B being the central scenario and Scenarios A and C being alternative lower and higher scenarios, respectively.

Table 59 shows the results for all non-mesothelioma diseases combined.

Table 59. Non-mesothelioma insurance estimates (2020 to 2060)

Non-mesothelioma UK EL Insurance Market estimate (£m)	Claim Number Scenario 1	Claim Number Scenario 2	Claim Number Scenario 3	Claim Number Scenario 4
Cost Scenario A	£237 m	£395 m	£601 m	£395 m
Cost Scenario B	£325 m	£559 m	£864 m	£561 m
Cost Scenario C	£401 m	£713 m	£1,123 m	£719 m

It should be noted that the estimates for each non-mesothelioma disease above represent the range of possible outcomes but do not define the range. They are not intended to suggest "optimistic" or "pessimistic" scenarios, or an upper or lower bound.

The following sections detail the number of claim and cost assumptions used for each non-mesothelioma diseases.

10.1. Overview of Approach

The Working Party has taken a more high-level approach to estimating the UK EL Insurance Market cost from each non-mesothelioma disease as:

1. There does not exist any publicly available epidemiological models for non-mesothelioma diseases to build a projection of claim numbers
2. They have shorter average latency periods than mesothelioma
3. There is limited to no data that will allow the measurement of the propensity to make a claim for these disease types, which also makes it difficult to separate out epidemiological and non-epidemiological impacts to the number of claims
4. Overall non-mesothelioma asbestos claims are a smaller proportion of total asbestos reserves of either the 2009 Insurance Market estimate[6] or individual insurers reserves, compared to mesothelioma claims.

[6]Using the 2009 Mesothelioma Scenario 23, the combined non-mesothelioma 2009 scenario 2Bs are 12% of the total estimate, with the combined 1As and 3Cs making up 5% and 38%, respectively. Note that the non-mesothelioma estimates are based a prudent average cost as discussed in Section 3.3.6.

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As a result, the Working Party has constructed the four claim number projections based on judgment. As noted above, these scenarios are based on scaling different mesothelioma deaths patterns. For each scenario, the number of claims the market is expected to receive in 2020 has been selected. This defines the scaling factor for the first year of the projection. For subsequent years the ratio of claims for that claim type to the number of mesothelioma claims (as per the selected pattern) has been selected judgmentally. Generally, it has been assumed that the ratio of non-mesothelioma claims to mesothelioma deaths will decrease over time to allow for the difference in average latency, although the speed of this decrease in each of the scenarios has been varied. It's worth noting that the scaling is also intended to implicitly allow for the propensity to claim.

The Working Party has selected 3 average cost scenarios based on the recent experience of settled claims (on a reporting and settlement year basis) and incurred claims, based on the 2019 year-end survey data. Using this historical data, average costs for the 2020 notification year have been selected. As noted above, Scenario B is the central estimate and Scenarios A and C represent lower and higher alternatives. All scenarios are intended to be plausible selections based on the historical data. For subsequent notification years these average cost selections have been inflated using constant rates of inflation. For Scenario A, 1% per annum has been selected, 3% for Scenario B and 5% for Scenario C. Given past experience, the Working Party believes that the inflation rates selected represent a reasonable range of alternative possible future inflation rates across the different disease types. However, it is a pragmatic selection and inflationary pressures may vary between disease types. Practitioners are advised to exercise their own judgement in their choice of inflation assumptions.

The selected numbers and average costs include nil claims. Based on the analysis in Appendix J the historical trends on nil rates have been reasonably stable for each disease type. Therefore, it is assumed that this experience will continue into the future.

The Working Party's "new Insurance Market estimate", published in December 2020, included new central estimates of market costs for each of the non-mesothelioma disease types. Whilst those results are analogous to those of claim number projection Scenario 2 and average cost per claim Scenario B in this report, they are not the same. This reflects the fact that, since December 2020, the Working Party has received the 2019 market survey data and this has been used to update the 2020 claim number and average cost selections in some cases. However, the run-off pattern selected for Scenario 2 (from 2020 onwards) has not been changed, so Practitioners that are using the pattern in conjunction with their own average cost per claim selection, will not see a change as a result of adopting the pattern from Scenario 2. A summary of the changes is as follows:

- Lung cancer – the number of reported claims in 2019 was almost 30% higher than expected. This has led us to increase the Working Party's claim number selection for 2020, and as a result for subsequent years. We have also increased our average cost per claims selection by around 10%. Overall, our central estimate of industry costs has increased by just over 30%.
- Asbestosis and pleural thickening – selected claim numbers for 2020 are slightly lower and average costs slightly higher but, overall, results have not changed materially.
- Pleural plaques – reported claim numbers for 2019 were around 5% less than expected and we have reduced our projected by a similar proportion. On the other hand, we have increased our average cost selection from £5,500 to £7,500 as average costs for settlements in 2019 were materially higher than prior years. Overall, our estimates for pleural plaques have increased by about 24%.

10.2. Asbestos-Related Lung Cancer

Table 60 demonstrates a cross-section of such outcomes combining the number and cost scenarios.

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Table 60 Lung cancer insurance estimates (2020 to 2060)

Asbestos-related lung cancer	Claim Number Scenario 1	Claim Number Scenario 2	Claim Number Scenario 3	Claim Number Scenario 4
Cost Scenario A	£63 m	£100 m	£167 m	£115 m
Cost Scenario B	£78 m	£129 m	£220 m	£149 m
Cost Scenario C	£93 m	£161 m	£283 m	£188 m

10.2.1. Asbestos-related lung cancer: Number of claims

The Working Party summary data survey provided the number of reported asbestos-related lung cancer claims from 1998 to 2019, for the companies able to provide this data. It was estimated that this survey covered 80% of the UK EL Insurance Market. The total number of reported UK asbestos-related lung cancer claim numbers was estimated by grossing up the survey data.

As can be seen by the black line in Figure 77, this indicated that the number of reported lung cancer insurance claims in the UK may have peaked at around 560 in 2012. Since 2012, the number of claims has followed a downward trend, although there was a notable uptick of claims in 2019, when claims notified were estimated to total 429. For the purposes of our central estimate scenario (Scenario 2), as well as for Scenario 4, we have assumed that claim numbers in 2020 will fall back to 380, which is approximately the average of the prior 3 years. For Scenario 1 we have assumed numbers in 2020 will drop slightly further to 360, and for Scenario 3 we have assumed that the upward trend since in 2019 will continue and that 450 claims would be notified.

For subsequent notification years, projected lung cancer claim numbers are determined by judgementally scaling the mesothelioma patterns used for each scenario. The scaling factors selected for each scenario are shown in Figure 78. Our selection of the scaling factors for each scenario were as follows:

- Scenario 1: This scenario assumes that future claims are scaled to the pattern from the Working Party adjusted HSE Scenarios 3 and is intended to give the lowest number of future claims. We have assumed that the ratio of lung cancer to mesothelioma trend will continue to decrease sharply, although the rate of decrease will slow over time.
- Scenario 2: This scenario is based on the Working Party adjusted HSE Scenario 2, the central scenario for mesothelioma deaths. We have assumed that the ratio of lung cancer to mesothelioma claims will decline linearly, reaching zero in 2050.
- Scenario 3: This scenario assumes that future claims are scaled to the pattern for mesothelioma from the Working Party adjusted HSE Scenarios 1. This scenario is our highest scenario and we have selected ratios that intentionally give a second peak of claims, continuing the sharp upward trend since in 2019. We have selected scaling factors that increase up to 2022 before falling back following a linear trend until the late 2040s, then gradually tailing off through to 2060.
- Scenario 4: This scenario is based on the number 2 scenario for lung cancer claims from the Working Party's 2009 paper. We have simply scaled that pattern such that the number of claims in 2020 is consistent with our current selection, which has meant increase the claim numbers from 2009 (at each future year) by about 10%.

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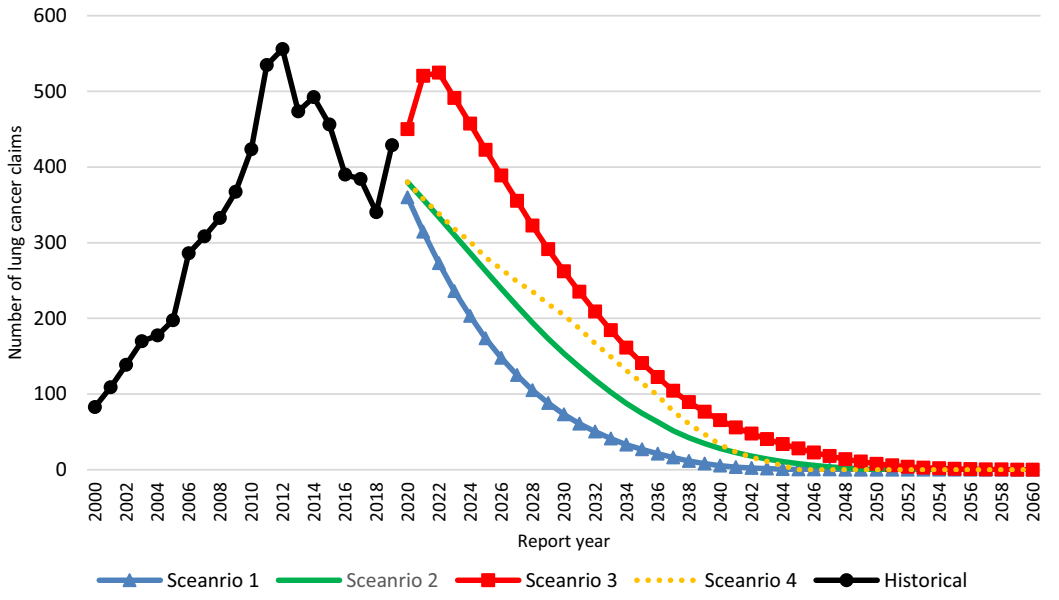


Figure 77. Number of claims: lung cancer.

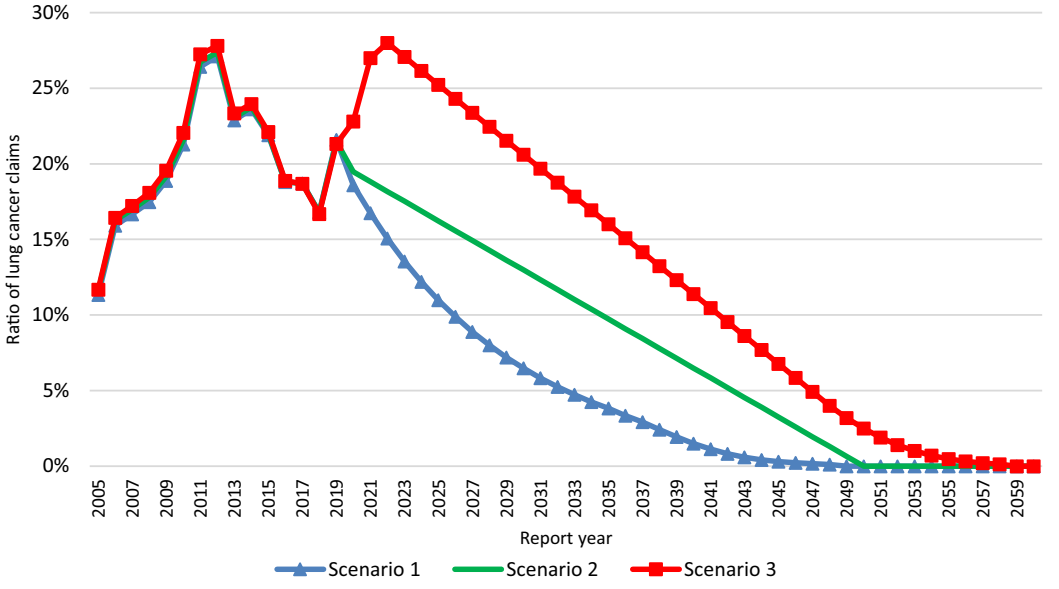


Figure 78. Lung cancer ratios to selected mesothelioma pattern.

10.2.2. Asbestos-related lung cancer: Average cost and inflation

Figure 79 plots average costs per claim incurred and settled (on a notification year basis), as well as settled amounts on a settlement year basis, based on the data from our survey. Historical inflation at an assumed rate of 3% per annum has been added to the figures in Figure 79 so that they are, approximately, on a 2020 cost basis. This inflation assumption is thought to be reasonable and a constant inflation rate was selected for the sake of simplicity, but we recognised that, in practice, the inflation rate would have varied over the period.

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As can be seen, average incurred costs appear high for recent years but these would be expected to reduce as some claims ultimately settle for less than reserves, including some at nil cost. Due to delays in settling claims, claims settling in any given year may come from a range of prior notification years. For recent notification years, average settlement amounts appear low, but this reflects the fact that large claims may be yet to settle and they would be expected to increase over time. For this reason, when looking at averages of notification year amounts we have typically excluded the most recent three years.

For our central selection of average cost for 2020 (i.e. Cost Scenario B) we have selected £28,000. Allowing for inflation, this is approximately the average cost of claims settled in the last few years. Looking at notification year averages (excluding the most three years) would suggest a slightly lower average cost, around £25,000, which we have used for Cost Scenario A. For Cost Scenario C we have selected £30,000.

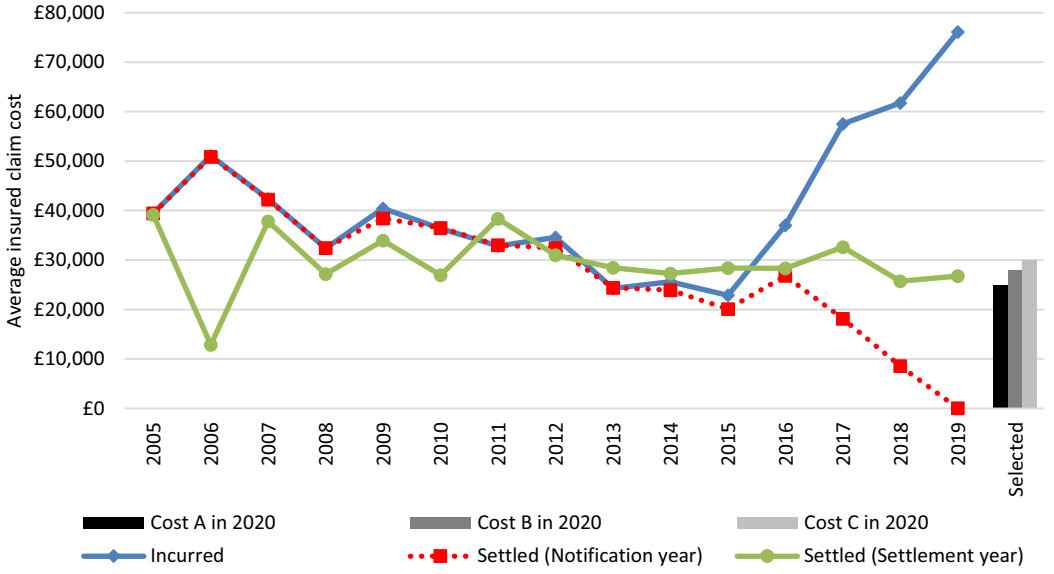


Figure 79. Lung cancer average cost per claim selections (including nil claims).

10.2.3. Asbestos-related lung cancer: Comparison to 2009 Working Party Results

Table 61 compares the low, central, and high scenarios against the corresponding scenarios from the 2009 Insurance Market estimates (over 2020 to 2060). Note that none of the 2009 scenarios allowed for claims post 2050. Only the 2020 high scenario (Scenario 3) allows for any claims post 2050.

Table 61. Lung cancer insurance estimates comparison (2020 to 2060)

Asbestos-Related Lung Cancer (2009 versus 2020)	2009 Estimate (£m)	2020 Estimate (£m)	Difference (£m)	Difference %
Scenario A1 versus A1	43	63	20	47%
Scenario B2 versus B2	286	129	(158)	(55%)
Scenario B2 versus B4	286	149	(137)	(48%)
Scenario C3 versus C3	1,482	283	(1,199)	(81%)

Comparing the central scenarios (i.e. B2), our revised estimate has reduced by 55% compared to 2009. This is principally due to a significantly reduced selected average cost for lung cancer claims. Our latest

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central estimate for claims reported in 2020 is about £28 k, whereas the 2009 average cost selection for 2020 was approximately £59 k. We have also assumed that claims will tail off slightly more quickly than had been assumed in the 2009 projection. As can be seen, by comparing the 2009 B2 Scenario to the latest B4 Scenario, had we continued to use the same run-off profile as was used in 2009, our results would have been slightly higher, although still 48% less overall than had been projected in 2009.

Comparing the low scenarios (i.e. A1), our low is now 47% higher than previously. This reflects the fact that the 2009 low scenario projected claim numbers to be considerably lower than has actually been the case in the preceding years. Likewise, the high scenario (i.e. C3) is now more than 80% lower. This is because the 2009 high scenario projected claim numbers far higher than have actually been the case, with a considerably later peak in 2018. The range of possible outcomes represented by our scenario selections, whilst still quite wide reflecting the remaining uncertainty, have narrowed considerably since 2009.

10.3. Asbestosis and Pleural Thickening

Table 62 shows the full range of results from combining our claim number and cost scenarios for asbestosis and pleural thickening claims.

Table 62. Asbestosis and pleural thickening insurance estimates (2020 to 2060)

Asbestosis and Pleural Thickening	Claim Number Scenario 1	Claim Number Scenario 2	Claim Number Scenario 3	Claim Number Scenario 4
Cost Scenario A	£165 m	£275 m	£404 m	£272 m
Cost Scenario B	£234 m	£404 m	£603 m	£402 m
Cost Scenario C	£292 m	£519 m	£788 m	£519 m

10.3.1. Asbestosis and pleural thickening: Number of claims

As per the lung cancer claims, the Working Party has compiled data for the number of asbestosis and pleural thickening claims reported to the market historically based on its market survey. As noted above, it was estimated that this survey covered 80% of the UK EL Insurance Market and the total number of reported claims was estimated by grossing up the survey data.

As can be seen by the black line in Figure 80, claim numbers peak at around 3,600 in 2005 and fell back subsequently, although there was then a smaller peak of around 2,700 claims reported in 2013. Through to 2016, claim numbers fell each year, but since that time have remained fairly constant at just over 2,000 claims per year.

For the purposes of our central estimate scenario (Scenario 2), as well as for Scenario 4, we have assumed that claim numbers in 2020 will fall slightly to 1,980. For Scenario 1 we have assumed numbers in 2020 will drop slightly further to 1,900, and for Scenario 3 we have assumed that claim numbers will be slightly higher at 2,200.

For subsequent notification years, projected lung cancer claim numbers are determined by judgementally scaling the mesothelioma patterns used for each scenario. The scaling factors selected for each scenario are shown in Figure 81. Our selection of the scaling factors for each scenario were as follows:

- Scenario 1: This scenario assumes that future claims are scaled to the pattern from the mesothelioma the Working Party adjusted HSE Scenarios 3 and is intended to give the lowest number of future claims. We have assumed that the ratio of lung cancer to mesothelioma trend will decrease quite quickly, although the rate of decrease will slow over time.
- Scenario 2: This scenario is based on the Working Party adjusted HSE Scenario 2, the central scenario for mesothelioma deaths. We have assumed that the ratio of lung cancer to mesothelioma claims will reduce steadily, reaching zero in mid-2040s.
- Scenario 3: This scenario assumes that future claims are scaled to the pattern from the mesothelioma for the Working Party adjusted HSE Scenario 1. This scenario is our highest

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scenario and we have selected ratios that intentionally give a further peak of claims, albeit only at levels slightly higher than those seen in recent years.

- Scenario 4: This scenario is based on the number 2 scenarios for asbestosis and pleural thickening claims combined from the Working Party's 2009 paper. We have simply scaled that pattern such that the number of claims in 2020 is consistent with our current selection, which has meant increasing the claim numbers from 2009 (at each future year) by about 80%.

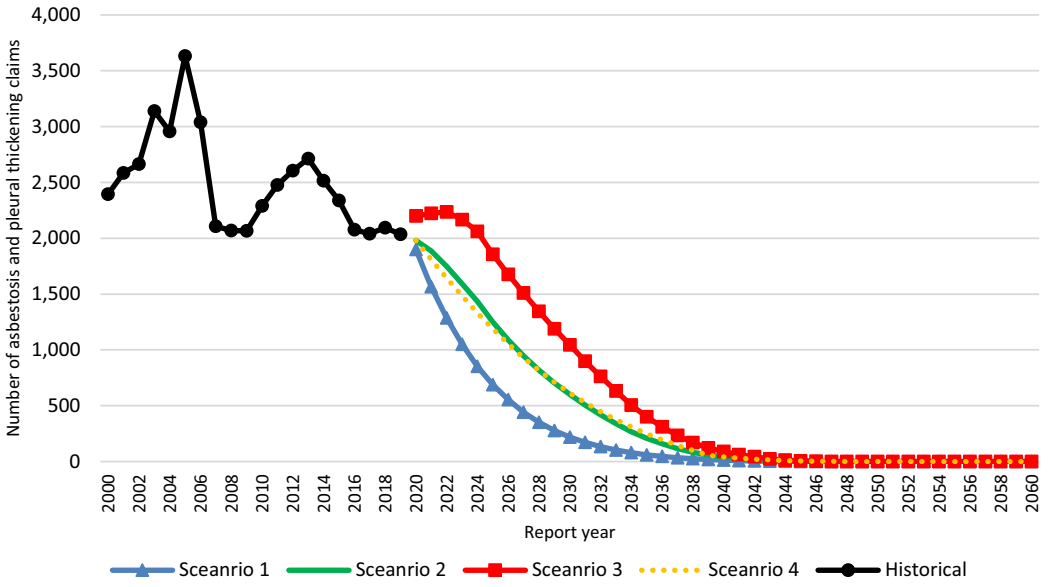


Figure 80. Number of claims: asbestosis and pleural thickening.

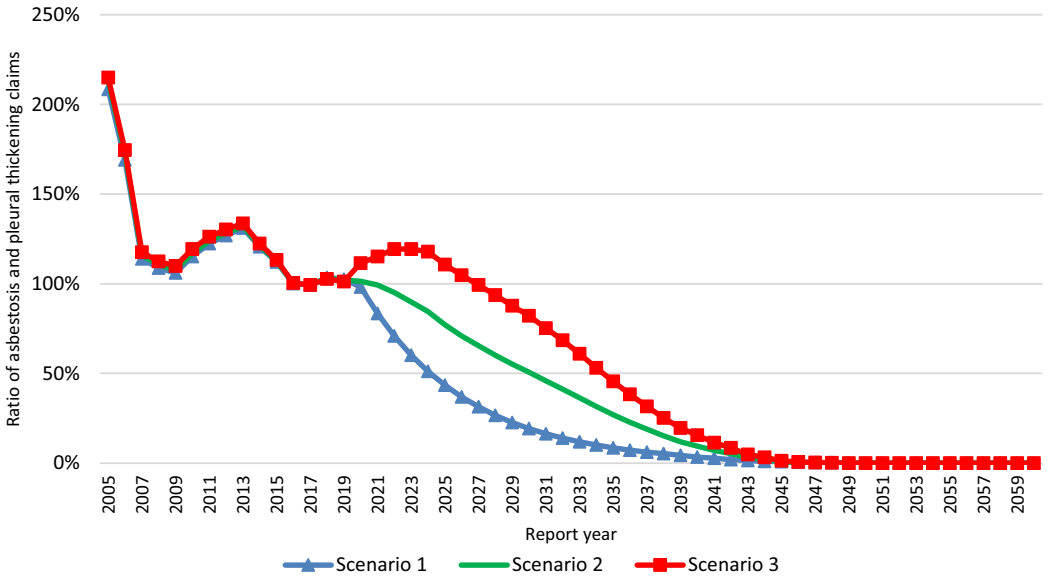


Figure 81. Asbestosis and pleural thickening ratios to selected mesothelioma pattern.

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We note that the experience of relatively constant claim numbers reported in the last several years makes projecting the future trend in claim numbers more challenging. Whilst the number will ultimately start to decrease, whether it will decrease as quickly (or indeed quicker than) implied by Scenario 2, or continue at the current rate for a period of time, remains to be seen. The Working Party did consider allowing for a further few years of constant claims numbers in its Scenario 2 selection, which would have caused a material increase in the overall estimate of industry costs. Practitioners will want to consider the recent pattern of development in their own portfolios prior before making a judgement about the suitability of the scenarios presented above.

10.3.2. Asbestosis and pleural thickening: Average cost

Figure 82 plots average costs per claim on the same basis as shown with lung cancer claims above, again using historical inflation at an assumed rate of 3% per annum. The general comments made above in relation to interpreting Figure 82 for lung cancer average costs are also applicable here.

For our central selection of average cost for 2020 (i.e. Cost Scenario B) we have selected £21,000. Allowing for inflation, this is approximately the average cost of claims settled in the last four years. Whereas there was a trend from 2012 onwards of average settled amounts reducing, averages have shown an increasing trend since 2016. Looking at notification year averages (excluding the most three years) would suggest a lower average cost, around £16,000, which we have used for Cost Scenario A. For Cost Scenario C we have selected £24,000.

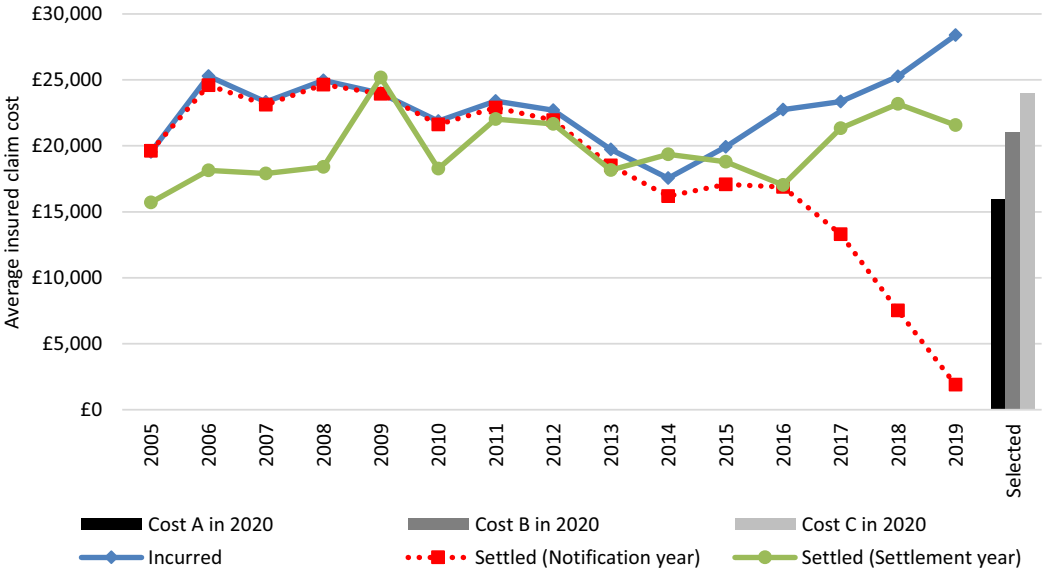


Figure 82. Asbestosis and pleural thickening average cost per claim selections (including nil claims).

10.3.3. Asbestosis and pleural thickening: Comparison to 2009 Working Party Results

Table 63 compares the lowest, central and highest scenarios against the corresponding scenarios from the 2009 Insurance Market estimates (over 2020 to 2050). Note that none of the 2009 or latest scenarios allowed for any claims post 2050.

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Table 63. Asbestosis and pleural thickening insurance estimates comparison (2020 to 2050)

Asbestosis and Pleural Thickening (2009 versus 2020)	2009 Estimate (£m)	2020 Estimate (£m)	Difference (£m)	Difference %
Scenario A1 versus A1	58	165	106	183%
Scenario B2 versus B2	288	404	116	40%
Scenario B2 versus B4	288	402	114	40%
Scenario C3 versus C3	1,245	788	(457)	(37%)

As can be seen from Table 63, our central estimate (i.e. B2) has increased by 40%. This is driven by expected claim numbers since 2009 tailing off less quickly than had been expected, leading us to select numbers of claims for 2020 to be 80% higher than implied by the 2009 selection. This is offset to some extent by a lower average cost per claim selection. Our selection for claims notified in 2020 is currently £21 k whereas our selection made in 2009 implied average costs of around £27 k in 2020. Note that we have not materially changed the shape of our central estimate loss notification pattern since 2009, as can be seen by scenario B4 giving very similar results to B2.

As with the lung cancer claims, our latest range of results for asbestosis and pleural thickening claims has narrowed since 2009, as would be expected. The low selection (A1) is substantially increased large due to increased claim numbers as the 2009 scenario had numbers tailing off far more quickly than has actually been the case. On the other hand, our revised C3 selection is substantially reduced largely as a result of a lower average cost selection.

10.4. Pleural Plaques

Table 64 shows the full range of results from combining our claim number and cost scenarios for asbestosis and pleural thickening claims.

Table 64. Pleural plaque insurance estimates (2020 to 2060)

Pleural Plaques	Claim Number Scenario 1	Claim Number Scenario 2	Claim Number Scenario 3	Claim Number Scenario 4
Cost Scenario A	£10 m	£20 m	£30 m	£8 m
Cost Scenario B	£13 m	£26 m	£41 m	£10 m
Cost Scenario C	£16 m	£33 m	£52 m	£12 m

10.4.1. Pleural plaques: Number of claims

In 2007 the House of Lords ruled that anyone who had developed pleural plaques following exposure to asbestos during the course of employment would no longer be able to claim compensation. However, in 2009 the Scottish government passed legislation allowing Scottish people to claim compensation for pleural plaques. The Northern Ireland Assembly passed similar legislation in 2011. As such, pleural plaques are currently only considered a compensable injury in Scotland and Northern Ireland and not in England or Wales, and our projections have been made on the basis that this will continue to be the case.

As can be seen by the black line in Figure 83, reported claim numbers increased steadily from their low in 2007 following the introduction of the Scottish and Northern Irish legislation, and reached a peak of over 400 claims in 2017. Numbers fell back substantially to fewer than 300 in 2018, but increased again to around 350 in 2019.

Due to the legislative developments outlined above, pleural plaque claims are perhaps the most challenging of the disease types to project. Furthermore, the asymptomatic nature of pleural plaques means claim frequencies are driven to a larger extent by the activities of claimant law firms rather than the onset of disease. As such, is it unclear whether claim numbers have yet peaked.

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For the purposes of our central estimate scenario (Scenario 2), as well as for Scenario 4, we have assumed that claim numbers in 2020 will remain at similar levels to those seen in 2019, at 350 claims. For Scenario 1 we have assumed numbers in 2020 will drop to 300, and for Scenario 3 we have assumed that claim numbers will be higher at 400.

As for the other disease types, we have projected future pleural plaque claim numbers by judgementally scaling the mesothelioma patterns used for each scenario. The scaling factors selected for each scenario are shown in Figure 84. Our selection of the scaling factors for each scenario were as follows:

- Scenario 1: This scenario assumes that future claims are scaled to the pattern from the mesothelioma for the Working Party adjusted HSE Scenario 3 and is intended to give the lowest number of future claims. We have assumed that the ratio of pleural plaque to mesothelioma will trend to decrease sharply, although the rate of decrease will slow over time such that claims will cease in the early 2040s.
- Scenario 2: This scenario is based on the Working Party adjusted HSE Scenario 2, the central scenario for mesothelioma deaths. We have assumed that the ratio of pleural plaque to mesothelioma claims will remain broadly constant over the next few years before declining steadily, reaching zero in the early 2040s.
- Scenario 3: This scenario assumes that future claims are scaled to the pattern from the mesothelioma the Working Party adjusted HSE Scenario 1. This scenario is our highest scenario and we have selected ratios that result in pleural plaque claim numbers not peaking until 2023. We have selected scaling factors that increase up to 2023 before falling back following a steady trend until reaching zero in the earlier 2040s.
- Scenario 4: This scenario is based on the number 2 scenario for lung cancer claims from the Working Party's 2004 paper. Given the legislative situation at the time, no projection was made for pleural plaque claims in 2009. We have shifted forward that pattern such that its peak is in 2020 and then we have simply scaled the pattern such that the number of claims in 2020 is consistent with our current selection, which has meant decreasing the claim numbers from 2009 (at each future year) by about 97.5% (reflecting the fact that a much greater volume of pleural plaque claims was expected at that time, in particular from England and Wales).

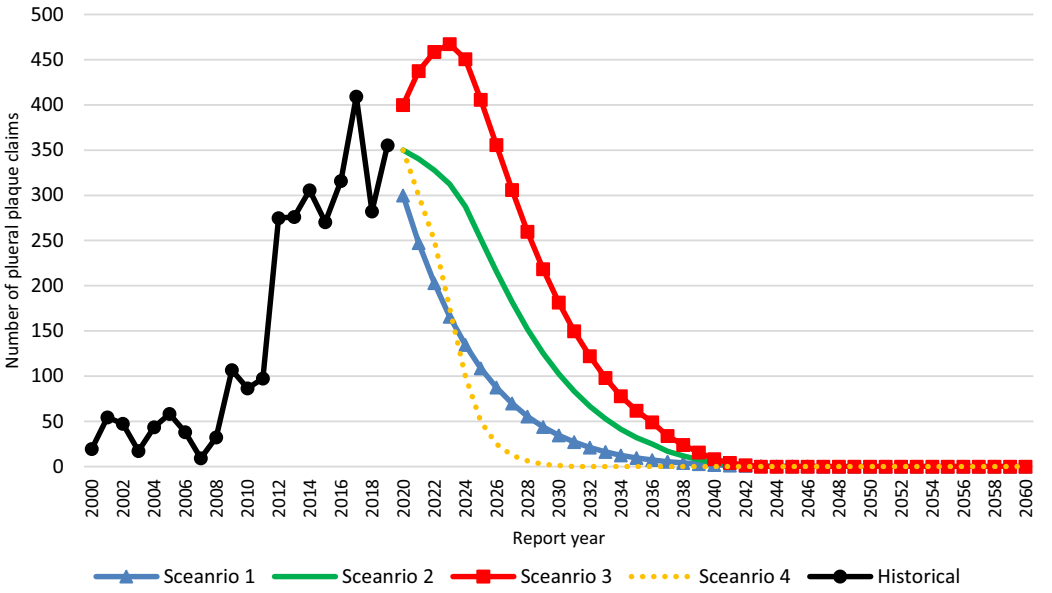


Figure 83. Number of claims: pleural plaques.

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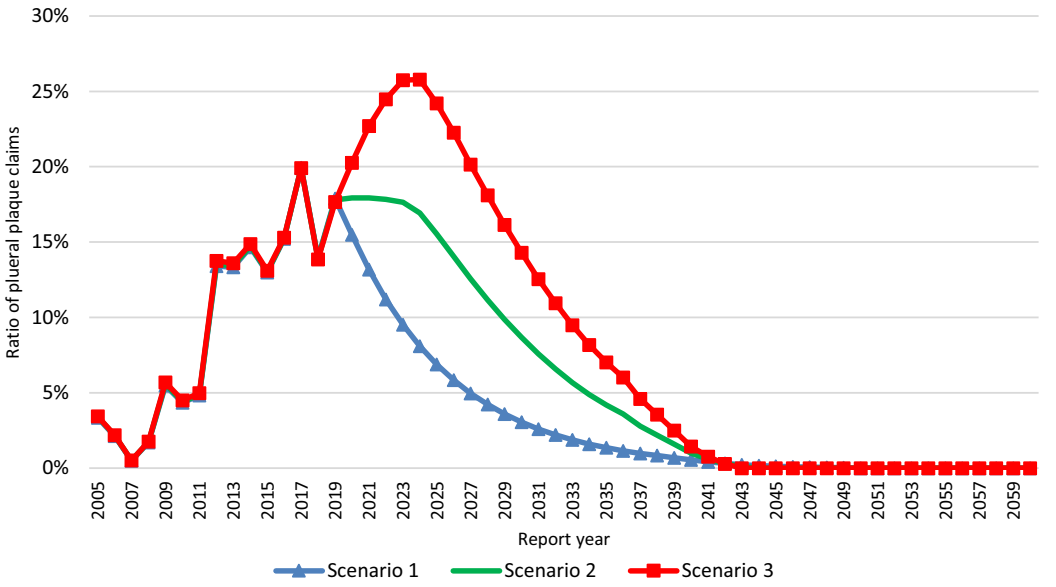


Figure 84. Pleural plaque ratios to selected mesothelioma pattern.

10.4.2. Pleural plaques: Average cost

Figure 85 plots average costs per claim on the same basis as shown with lung cancer claims above, again using historical inflation at an assumed rate of 3% per annum. The general comments made above in relation to interpreting the figures in the graph for lung cancer average costs are also applicable here.

For our central selection of average cost for 2020 (i.e. Cost Scenario B) we have selected £7,500. On a settlement year basis, averages had been running at around £6,000 for years 2013–16, although notification years 2017–18 currently have a higher average amount (over £7,000). On a settlement year basis, the average has also increased (to over £8,000 in 2019). Our selection of £7,500 allows for a potential increasing trend. For Cost Scenario A we have used £6,250, in line with the notification year average over 2013–16, and for cost Scenario C we have selected £8,500, in line with the latest settlement year.

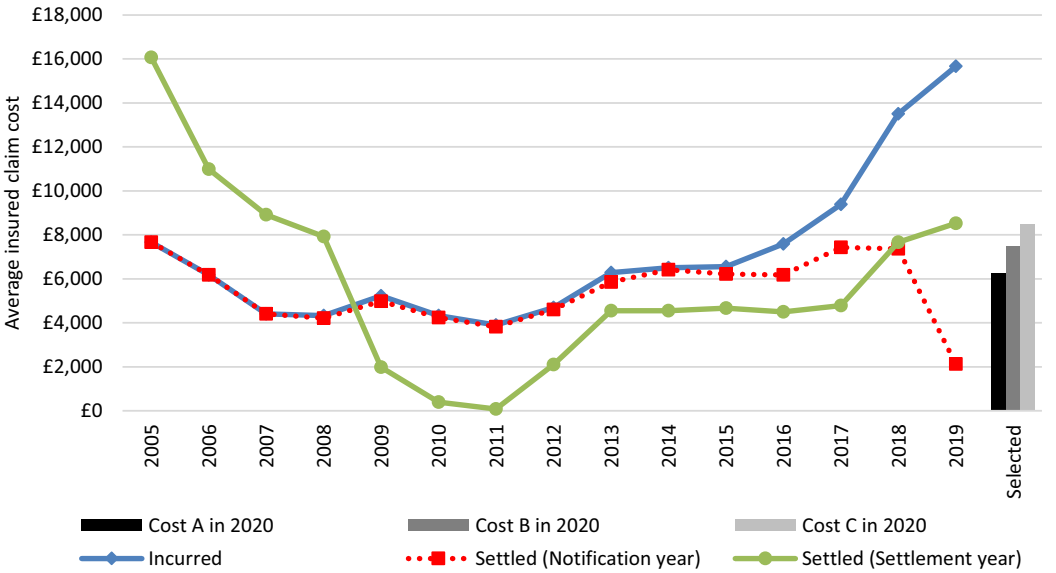


Figure 85. Pleural plaque average cost per claim selections (including nil claims).

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10.4.3. Pleural plaques: Comparison to 2009 Working Party Results

Given that there were no pleural plaque claim projections in the 2009 Paper and that the projections in the 2004 Paper were based on pleural plaque claims from all of the UK, we cannot compare the results.

11. Total UK EL Insurance Market Estimate

This section brings together the selected results for the individual disease types described in Section 9 (mesothelioma) and 10 (non-mesothelioma).

Table 65 illustrates the range of results that can be generated for all disease types combined. We have combined the low, central, and high deaths and propensity assumptions for the mesothelioma scenarios with the respective low, central and high claim number scenarios for the non-mesothelioma scenarios and, for each, we have shown the results using the respective low, central, and high cost scenarios. In order the encompass the full range of results from our projections, we have shown this using both the HSE/HSL based mesothelioma deaths projections, and the GLM projections.

It should be noted that the numbers are intended to represent a range of potential estimates and not a range from low to high. These projections are highly uncertain, and it is possible that the ultimate cost could be outside of this range.

Table 65. Total UK EL Insurance Market estimate (£m)

Mesothelioma Scenario (Deaths and Propensity)	Non-Mesothelioma Scenario (Claim Numbers)	Cost Scenario A (Low)	Cost Scenario B (Central)	Cost Scenario C (High)
Adjusted HSE: 3 (Low)	**Scenario 1 (Low)**	£3,524 m	£4,201 m	£5,335 m
Adjusted HSE: 2 (Central)	**Scenario 2 (Central)**	£4,411 m	£4,935 m	£5,529 m
Adjusted HSE: 1 (High)	**Scenario 3 (High)**	£5,436 m	£6,749 m	£9,191 m
GLM Age-Birth: Low	**Scenario 1 (Low)**	£4,025 m		
GLM Age-Birth: Central	**Scenario 2 (Central)**		£6,361 m	
GLM Age-Birth: High	**Scenario 3 (High)**			£12,145 m

As described in Section 9, the outcomes encompassed by the 21 mesothelioma scenarios range from a lowest future UK EL Insurance Market cost estimate of £3.3 bn to the highest of £11.0 bn. Combining these with the lowest and highest non-mesothelioma projections gives an overall lowest EL UK Insurance Market cost estimate of £3.5 bn and a highest of £12.1 bn.

As noted within the mesothelioma results section, the results of the scenarios are for illustrative purposes only. Care should be taken when interpreting the scenario results. They include model selections and assumptions sets which, whilst possible, would not be considered appropriate as a best estimate. The scenario results are not intended to define a set of possible outcomes or to indicate any percentiles that may be used in a stochastic range of results.

Possible outcomes may fall outside of the range of results displayed. The quantification of the distribution of possible results has not been considered within this paper.

11.1. Comparison to 2009 Working Party Results

In Table 66, we compare our central estimate results in total for mesothelioma and non-mesothelioma claims combined to those from the 2009 analysis (i.e. using Scenario 23 for

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mesothelioma claims and the B2 scenarios for non-mesothelioma claims). When comparing results with those from the 2009 Working Party it should be noted that:

- The 2009 Working Party Scenario 23 estimate related to the cost to the UK EL Insurance Market for mesothelioma claims notified up to 2050 only, whereas the 2020 Working Party central estimate allows for claims to be notified through to 2060. Note that the figures shown below are, in all cases, for notification years 2020 and post.
- There were no pleural plaque claim projections in the 2009 Paper.

Table 66. Comparison of central estimate results

Mesothelioma UK EL Insurance Market Estimate	2009 Scenario 23 and B2*	2020 Central Estimate†	Impact	% impact
Mesothelioma	£7,275 m	£4,376 m	(£2,899 m)	(40%)
Non-Mesothelioma	£574 m	£559 m	(£16 m)	(3%)
Total Market Estimate	**£7,850 m**	**£4,935 m**	**(£2,915 m)**	**(37%)**

*2020 and post only.
†Scenario 5 for mesothelioma and B2 for non-mesothelioma.

As can be seen from Table 66, the central estimate for mesothelioma claims has reduced by around 40%, whereas that for the non-mesothelioma claims is less than 3% reduced, as compared to 2009. The reasons for these changes are explained in more detail in Sections 9 (mesothelioma) and 10 (non-mesothelioma). For the non-mesothelioma claims, it should be noted that, whilst they have reduced slightly overall, there is a more significant reduction in our estimate for lung cancer claims that has been offset, to a large extent, by a material increase in our estimate for asbestosis and pleural thickening claims, as well as the introduction of an estimate for pleural plaque claims.

The range of results implied by our scenarios has narrowed since 2009. In the 2009 Paper the scenarios considered implied a range of possible results (for notification years 2020 and post) of between £2.6 bn and £27.7 bn, whereas our latest analysis imply a range of between £3.5 bn and £12.1 bn.

12. Future Monitoring

In this paper, we have outlined the work undertaken to estimate the potential UK EL Insurance Market cost of asbestos-related claims. The key message emerging from this work is that a large amount of uncertainty surrounds this cost, principally driven by the future cost of mesothelioma claims. Although a reasonable estimate of the cost of asbestos-related claims might be of the order of 11 bn, there is a large range of uncertainty surrounding this figure as discussed in Section 11. It will be important to monitor the claims experience as it emerges over the next few years.

This section sets out what the Working Party considers to be the most important areas to monitor. It is the Working Party's intention to monitor these areas in the future and to report on any material deviances compared to expectations.

12.1. Actual Population Deaths

The actual number of mesothelioma deaths in the British population is published by the HSE each year. The figure is usually published with a lag of about 18 months to two years, for example, the

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2017 number of deaths was published in July 2019, and the 2018 number of deaths was published in July 2020. The HSL used the deaths up to and including the year 2017 to fit their model and produce their projections as discussed in Section 6.3.

Monitoring the total number of deaths will give an early indication as to whether the projections made are reasonable.

However, it is more revealing to break down the total number of deaths by year of birth/age at death so that the development by year of birth cohort can be compared to that expected. It was highlighted in Section 6 that a key assumption was that each year of birth cohort would develop differently in the future and hence the HSL model structure was preferred. If all the year of birth cohorts develop in line with each other in the future, then this would indicate that a simple birth cohort model structure might be a better model. A projection with a different model structure could give rise to significantly different results. As discussed in Section 6.3, there is a large amount of uncertainty as to what the future incidence rate by year of birth cohort will be, and this is a main driver of the uncertainty within the population death projections due to mesothelioma. Monitoring the actual year of birth incidence rates will help amend the selection of the way the year of birth cohorts develop and hence point to whether the selected future projections require amendment.

We intend to review the developing incidence rates each year as and when the relevant data is available, although it is noted that a yearly analysis will not be as revealing as looking at the development by three or five year bands due to the high level of random variation that will exist in a single year figure. However, annual developments will give an early indication of the emerging experience ahead of a more robust analysis of the trends.

12.2. Population Projections

It was highlighted in Section 4.4 of the 2009 report that a large proportion of the increase in the HSL population projections between 2003/5 and 2009 was due to a revision in the overall population projections for Great Britain made by the ONS in 2006. The impact of using the ONS 2006 population projections on the HSE 2019 model instead of the ONS 2018 population projections would increase the projected deaths, for years 2019 to 2050, by 772 (or −3% of the deaths projected using the ONS 2018 population projections)

If these projections change in the future, then this will have an impact on the projected level of population mesothelioma deaths – for example, if it is assumed that a greater number of people are alive at a certain age in the future, then for a fixed mesothelioma incidence rate, it follows that there will be a higher level of mesothelioma deaths.

There are two key aspects to consider here. First, the overall level of longevity assumed in the population projections may not turn out to be as expected. Secondly, the overall level might be as expected, but this could vary by year of birth cohort. Over the past decade the improvements in mortality have not been as high as previously predicted, leading to lower population projections than previously estimated. An increase in improvement beyond that expected in the current projections will have an impact on the total population mesothelioma deaths projections. The impact of COVID-19 on both the current population and on longer term mortality are also highly uncertain. Mortality improvements by year of birth cohort and the impact of COVID-19 are considered in more detail in the Continuous Mortality Investigation Working Party (Paper 147). This is an area that is worthy of further investigation and scenario testing.

The Working Party will monitor the updated population projections and other related work and communicate any emerging impacts.

12.3. Claims to Deaths Relationship

The 2004 Working Party estimates made the assumption that the proportion of mesothelioma sufferers that claim against employers/insurers would remain constant based on past experience at

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that time. However, between 2004 and 2009 it doubled, and this was the main reason for the rise in the estimates of the cost of asbestos-related claims to the UK EL Insurance Market, with the 2009 Working Party estimates assuming that the increasing propensity to claim would continue (to varying degrees). As discussed in Section 7, the latest CRU and HSE data suggests that this has been much more stable (by age) across the more recent calendar years, and so we have assumed that this remains stable in future.

The actual ratio can be monitored using the data that is available from the CRU, as long as it can be provided again in future (see Section 7.2 for background). It is therefore proposed that the Working Party obtains the data from the CRU each year and, linking in with the actual deaths data, sets out how the level of the ratio is trending over time, split by age band where possible.

Sourcing this data from the CRU has been made considerably more difficult by the constraints placed on FOI requests. Nevertheless, since data protection laws make it impossible to collect insurance market data by claimant, this remains the only source of data available at the claimant level and therefore the only way of linking death and claim number trends.

It has been assumed in the projections made by the Working Party that this proportion of female claimants compared to male remains constant at around 5.5% in the future, as the rate seems to have been quite stable over recent years (see Appendix F). However, it will be important to monitor this proportion in the future.

12.4. Insurance Claim Notifications

The UK EL Insurance Market data collection surveys that have been performed by the Working Party have served as a vital way of monitoring actual versus expected experience. Therefore, it is believed that the market survey data should be collected each year as long as the participants are happy to assist.

12.5. Average Claimant Costs

In the 2009 report, we recommended that insurance companies start to collect mesothelioma claimant data split by the different heads of claim as set out in Section 8. This would assist with the monitoring of the assumptions underlying the average cost per claim model. This would also enable a much larger sample of claims to be collected in the future which will facilitate a much richer analysis. This data is not currently available consistently across the industry, but we would like to reiterate how useful this data would be if it was captured.

12.6. Age of Mesothelioma Sufferers

The average age of both those who die from mesothelioma and those who bring claims against the insurers can be a useful way of monitoring the suitability of the underlying death projections and any lag between this and the age of claimants (which may imply either a change in claim filing profiles and/or life expectancy).

12.7. Other Items to Monitor

The following items should also be monitored as they could impact the assumptions used in the models:

- New medical treatments (e.g., Immunotherapy for mesothelioma)
- JSB Guidelines (court inflation)
- Proportion of claimants who are alive at time of claim
- Proportion of claimants from Scotland

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- Legal Costs (both claimant and defence/claims handling)
- Changes to Ogden Tables and/or Ogden discount rates
- Other inflation factors (CPI, RPI, and earnings)

13. Practical Guide for Actuaries

The primary focus of this paper has been to re-estimate the potential cost of UK asbestos-related claims covered by EL insurance policies written by the UK Insurance Market. However, the Working Party also wants to ensure that the tools and assumptions used to arrive at these projections can be utilised by actuaries involved in the reserving of asbestos. Whether this is for estimating the reserves for an insurance/reinsurance company who wrote EL policies, a captive insurer of a company with exposure to asbestos claims, or even the underlying company itself.

As such, this section sets out a suggested approach for estimating the asbestos-related reserves for a specific company, along with key considerations.

13.1. Overview of Approach

Assuming the data is available, projections should be done split by disease type, namely:

- Mesothelioma
- Lung Cancer
- Asbestosis
- Pleural thickening
- Pleural Plaques (Scotland and NI exposure only)

For each disease type, the most common approach is to use an average cost per claim methodology:

1. Estimate the profile of future claim numbers relative to a start year.
2. Select a "jump-off" point for the first year of projection (e.g., 2021).
3. Apply the claim number profile to the jump-off point to get an estimate of future claim numbers.
4. Select an initial Average Cost Per Claims (ACPC) for the first year of projection.
5. Select future inflation assumptions.
6. Apply the future inflation assumptions to the initial ACPC to get an ACPC for each future report year.
7. Multiply the estimate of future claim numbers by the ACPC by future year to get a total cost for each future (report) year (Pure IBNR).
8. Add in outstanding case reserves (OS), adjusted for Incurred But Not Enough Reported (IBNER) if needed (this could be positive or negative) to get a total gross reserve. The selection IBNER may influence the selection of future ACPC.
9. Estimate reinsurance (RI) recoveries, if appropriate.
10. Discount the reserves based on projected future cashflows, if appropriate, lagging the reporting patterns for settlement delay.

13.2. Number of Claims

There are two main options available for estimating the future claim number profile, namely benchmarking to the market estimates or (for mesothelioma) using the HSE/Working Party population projection model and adjusting the parameters to more accurately reflect the exposure

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covered by the company in question and to allow for any data made available after the HSE/Working Party model was parameterised.

The suitability of each approach will be dependent on the following factors:

- Volume of claims
- Quality of data
- If the company's exposure would be materially different to the UK EL market as a whole
- The divergence of updated market-level data from that assumed in the HSE/Working Party model.

13.2.1. Benchmark approach

If a benchmark approach is considered most suitable, then the profile can be calculated directly from the future claim estimates provided in the spreadsheets on the IFoA UK Asbestos Working Party webpage (Ref: 67). This can either be done be taking year-to-year relativities from the actual future claim number projections, or by taking the underlying number of deaths projections and applying adjusted the propensity for a mesothelioma sufferer to make an insurance claim assumptions before calculating the year-to-year relativities. The second option might be more appropriate if, for example, a manufacturing company or captive insurer is aware that a higher than average proportion of their potential claimants are likely to make a claim, and therefore would expect the future propensity to change differently to the Working Party's market wide assumptions.

13.2.2. Adjusting the exposure approach (mesothelioma only)

This approach would be used if the company has a suitable volume and quality of data available, and it is likely that the company will have a different exposure to the EL insurance market as a whole.

The exposure within the HSE mesothelioma deaths population projection model can be adjusted to estimate a company-specific future claims profile. This might be suitable if, for example, the company's exposure is known to be a certain defined period. The model can also be tailored to allow for updated population estimates or to assess the impact of using different assumptions regarding exposure in the later years which are more uncertain.

13.3. Claim Number "Jump-off" Point

The estimated number of claims for the first year of projection (e.g., 2021) can be selected based on a company's own claims history. If data is sparse, this could be a simple average of claim numbers reported over the past five to ten years. However, if there is a reasonable volume of claims with accurate reporting dates, then adjusting the number of claims reported in the base period for the expected shape of the claim number curve over that period can give a more suitable starting point. This is achieved by scaling the actual number of claims reported in each year up or down to put them "on-base" to the first year of projection before taking an average over a suitable number of reporting years. The scaling factor used is the ratio of expected claim numbers from each reporting year to the expected claim numbers in the first year of projection, both from the claim number profile in Section 13.2 above.

There are a number of things to consider when selecting the estimated number of claims for the first year of projection:

- Should this be set in aggregate for each disease or can the data be grouped into bands and selections made for each band? For example, if you use the HSE model it is easy to get

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expected claim number profiles from the model by age of year of death, so the selections could be done for each age group rather than in aggregate.
- What is a suitable base period for averaging over? This will depend on the volume and stability of reported claims; but could be somewhere between 2 and 10 years and may exclude exceptional years such as 2020 where reporting is likely to have been impacted by the COVID-19 pandemic and subsequent lockdowns.
- Is a selection being made for all reported claims or just non-nil claims?
  - If a selection is being made on the number of non-nil claims only then the data from the more recent reporting years will need to be adjusted to allow for currently open claims that will settle at nil in future.
  - If a selection is being made for all claims then either:
    - a nil-claim percentage needs to be applied to the projected number of claims and combined with a non-nil average cost per claim; or
    - the average cost per claim selection needs to include nil claims.
    - You should consider whether there have been any changes in how claims have been recorded in the data which may affect the reporting of nil claims.

13.4. Initial ACPC for the First Year of Projection

As with the claim number profile and claim number jump-off point, the selection of the ACPC for the first projection year will also depend on the volume and quality of data available, but also on the disease. The average cost of a mesothelioma or lung cancer claim will be much higher and will vary more by age than an asbestosis or pleural thickening claim. As such, it is often worth estimating the ACPC in greater detail for mesothelioma, by heads of damage and by age (or age band) if possible, whereas the ACPC for asbestosis and pleural thickening can usually be set in aggregate.

If a company's own data is being used to estimate the ACPC, then the following adjustments should be considered before making a selection based on averages:

- Adjusting any open claims to allow for (positive or negative) IBNER (see Section 13.6);
- Inflating all claims to be on-base to the year you are making the selection for (e.g., 2021). The historical inflation assumptions used could:
  - be a flat percentage
  - be based on company data
  - use an index such as UK RPI
  - use the implied inflation from the Working Party mesothelioma cost model.
- Removing nil claims or considering nil claims separately if there is still a defence cost associated with them (i.e. there are three claim groups (i) total nil claims, (ii) costs only, and (iii) non-nil damages).

For mesothelioma the Working Party have provided a cost model which will estimate the cost of a mesothelioma claim for each age in each future reporting year based on the aggregation of the different heads of damages. Note that these estimates are the average cost per claimant, not claim. The model is based on a number of assumptions that the user can adjust including:

- What type of inflation is applied to each component of the award (CPI, RPI, Court, Wage, Bereavement, State Pension or a user entry), see Section 8.1.1 for more details
- The proportion of claims that settle in each year subsequent to reporting, separately for living and deceased claimants, see Section 8.5.1 for more details

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- Historical and future inflation assumptions for CPI, RPI, Court, Wage, Bereavement, and State Pension inflation, along with a user entry that can be used, see Sections 8.4.1.5 to 8.4.1.7 for more details
- The Ogden table that applies to claims settled in each year, the assumed Ogden discount rate in each future settlement year, and the age adjustment made to the Ogden multipliers due to the general worse health of claimants;
- The proportion of living claimants for each future settlement year, see Section 8.5.1 for more details
- The average cost of each component, by age and separately for living and deceased claimants in 2007 settlement year terms. Whilst these inputs can be adjusted, they are based on the work done for the 2009 Working Party report and should only be adjusted based on comprehensive data.

These costs can then be compared to company specific data (and scaled if needed based on the share of the claim that the company pays) and banded into groups consistent with those used for the claim number projections.

13.5. Select Future Inflation Assumptions

There are many approaches to the inflation to be applied to future claims, including:

- Assuming a flat long-term average rate that will not be particularly accurate in the short-term, but is likely to be suitable longer-term for the lower-cost diseases. This is what the Working Party have assumed for non-mesothelioma claims. See Section 9.2 for more detail;
- Using the Working Party mesothelioma cost model, making specific assumptions about CPI, RPI, wage, court, bereavement and state pension inflation for each future year, and using these cost estimate split by age (or age band) for each future year to apply to the projected claim numbers (also by age or age band);
- Using the output of the mesothelioma average cost model (with or without adjustments to the assumptions) to give an age-weighted average future inflation that can be applied to a selected company specific starting ACPC.

The annual inflation can then be applied to the starting ACPC to give an ACPC for each future reporting year, which when multiplied with the expected number of claims will give the total estimated cost for all future reported claims.

13.6. Case Reserves and IBNER

Whilst all open claims are likely to have an outstanding case estimate against them, it may be that these estimates are, on average, consistently higher or lower than the amount that they ultimately settle for. To establish if this is the situation, it is preferable to look at the development of claims over time, from when they are reported to when they are closed. This can then give uplift factors (or negative IBNER factors) to apply to the OS (or Incurred) to estimate the ultimate position of the open claims.

Two methods to establish the level of IBNER (positive or negative) that is needed are:

- Creating triangles of Paid Claims and OS Claims development, adding these together to get the Incurred and then projecting to ultimate using a chain-ladder method. The IBNER is then the difference between this ultimate and the current Incurred Claims (which could be positive or negative); and

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- Estimate the number of open claims that will ultimately settle as non-nil based on an ultimate nil-rate (estimated from older reporting years' nil-rates) and/or using a chain-ladder projection to estimate the ultimate number of non-nil claim numbers. Select an ACPC for each report year (based on older report years ACPC and an inflation assumption) and combine these assumptions to estimate the ultimate claim amounts for open claims. If this is lower than the current Outstanding Case Reserve for all open claims, then positive IBNER is needed. If the Outstanding Case Reserve is higher, then negative IBNER may be appropriate.

If the IBNER is significant as a proportion of the Outstanding Claims it may be appropriate to adjust the underlying claims data **before** using it to select an ACPC for future claims. However, care should be taken to distinguish if each claim is generally over/under reserved, or if the IBNER is a product of some claims ultimately being dismissed (which will be captured in the nil-rate), in which case no adjustment to the claims data for the purpose of estimating an ACPC will be needed.

Once the IBNER has been estimated, it can be added to the Outstanding Claims and the Pure IBNR (for future claims) to give the total gross reserve.

13.7. Reinsurance

If there is reinsurance in place (or insurance if the company is the underlying manufacturing company and not an insurer), then estimating the recoveries on future claims can be done from first principles by following the following steps:

- Allocating each projected future claim to the year of first medical exposure (YFE) (which is a parameter assumed in the HSE mesothelioma model which can be backed out, representing the year in which the asbestos fibre entered the body).
- Assuming a profile of legal exposure for each YFE (for example 100% work in that exposure year, 95% work in the following year and the year before, etc.). This profile should be based on a company's own data where possible.
- Combining the assumptions above with the ACPC of the claim to "spread" each claim over a number of legal exposure years/basis of presentation
- Apply the insurance that is in place for an underlying company.
- If estimating the reinsurance recoveries for an insurance company, the ideal way to estimate the reinsurance is to use a stochastic model, as this will capture the variability of each claim. In general, the excess and limit on an excess of loss reinsurance contract will be reduced in proportion to the number of years that the legal exposure is spread over.

For smaller companies, this level of detail is unlikely to be possible or appropriate and so estimating future recoveries based on recoveries to date (as a proportion of gross) would be a suitable simplification.

13.8. Discounting

It may be appropriate to discount the (gross or net) reserves to allow for investment income. The steps to do this are:

- Estimate the cashflows for future claims based on the claims estimated for each future reporting year with a settlement pattern applied, and based on a company's own data where possible.
- Adding in any Outstanding Claims and IBNER, with assumptions about how many years these will pay out over.

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- Discounting the future cashflows using an appropriate discount rate (e.g., Bank of England risk-free rate) or a yield curve.

13.9. Other Factors to Consider

Other factors to consider depending on the nature of the company the reserves are being estimated for are outlined below:

- Are there any Public Liability claims that need to be considered?
- Is the proportion of Female claimants significant/different to the industry as a whole?
- Are there any costs associated with nil claims?
- Deaths curves versus claim curves
- Settlement delay

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The Chairman would like to thank all members of the Working Party: producing a market estimate is an incredible amount of work.

We would also like to thank the many solicitors, claims handlers, and others within the insurance industry, the HSE, the Compensation Recovery Unit, the Department of Work and Pensions, the professors, clinicians, radiologists, and nurses within the NHS and the representatives of voluntary bodies that have helped to answer our questions.

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Appendices

The following appendices are attached to this paper:

A. Working Party Members

Since the 2009 paper, there have been a number of individuals involved in the Working Party. This list details the individuals who have been involved since 2009 until the publication of this paper:

- Alain de Lavernette
- Alex Twose
- Andy Whiting
- Arran Nolan
- Avital Kaye
- Christopher Clarke
- Cherry Chan
- Dan Beard
- Daniel Sykes
- Daniel West
- Gabriela Macra
- Graham Sandhouse
- John Wilson
- John McCarthy
- Kan Lu
- Kirstie Barton
- Laura Worth
- Mark Hart
- Michael Coleman
- Michael Jones
- Miriam Lo
- Natasha Carey
- Nicholas Boutal
- Pauline Barthelemy
- Philip Jacob
- Rachel O'Connell
- Rhiannon Seah
- Robert Brooks
- Robert McGowan
- Stephen Edler
- Shantanu Mahajan
- Ujjaval Agarwal
- Yubo Rasmussen

B. Data Collection Process and Templates

A data collection template was sent out to any previous respondents to the Asbestos Working Party or Deafness Working Party data collection requests.

The Working Party recognises the need to maintain confidentiality and that most organisations that are willing to contribute to the survey would prefer that their answers are kept anonymous. To achieve this, all responses will be sent directly to a staff member at the Institute and Faculty of Actuaries, who is not connected to the Working Party. The individual responses will then be aggregated before they are passed on to the individual Working Party members. This will ensure that no members of the Working Party will be able to identify the data for any specific company. The Working Party will make no mention of which companies take part in any survey. In addition, the individual company level data will be deleted once it has been amalgamated.

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Copies of survey data can be found on the IFoA UK Asbestos Working Party web-link (Ref: 67).

- Aggregated market data for years 2000 to 2019 (as at year end 2019) (https://www.actuaries.org.uk/documents/awp-ye2019-survey-data)
- Aggregated market data for years 1999 to 2018 (as at year end 2018) (https://www.actuaries.org.uk/documents/aggregated-market-data-years-1999-2018-year-end-2018)
- Aggregated market data for years 1998 to 2017 (as at year end 2017) (https://www.actuaries.org.uk/documents/asbestos-working-party-aggregation-q4-2017)
- Aggregated market data for years 1997 to 2016 (as at year end 2016) (https://www.actuaries.org.uk/documents/aggregated-market-data-years-1997-2016-year-end-2016)
- Aggregated market data for years 1996 to 2015 (as at year end 2015) (https://www.actuaries.org.uk/documents/aggregated-market-data-years-1996-2015-year-end-2015)
- Aggregated market data for years 1995 to 2014 (as at year end 2014) (https://www.actuaries.org.uk/documents/uk-asbestos-aggregated-market-data-years-1995-2014-year-end-2014)
- Aggregated market data for years 1994 to 2013 (as at 2014Q1) (https://www.actuaries.org.uk/documents/uk-asbestos-working-party-summary-data-2014q1)

C. Spreadsheet Models Produced by the Working Party

The following models have been developed by the Working Party and can be found on the Institute and Faculty of Actuaries' website under the Research Working Parties link, together with this paper, in a zipped file entitled Asbestos Working Party 2020 Models.

Each spreadsheet model contains documentation and instructions on how the spreadsheet works.

AWP 2020 – Population Male Mesothelioma Deaths Model
This model has been used to estimate the number of male mesothelioma deaths in Great Britain, using the Poisson regression population model used by the HSE and HSL. The results from this model from the basis of mesothelioma scenarios 1 to 18.

AWP 2020 – GLM AgeBirth Male Mesothelioma Deaths Model
This model has been used to estimate the number of male mesothelioma deaths in Great Britain, under an age-birth cohort GLM model as used by Martinez-Miranda, Nielsen and Nielsen in their 2015 paper entitled "A simple benchmark for mesothelioma projection for Britain". The results from this model from the basis of mesothelioma scenarios 19 to 21.

AWP 2020 – Mesothelioma Cost Model
This model has been used to estimate the total costs for male mesothelioma claimants by using different heads of damage for an average award, taking into account age, inflation and whether the claimant is living/decreased at the time of settlement.

AWP 2020 –Mesothelioma Propensity to Claim Model
This model has been used to produce the scenarios on the propensity of male mesothelioma sufferers to make an insurance claim.

AWP 2020 – Mesothelioma Scenarios Model
This model has been used to estimate the total insurance cost for mesothelioma claims by combining different male GB deaths, male propensity to make an insurance claim, average claimant cost, and ratio of female and Northern Ireland claims.

AWP 2020 – Non-mesothelioma Model
This model has been used to estimate the total insurance costs for non-mesothelioma claims by using different ratios of mesothelioma deaths/claims to estimate number of claims and an inflated selected average cost per claim.

D. Summary of Mesothelioma Projections

There are 21 mesothelioma scenarios, based on 6 GB male mesothelioma death models/scenarios, 3 propensity models for a mesothelioma sufferer to make a claim and 3 average cost/inflation scenarios.

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Copies of survey data can be found on the IFoA UK Asbestos Working Party (Ref: 67) under the "Models and Spreadsheets" section.

Table D.1. Mesothelioma projections

Scenario number	Deaths Model/Scenario	Propensity for a Mesothelioma Suffer to Make a Claim Scenario	Average Cost/ Inflation Scenario	Male GB Deaths*	Male and Female GB and NI Insurance Claims*	2020–2060 Average Cost per Claimant	Undiscounted Total GB and NI Insurance Cost*
1	Adjusted HSE: 2 (Central)	Low	Low	28,145	27,238	£270,082	£3,678 m
2	Adjusted HSE: 2 (Central)	Central	Low	28,145	29,785	£269,656	£4,016 m
3	Adjusted HSE: 2 (Central)	High	Low	28,145	34,491	£271,869	£4,689 m
4	Adjusted HSE: 2 (Central)	Low	Central	28,145	27,238	£293,975	£4,004 m
5	Adjusted HSE: 2 (Central)	Central	Central	28,145	29,785	£293,848	£4,376 m
6	Adjusted HSE: 2 (Central)	High	Central	28,145	34,491	£298,292	£5,144 m
7	Adjusted HSE: 2 (Central)	Low	High	28,145	27,238	£323,091	£4,400 m
8	Adjusted HSE: 2 (Central)	Central	High	28,145	29,785	£323,359	£4,816 m
9	Adjusted HSE: 2 (Central)	High	High	28,145	34,491	£330,839	£5,705 m
10	Adjusted HSE: 3 (Low)	Low	Low	26,037	25,208	£260,829	£3,287 m
11	Adjusted HSE: 3 (Low)	Central	Central	26,037	27,538	£281,528	£3,876 m
12	Adjusted HSE: 3 (Low)	High	High	26,037	31,575	£312,504	£4,934 m
13	Adjusted HSE: 1 (High)	Low	Low	33,295	32,339	£298,993	£4,835 m
14	Adjusted HSE: 1 (High)	Central	Central	33,295	35,418	£332,310	£5,885 m
15	Adjusted HSE: 1 (High)	High	High	33,295	41,892	£385,187	£8,068 m
16	Adjusted HSE: 2 (Central) + background	Central	Central	29,537	31,112	£319,114	£4,964 m
17	Adjusted HSE: 2 (Central)	Jump	Central	28,145	45,669	£289,562	£6,612 m
18	Adjusted HSE: 2 (Central)	Central	Jump	28,145	29,785	£339,821	£5,061 m
19	GLM Age-Birth: Low	Low	Low	27,979	28,138	£269,276	£3,788 m
20	GLM Age-Birth: Central	Central	Central	38,419	37,374	£310,499	£5,802 m
21	GLM Age-Birth: High	High	High	51,679	55,735	£395,527	£11,022 m

*2020 and onwards.

E. Summary of Non-mesothelioma Projections

There are 12 non-mesothelioma scenarios for each disease type (asbestosis/pleural thickening, asbestos-related lung cancer and pleural plaques), based on 4 number of claims scenarios and 3 average cost/inflation scenarios.

Copies of survey data can be found on the IFoA UK Asbestos Working Party (Ref: 67) under the Models and spreadsheets section.

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Table E.1. Non-mesothelioma projections

Cost and Number Scenario	2020 ACPC			Inflation (p.a.) : All disease types	Number of claims*				Undiscounted*			
	Asbestosis and Pleural Thickening	Asbestos-related Lung Cancer	Pleural Plaques		Asbestos-related Lung Cancer	Asbestosis and Pleural Thickening	Pleural Plaques	Total	Asbestosis and Pleural Thickening	Asbestos-related Lung Cancer	Pleural Plaques	Total
A1	£16,000	£25,000	£6,250	1%	9,893	2,384	1,562	**13,839**	£164.6 m	£62.5m	£10.1m	**£237.2m**
A2					16,307	3,734	2,993	**23,035**	£275.2 m	£99.8m	£19.7m	**£394.6m**
A3					23,780	6,171	4,587	**34,538**	£404.4 m	£166.7m	£30.3m	**£601.5m**
A4					16,101	4,271	1,273	**21,645**	£272.3 m	£114.7m	£8.1m	**£395.2m**
B1	£21,000	£28,000	£7,500	3%	9,893	2,384	1,562	**13,839**	£234.2 m	£77.5m	£13.2m	**£325.0m**
B2					16,307	3,734	2,993	**23,035**	£403.5 m	£128.8m	£26.2m	**£558.5m**
B3					23,780	6,171	4,587	**34,538**	£602.8 m	£220.4m	£40.9m	**£864.0m**
B4					16,101	4,271	1,273	**21,645**	£401.6 m	£149.4m	£10.1m	**£561.0m**
C1	£24,000	£30,000	£8,500	5%	9,893	2,384	1,562	**13,839**	£291.8 m	£92.6m	£16.3m	**£400.7m**
C2					16,307	3,734	2,993	**23,035**	£518.7 m	£160.7m	£33.2m	**£712.6m**
C3					23,780	6,171	4,587	**34,538**	£787.9 m	£282.9m	£52.4m	**£1,123.1m**
C4					16,101	4,271	1,273	**21,645**	£519.4 m	£187.7m	£11.9m	**£719.0m**

*2020 and onwards.

F. Mesothelioma Female:Male and NI Ratios

Tables F.1 and F.2 detail the assumptions and data used by the Working Party in developing a) a ratio to uplift male employers' liability insurance claims to include female employers' liability insurance claims and b) the uplift to allow for NI mesothelioma claims as the mesothelioma deaths models are based on GB data.

Table F.1. Female to male ratios

Year	CRU Female Claimants*	CRU Male Claimants*	*CRU Ratio*	*YE2019 Survey*	*GB Deaths – All Ages*	*2009 Ratio*	Selected Ratio
2007	61	1,314	4.6%	4.8%	*19.0%*	*2.4%*	
2008	94	1,285	7.3%	7.2%	*20.5%*	*3.2%*	
2009	76	1,267	6.0%	5.0%	*20.1%*	*5.0%*	
2010	70	1,280	5.5%	5.2%	*20.8%*	*5.0%*	
2011	73	1,330	5.5%	6.2%	*18.9%*	*5.0%*	
2012	77	1,296	5.9%	5.3%	*19.2%*	*5.0%*	
2013	75	1,242	6.0%	5.6%	*19.6%*	*5.0%*	
2014	90	1,565	5.7%	6.1%	*19.7%*	*5.0%*	
2015	92	1,567	5.9%	4.6%	*19.1%*	*5.0%*	
2016	78	1,169	6.7%	4.9%	*19.0%*	*5.0%*	
2017	80	1,398	5.7%	5.0%		*5.0%*	
2018	80	1,425	5.6%	3.9%		*5.0%*	
2019	74	1,105	6.7%	5.2%		*5.0%*	
Selected ratio for the future						***5.0%***	**5.5%**

*Based on CRU data for Liability Type = EMPLOYER, Future Live claims assumed to withdraw 32% Female, 10% Male. *2015 CRU Data 2007–2015*, 2019 CRU Data 2016–2019

Table F.2. GB and NI mesothelioma deaths

Year of Death	GB All Years (Ref: 4) (Male and Female)	Northern Ireland (Ref: 53)	Selected Ratio
2001	1,860	54	2.90%
2002	1,867	42	2.25%
2003	1,887	46	2.44%
2004	1,978	51	2.58%
2005	2,049	34	1.66%
2006	2,060	47	2.28%
2007	2,176	34	1.56%
2008	2,265	38	1.68%
2009	2,336	42	1.80%
2010	2,360	35	1.48%
2011	2,312	49	2.12%

(*Continued*)

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Table F.2. (*Continued*)

Year of Death	GB All Years (Ref: 4) (Male and Female)	Northern Ireland (Ref: 53)	Selected Ratio
2012	2,549	48	1.88%
2013	2,560	40	1.56%
2014	2,522	41	1.63%
2015	2,547	44	1.73%
2016	2,606	43	1.65%
2017	2,541	43	1.69%
2018	2,453	49	2.00%
2019	2,369	37	1.56%
Weighted average 2001–2019			***1.89%***
Weighted average 2010–2019			***1.73%***
Weighted average 2015–2019			***1.73%***
Weighted average 2017–2019			***1.75%***
Selected ratio for the future			**1.75%**

G. Mesothelioma Claims per Claimant

Tables G.1–G.4 detail the assumptions and data used by the Working Party in developing a claims per claimant assumption using the following data:

1. 2009 mesothelioma cost sample data
2. YE2016 market survey
3. Expert views of the number of claims per claimant
4. Expert views of the average claimant cost in 2016
5. YE2019 market survey for claim notifications and nil rates
6. CRU data

Table G.1. Mesothelioma: settlement year claims per claimant

Year of Settlement	Sample: Number	Sample: Number of Insurers	Sample: Cost (A)	YE2016 Survey: Settled (ex nils) (B)	Implied Claims per Claimant (A/B)
2001	3	4.00	£181,075	£47,693	3.06
2002	1	1.00	£446,048	£58,969	6.73
2003	6	1.00	£174,378	£66,106	2.93
2004	10	1.70	£147,221	£59,156	2.11
2005	6	3.00	£123,610	£69,469	1.85
2006	35	2.91	£157,384	£66,606	1.94
2007	107	2.03	£200,102	£80,673	2.55
2008	99	1.85	£180,645	£78,608	2.36
2009	24	n/a	£174,093	£76,801	2.08
Average		**2.10**	**£182,924**	**£75,116**	**2.44**

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Table G.2. Mesothelioma: report year claims per claimant

Year of Report	Sample: Number	Sample: Number of Insurers	Sample: Cost (A)	YE2016 Survey: Incurred (Ex Nils) (B)	Implied Claims per Claimant (A/B)	YE2016 Survey: Settled (Ex Nils) (C)	Implied Claims per Claimant (A/C)
1999	1	1.00	£317,085	£57,022	5.56	£57,020	5.56
2000	5	2.80	£147,076	£69,792	2.11	£69,792	2.11
2001	5	1.80	£185,259	£72,911	2.54	£73,096	2.53
2002	8	1.75	£173,545	£73,649	2.36	£73,665	2.36
2003	17	3.47	£155,359	£74,500	2.09	£74,631	2.08
2004	25	1.83	£188,485	£72,784	2.59	£72,988	2.58
2005	43	2.02	£181,502	£82,590	2.20	£83,261	2.18
2006	67	2.32	£170,542	£79,423	2.15	£79,327	2.15
2007	95	1.81	£179,126	£88,616	2.02	£86,704	2.07
2008	23	1.67	£153,417	£89,627	1.71	£89,666	1.71
2009	2	n/a	£192,126	£90,264	2.13	£89,013	2.16
Average		**2.10**	**£175,186**	**£80,336**	**2.18**	**£80,013**	**2.18**

Table G.3. Mesothelioma: expert views on claims per claimant

Area	Mean	Median	Interquartile range
Claims per claimant	2.5	2.3	2.0 to 3.0
Average claim (A)*	£235,000	£233,000	£227,000 to £238,000
YE2016 survey: Incurred (ex nils) (B)†	£97,261	£97,261	*£97,261 to £100,952*
YE2016 survey: Settled (ex nils) (C)‡	£97,960	£97,960	*£89,869 to £97,960*
Implied Claims per claimant (A/B)	2.4	2.4	2.2 to 2.4
Implied Claims per claimant (A/C)	2.4	2.4	2.3 to 2.6

*See Section 8.2 for more details.
†Mean and Median based on 2016 notification year, range based on minimum and maximum over notification years 2012 to 2016.
‡Mean and Median based on 2016 settlement year, range based on minimum and maximum over settlement years 2012 to 2016.

Table G.4. Mesothelioma: report year claims per claimant from CRU data

Year of Report	YE2018 Survey: Notified ex Nil* (A)	CRU Data: Male GB Claimants† (B)	CRU Data: Female GB Claimants† (C)	CRU Data: Total GB Claimants† (D) = (B) + (C)	NI % of GB‡ (E)	UK Claimants (F) = (D) x (1 + (E))	Claims to Claimants Ratio (G) = (A)/(F)
2009	2,329	1,207	68	1,275	1.80%	1,298	1.80
2010	2,362	1,213	70	1,283	1.48%	1,302	1.81

(*Continued*)

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Table G.4. (*Continued*)

Year of Report	YE2018 Survey: Notified ex Nil* (A)	CRU Data: Male GB Claimants† (B)	CRU Data: Female GB Claimants† (C)	CRU Data: Total GB Claimants† (D) = (B) + (C)	NI % of GB‡ (E)	UK Claimants (F) = (D) x (1 + (E))	Claims to Claimants Ratio (G) = (A)/(F)
2011	2,570	1,277	69	1,346	2.25%	1,376	1.87
2012	2,580	1,244	86	1,329	1.92%	1,355	1.90
2013	2,595	1,188	81	1,269	1.64%	1,290	2.01
2014	2,572	1,271	93	1,363	1.63%	1,385	1.86
2015	2,730	1,211	156	1,367	1.73%	1,390	1.96
2016	2,536	1,136	61	1,196	1.75%	1,217	2.08
2017	2,299	1,075	56	1,130	1.75%	1,150	2.00
2018	2,351	1,105	61	1,165	1.75%	1,186	1.98

*Estimated for 2016 onwards based on weighted average nil rate from 2011–2015.
†EL claimants based on CRU data excluding estimated ultimate withdrawn and Government.
‡Based on HSE and HSE NI mesothelioma deaths data for 2015 and prior and estimated for 2016 onwards.

The analysis of the different data in Tables G.1–G.4 shows that the claim per claimant is around 1.8 to 2.5.

We have selected a claim per claimant ratio of 2.0 to review output from the mesothelioma average cost model against the latest survey data. This is primarily based on Table G.4 (comparing the CRU data to the survey data) as this data is more up to date and factual than some other sources, and from our discussions with claims handlers in the market we understand that all mesothelioma claims made within Great Britain should be registered with CRU, making this the most complete data source.

It should be noted that the claim to claimant ratio assumed will not impact the relative run-off of future claims as long as it is set flat and is internally consistent.

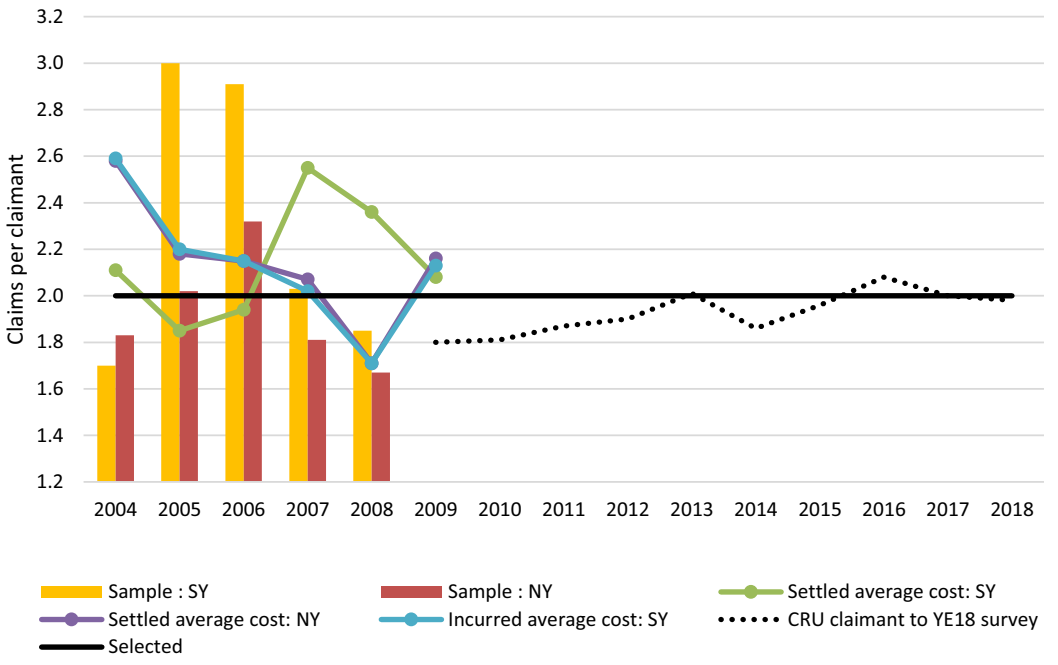


Figure G.1. Mesothelioma claims per claimant by year.

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H. Male Ogden Rates at 2.5% Discount

Figure H.1 and H.2 detail the Ogden rates under Table 1 (multipliers for pecuniary loss for life (males) under each edition using a 2.5% discount rate). Note the multipliers for the 3rd and 4th editions were the same.

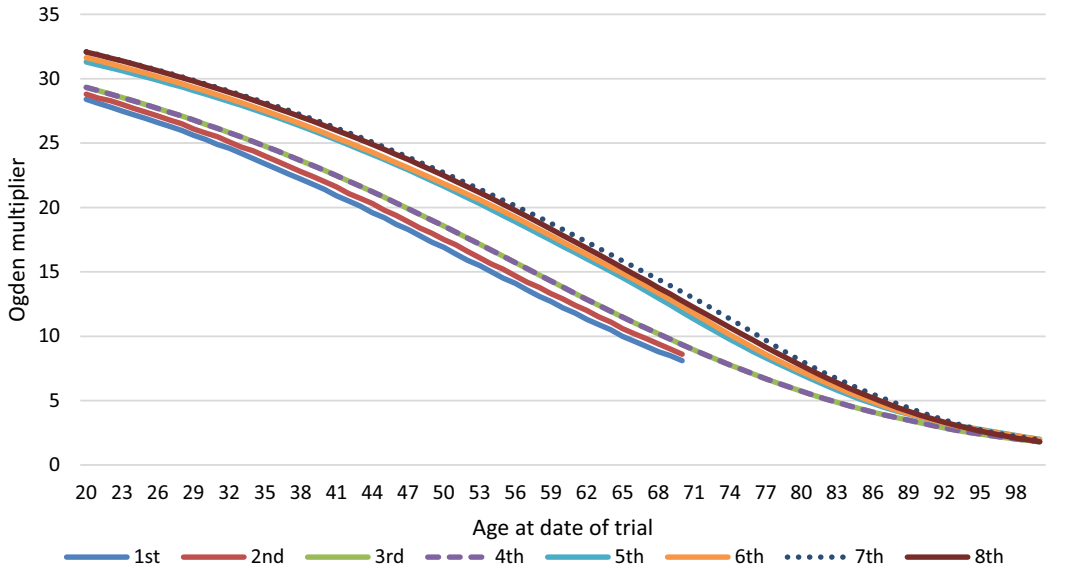


Figure H.1. Ogden multipliers for pecuniary loss for life (males) by age.

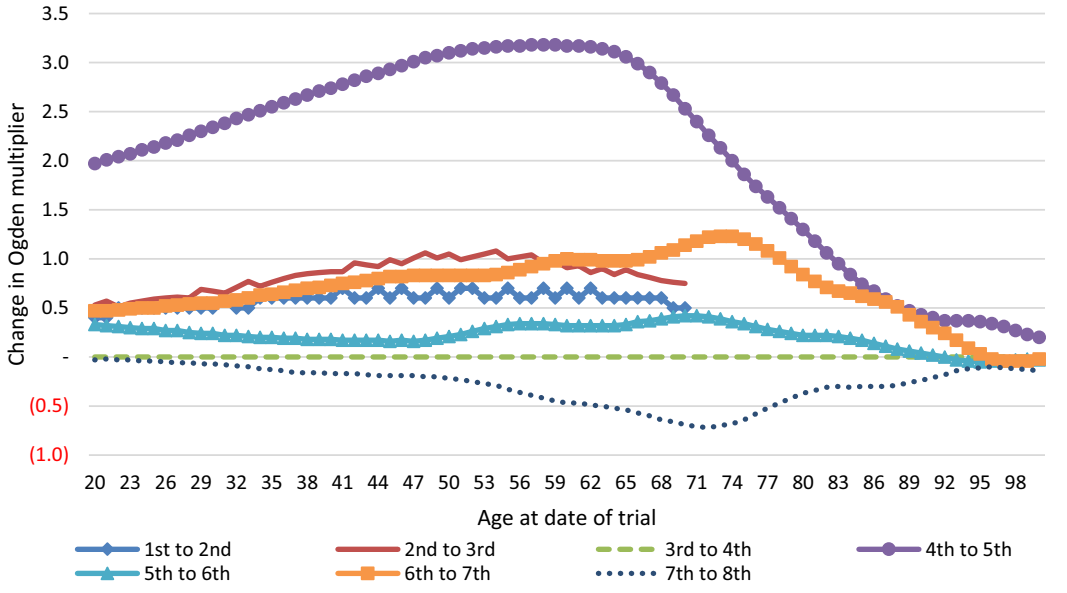


Figure H.2. Ogden multipliers for pecuniary loss for life (males) movements between editions.

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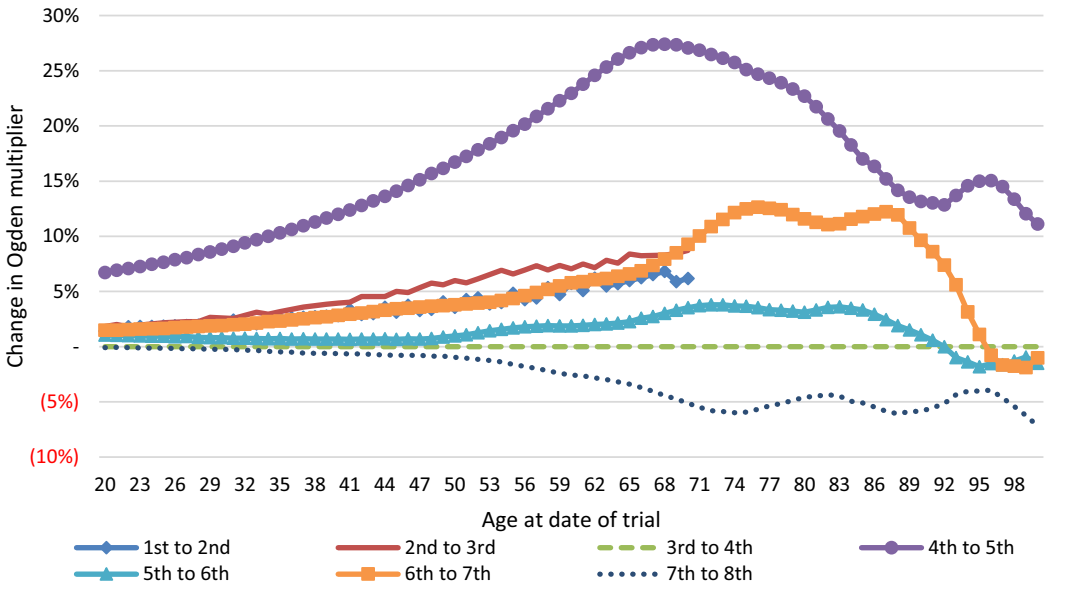


Figure H.3. Ogden multipliers for pecuniary loss for life (males) percentage movements between editions.

I. Market Estimate Changes Over Time and the Key Drivers

Since the first UK EL Insurance Market estimate was published by the Working Party in 2004 there have been a number of changes to the underlying assumptions to reflect the latest data and claims environment. This appendix summarises the key changes between estimates and what we believe to be the key drivers of these underlying changes.

2004 to 2009

See Section 3.3 for a breakdown of the monetary differences in Market Estimate between 2004 and 2009.

Higher mesothelioma claim numbers driven by increasing propensity to claim

As discussed in Section 3.3.1.2, reported claim numbers between 2004 and 2008 were materially higher than estimated in the 2004 paper, while the underlying deaths were very close to those projected. This was caused by an increase in the number of deaths that resulted in a claim, driven by a wider understanding of the disease and its cause, more streamlined compensation processes and possibly higher claimant lawyer activity.

Ultimately, this led to a wider range of future propensity to claim assumptions being set in the 2009 paper, most of which assumed this would continue to increase by age.

Higher mesothelioma average cost per claim

The average cost per claim was also higher in 2004–2008 compared to the estimates from the 2004 paper, primarily driven by a reduction in the average number of insurers involved in a claim from any individual claimant.

Ultimately this led to a change in methodology regarding the ACPC being assessed at the claimant level, not the claim level as in the 2009 paper.

Extension from 2040 to 2050

Although the HSE have always used an exposure profile to 2050 and projected deaths to 2050, the 2004 Working Party estimate cut the UK EL Insurance Market projection at 2040. This was as a proxy for eliminating claims from exposure post 2004. The 2009 Working Party estimates included exposure up to 2050, and projected deaths to 2050, giving an extra 10 years of projected deaths. The UK EL Insurance Market projections contained in the 2009 paper were intended to include all claims arising from all asbestos exposure in the UK, and hence some claims in the projections were assumed to arise from future exposures.

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Pleural plaques removed
Based on the legal environment at the time of the 2009 report, pleural plaques were no longer compensable anywhere in the UK and so were not included in the market estimate for the 2009 paper.

2009 to 2020
See Figure 1 for a breakdown of the monetary differences in UK EL Market Estimate between 2009 and 2020.

Mesothelioma deaths
As discussed in Section 6.2.3, the underlying deaths for ages 20–89 were broadly in line with those projected in the 2009 paper using the "Adjusted HSE" model. However, deaths from those aged 90+ have become more pronounced than prior to 2009. As such, the 2020 model has now been adjusted to include an allowance for deaths (and hence claims) from those aged 90+.

There has also been a recalibration of the HSE model based on the latest deaths data, which we have adopted, which has increased the peak level of deaths, but which has also made the run-off of deaths faster.

In addition to the changes above made by the HSE, we have also made three further changes, namely:

- The removal of the background deaths from our projections as these are highly unlikely to result in an Employers' Liability insurance claim.
- A reduction in the exposure assumed post 1989 to reflect the changes in regulations and law in the UK which make it less likely that Employers' Liability claims will result from this period.
- Extension of the time horizon for deaths, and therefore claims, from 2050 to 2060.

The details on the changes to the HSE model and our additional adjustments are in Section 6.3.6.

Mesothelioma propensity to claim
As summarised in Section 7.1, following the large increase in propensity to claim seen in 2004–2009, the 2009 paper estimated that this was likely to continue, and the scenarios predominantly considered the speed at which this would increase. However, data from CRU from 2009 to 2018 has shown that this has now stabilised and may even be reducing. As discussed in Section 3.3.1.2, the key reasons for the increases in propensity to claim between 2004 and 2009 were believed to be publicity, use of the internet and the creation of the NHS National Mesothelioma Framework. It appears that the impact of these caused a steep increase over that period, but then became a "new normal" rather than continuing to increase over time.

As such, the central scenario of the 2020 estimate assumes that the propensity to claim (for each age) will remain stable in future (with a reducing propensity by age implying that the aggregate propensity to claim will reduce over time as the underlying pool of potential claimants ages.

Mesothelioma Average Cost per Claim
Average costs in more recent years from the survey data have been lower than those assumed in the 2009 paper, driven by a lower inflationary environment in the UK than projected in the 2009 estimate, particularly with regard to court inflation. This lower inflation has been reflected both over the period 2009–2020 to give a lower "starting point" and to future inflation. A summary of the changes made to the ACPC model is given here, with more details in Section 8.4.1:

- Ogden Tables updated to version 8 for future
- Ogden Table discount rate change from +2.5% to −0.75% then −0.25%
- Allowance for Future Ogden Tables
- Some heads of damage changed to use CPI rather than RPI
- Long-term CPI set as 2.0%
- Future Pension and Wage inflation reduced from to 4% (RPI + 1.5%) to 3%
- Future Court inflation reduced from 4.9% (RPI + 2%) to 2.9% (RPI + 0.4%)

The impact of these changes has been to reduce the current and future average costs, primarily due to the future court inflation assumption.

J. Claims Experience Since 2009 to 2019

The Working Party has compared the total insurance costs from the 2020 Survey (carried out for 31 December 2019) on an implied settled (i.e. notified claims in each notification year multiplied by average settled cost for settlement year) and incurred basis; against the Working Party's 2009 medium estimates (Scenario 23 for mesothelioma and Scenario 2B for all other disease types).

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As case estimates on average overstate the eventual settlement cost (as there is limited information when a claim is first notified, especially on an insurer's share of the claim), the incurred average cost (by year of notification) will generally fall over time as claims settle and therefore tends to represent an upper bound of the total insurance costs. On the other hand, claims reported in year X will settle in years X+1, X+2, etc. and, because of claim inflation, will on average be larger than claims settled in year X. Therefore, the implied settled basis tends to represent a lower bound of the total insurance costs.

The actual claim amounts incurred in the period 2009 to 2016 have been fairly in line with the medium scenarios produced by the Working Party in 2009 when all diseases are combined, although the number of claims notified in the period have been higher than expected across all disease types when compared with the medium scenarios.

The actual versus expected experience based on the market survey data is shown in Table J.1.

Table J.1. Actual versus expected experience 2009 to 2019 (£m)

£m	Mesothelioma	Asbestosis	Lung Cancer	Pleural Thickening	Total
AWP 2009 medium scenarios*	2,828	314	225	98	**3,467**
Survey incurred basis†	3,014	307	164	169	**3,654**
Survey implied settled basis‡	2,546	290	121	142	**3,099**

*Scenario 23 for mesothelioma and Scenario 2B for the other asbestos-related diseases.
†Figures grossed up, based on assumption that survey covers 80% of the UK EL Insurance Market – reported numbers x incurred reported average costs (including nils).
‡Figures grossed up, based on assumption that survey covers 80% of the UK EL Insurance Market – reported numbers x settled average costs (including nils) by settlement year.

Pleural plaques are not included in the above table as estimates were not included in the 2009 paper, with current claims typically relating to Scottish and Northern Irish exposure only.

The trends are based on the summary data collected from insurance companies and relate to insurance claims rather than individual claimants. The data therefore only covers claimants that make a claim to at least one of the survey participants and each individual claimant may appear more than once in the data collected.

Data collection

One of the key aims of the Working Party is to collect insurance company claims data to enable an analysis of the trends and features in the data for recent years to be undertaken. Section 3 of the 2009 paper contained this analysis based on data as at 31 December 2008 (the "2009 Survey"). The data collection has been repeated every year since, with the survey carried out as at 31 December 2019 (the "2020 Survey").

Appendix B contains links to the results from Working Party's market surveys.

Data is collected on the following claim types:

- Mesothelioma
- Asbestos-related lung cancer
- Asbestosis
- Pleural thickening
- Pleural plaques (Scottish and Northern Irish exposure only)

12 companies participated in the aggregate data collection exercise, which is the same number that participated in the 2009 Survey. The Working Party is extremely grateful for all the companies' assistance.

All data was collected on an anonymous basis and aggregated via the actuarial profession. One member of the Working Party produced summaries of aggregated anonymous data collected at the IFoA, which was then circulated to all Working Party members before being published online on the IFoA's UK Asbestos practice area (Ref: 67). No Working Party member was allowed to take copies of the original data sets.

Note that although most of the items requested had sufficient data for some kind of credible analysis, not all of the requested data was complete or available. In particular, there were not enough adequate responses received on mesothelioma settlement data by living/deceased status and location, albeit similar statistics were available by notification year. The number of participants that provided each data item by year is included within the publicly available data set.

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Consistency with 2009

It is important to note that several assumptions are required when grossing-up results to the full insurance market level. The most crucial assumptions required are:

1) The percentage of the market that is assumed to be captured by the survey data.
2) How to allocate out "unidentified" asbestos-related claims into their constituent claim types (i.e. mesothelioma, asbestosis, lung cancer, pleural thickening and pleural plaques).

Both this paper and the 2009 paper assumed their survey collected data for 80% of the EL UK Insurance Market. Analysis during 2008 and 2009 of the Compensation Recovery Unit data confirmed that this assumption was reasonable, and since this time the assumption has been adjusted depending on the number of survey participants. The participants in the 2009 and 2017 surveys are unlikely to be identical, albeit this cannot be confirmed owing to the anonymity of the survey process. Furthermore, the Working Party has compared the number of reported claims and average settled cost (excluding nil claims) over time between the 2009 and 2020 Surveys. Generally, the data is consistent between the two surveys, in particular for mesothelioma claims.

Survey results

Each of the following sections includes a Figure showing the summary data collected for that claim type. These show claim number statistics (including nil claim notifications) by notification year and the average cost per claim based on non-nil claims by settlement year. Note that the nil claims data collected in Appendix B refers to claims that are "true nils" (i.e. £0) for all disease types.

For the avoidance of doubt, all historical data and projections referred to below have been grossed up to 100% of the market and unidentified claims have been allocated pro-rata to each claim type. They are therefore all on a "like for like" comparison. The projections are based on the 2009 Working Party's medium scenarios (Scenario 23 for mesothelioma and Scenario 2B for the other asbestos-related diseases).

Two features of the data are worth bearing in mind. First, the data has been split by claim type more accurately from 2003 onwards, meaning that data prior to 2003 may not be as complete and accurate as that for more recent periods. Secondly, the claims notified pre-2016 (in the 2020 Survey) are largely settled, whereas claims notified 2017 and post will still be largely outstanding. Hence, it is difficult to draw any conclusions in respect to inflation trends using recent incurred data.

Nil claim rates

An assumption regarding nil rates for each asbestos-related disease is needed to allow for consistent comparison with the 2009 projected average costs (which were on an excluding nil claims basis for mesothelioma, and included nil claims for the other disease types). Table J.2 following shows the selected nil rates based on a 5-year weighted average of settlement year data in the 2020 survey:

Table J.2. Nil rate selections by claim type

Disease Type	Nil Rate
Mesothelioma	28%
Lung cancer	40%
Asbestosis	36%
Pleural thickening	31%

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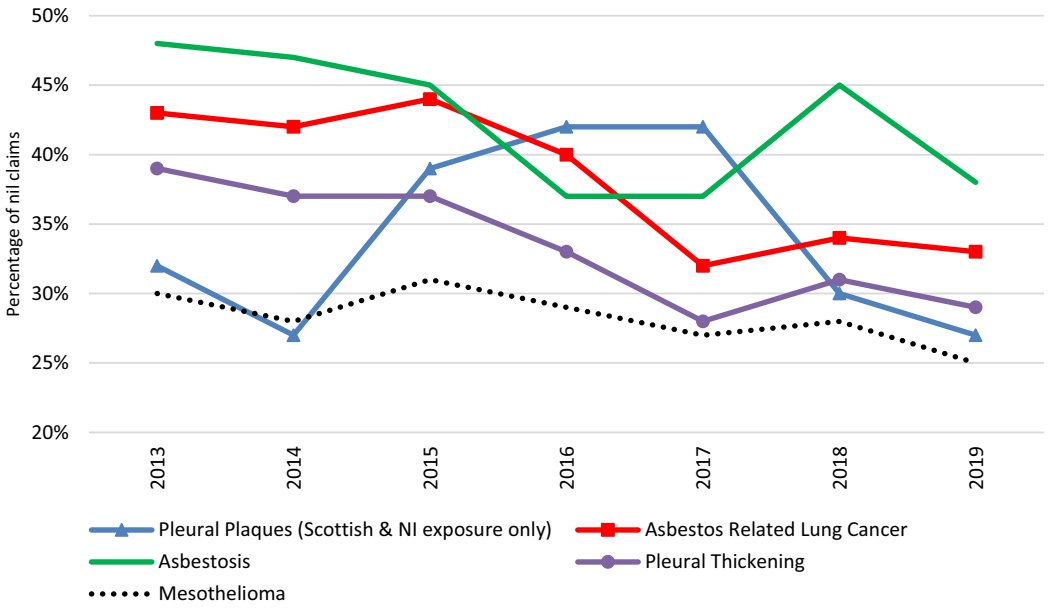


Figure J.1. Percentage of nil claims by settlement year.

Mesothelioma numbers and average costs

Figures J.1–J.9 detail the number of claims (including nils) notified and the average settled cost (excluding nils) from the 2009 and 2020 Surveys against Scenario 23. Note that the number of claims in Scenario 23 has been adjusted to include nil claims using the assumption in Table J.2.

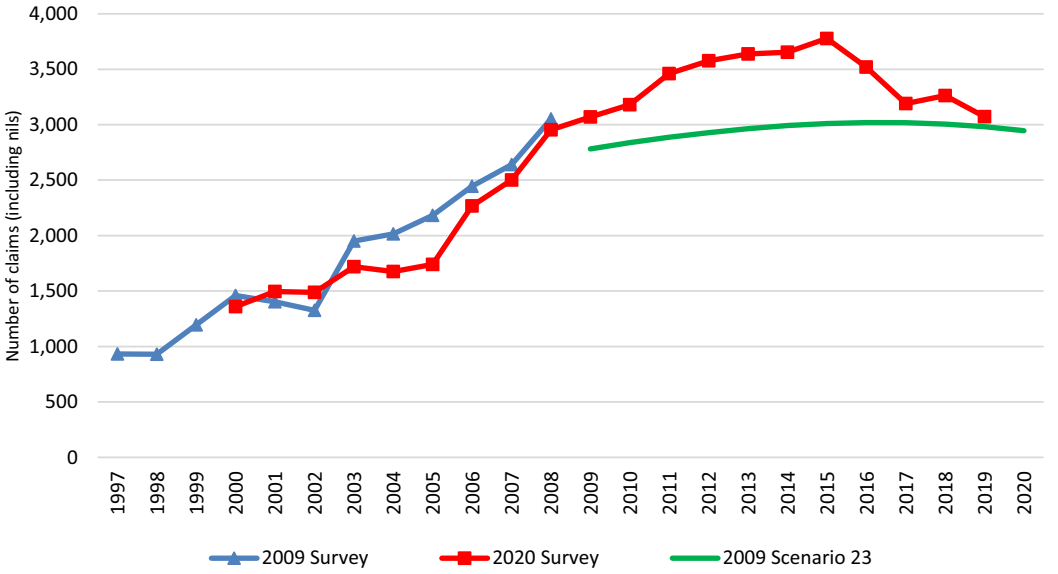


Figure J.2. Mesothelioma claim number experience by notification year.

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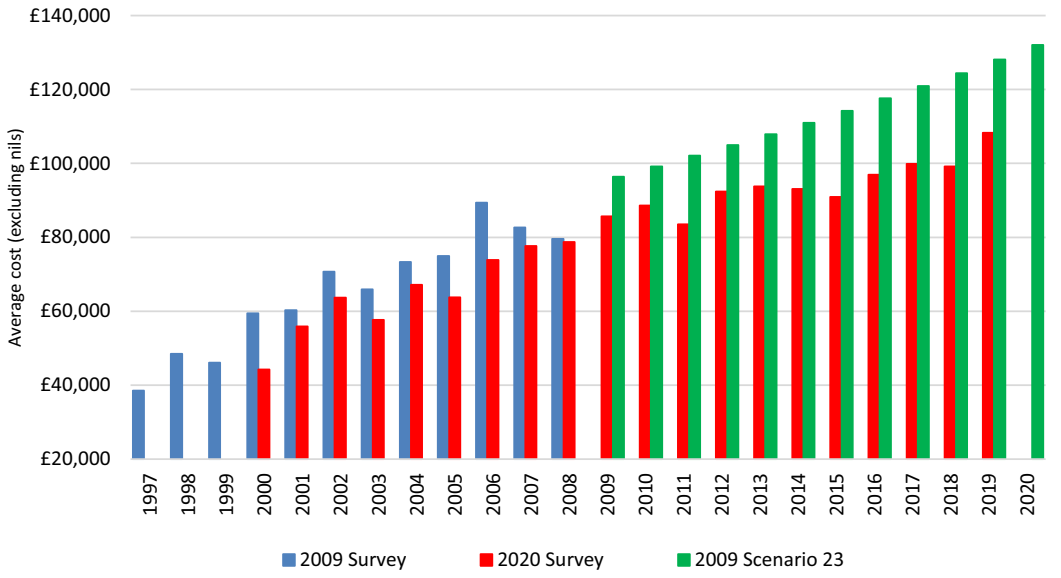


Figure J.3. Mesothelioma average cost experience.

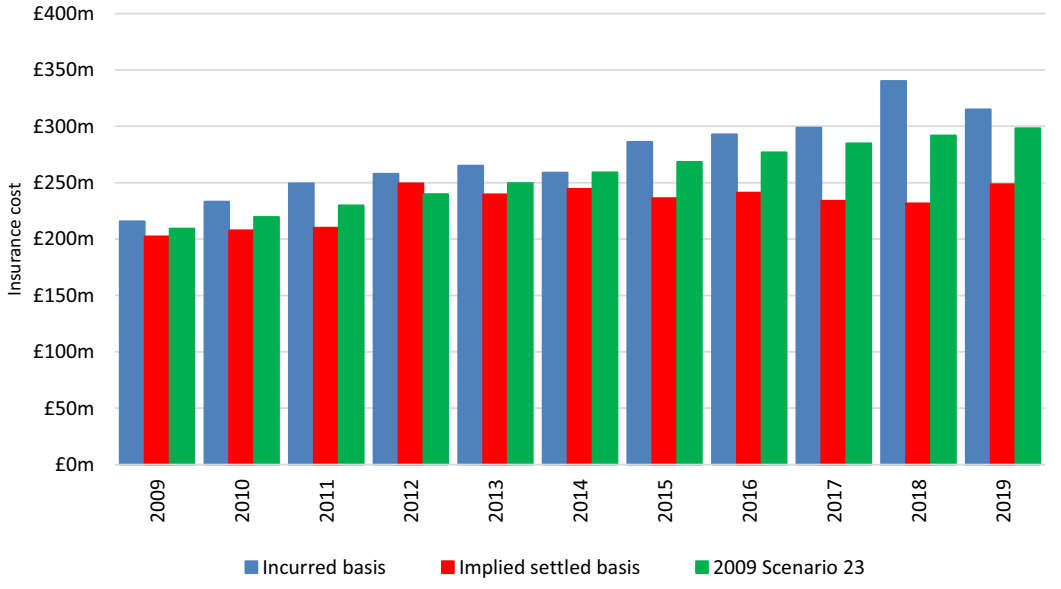


Figure J.4. Mesothelioma: actual versus expected experience.

Lung cancer numbers and average costs

Figures J.5–J.7 detail the number of claims (including nils) notified and the average settled cost (excluding nils) from the 2009 and 2020 surveys against Scenario 2B. Please note that average cost in Scenario 2B has been adjusted to be on an including nil claims basis using the assumption in Table J.2.

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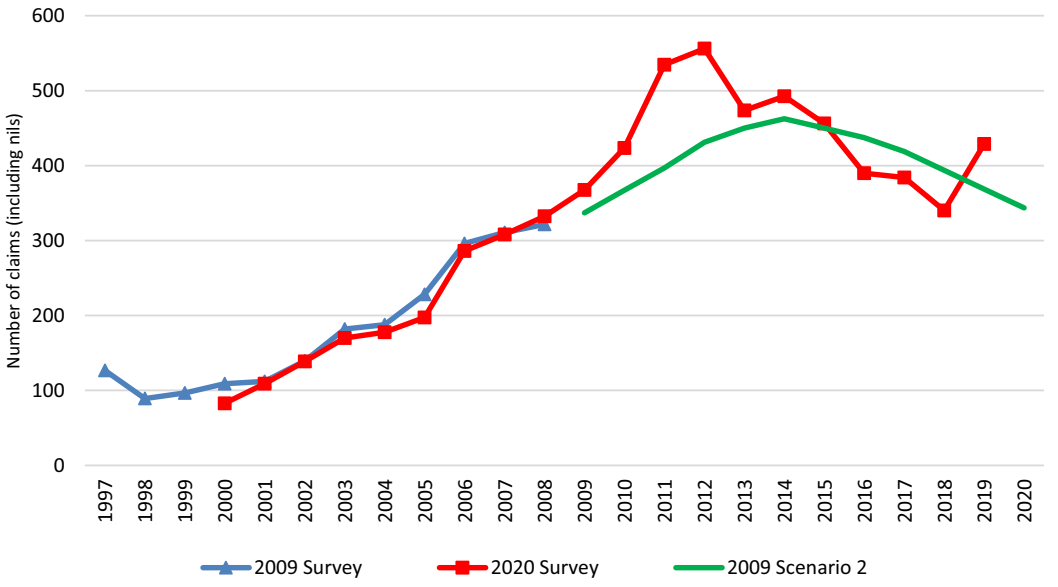


Figure J.5. Lung cancer number of claims experience by notification year.

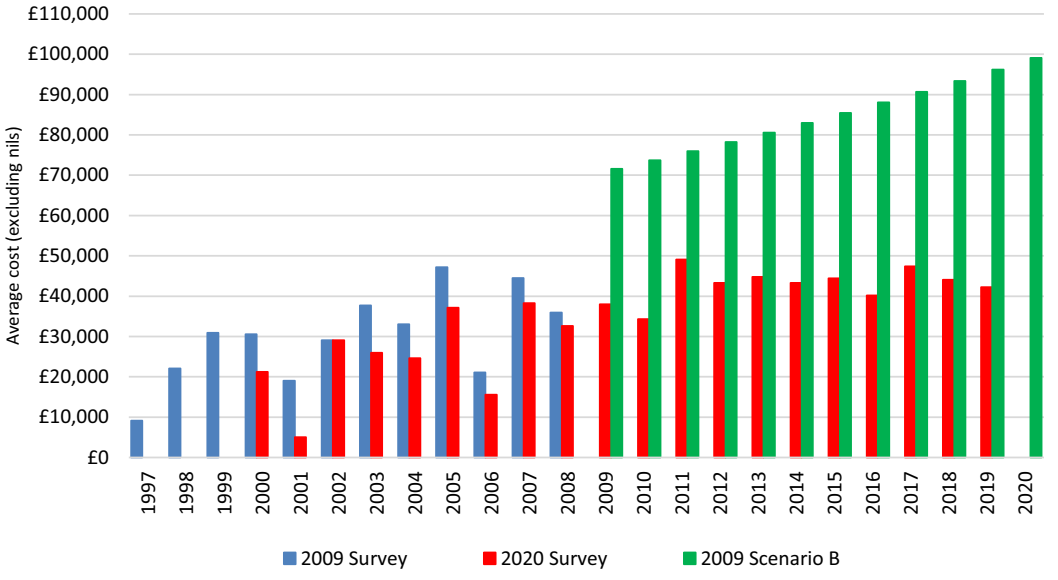


Figure J.6. Lung cancer average cost experience.

The average cost is significantly lower than expected as the 2009 Working Party overestimated the average cost of non-mesothelioma claims (see Section 3.3.6).

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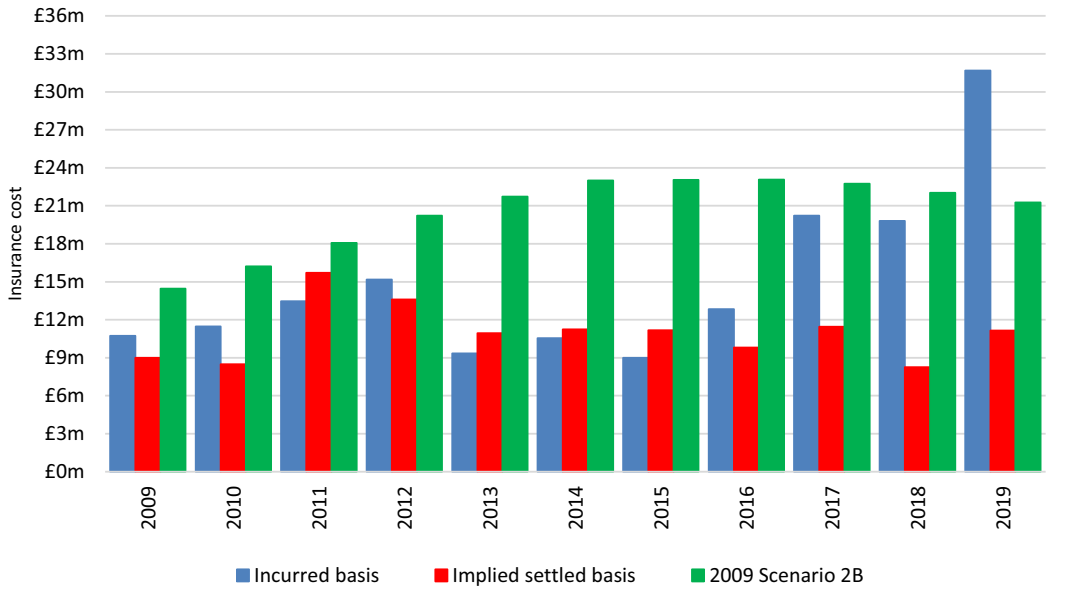


Figure J.7. Lung cancer – Actual versus expected experience.

Asbestosis numbers and average costs

Figures J.8–J.10 detail the number of claims (including nils) notified and the average settled cost (excluding nils) from the 2009 and 2020 surveys against Scenario 2B. Note that the average cost in Scenario 2B has been adjusted to be on an including nil claims basis using the assumption in Table J.2.

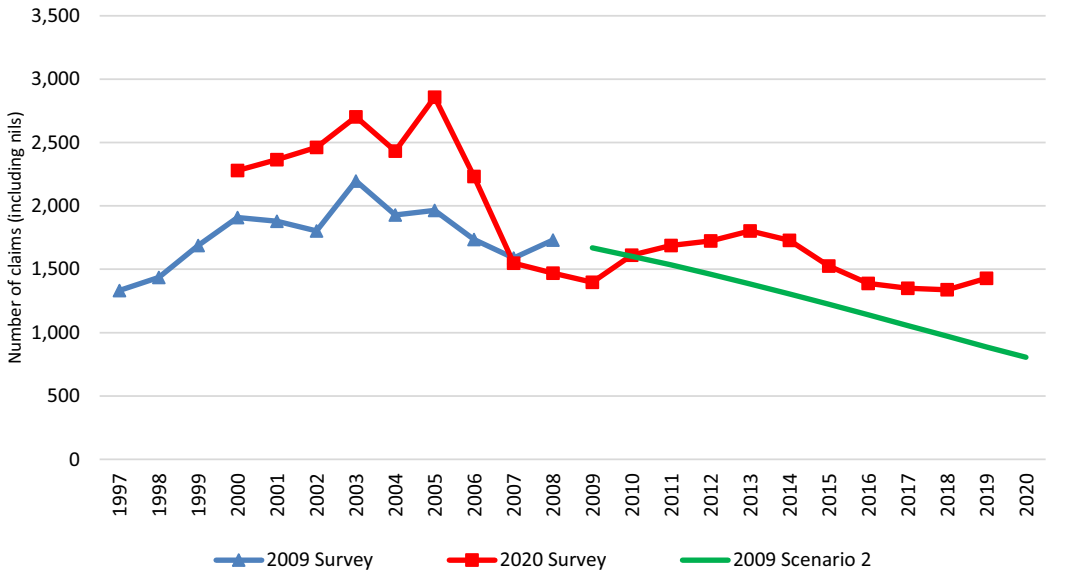


Figure J.8. Asbestosis number of claims experience by notification year.

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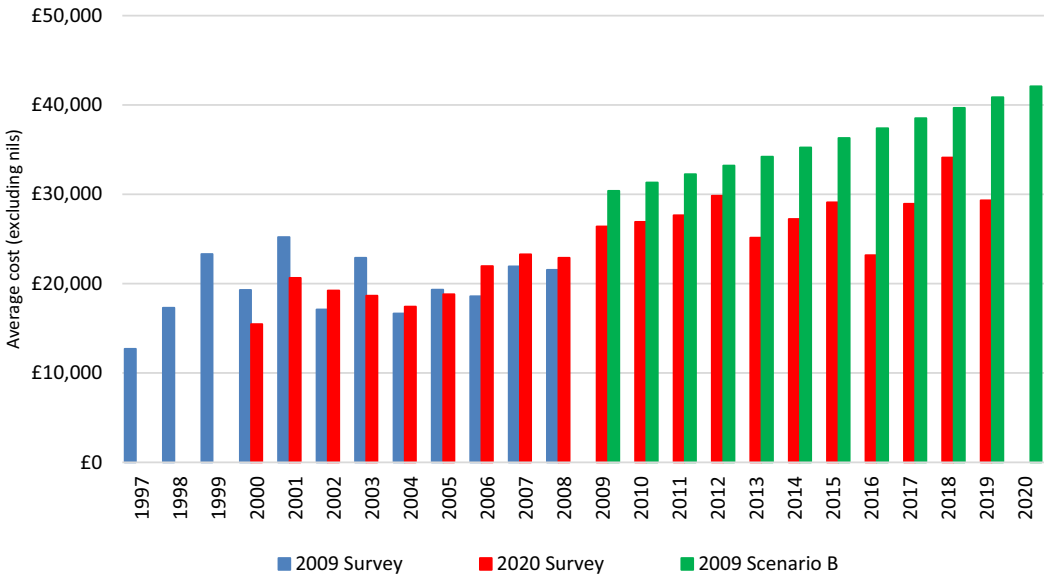


Figure J.9. Asbestosis average cost experience.

Settled average costs (excluding nils) are significantly lower than expected as the 2009 Working Party overestimated the average cost of non-mesothelioma claims (see Section 3.3.6 for more details).

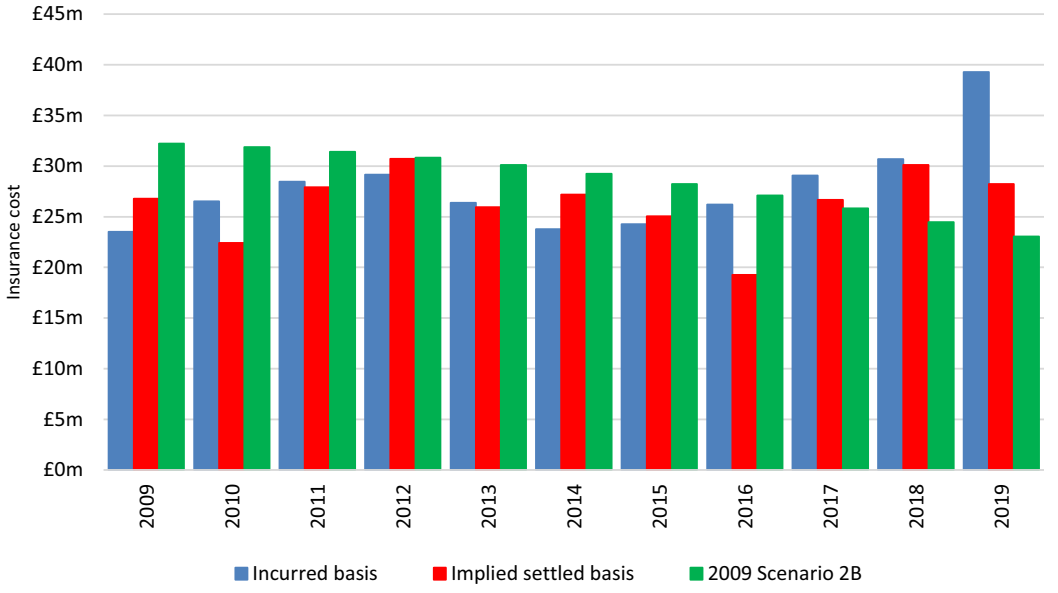


Figure J.10. Asbestosis: actual versus expected experience.

Pleural thickening numbers and average costs

Figures J.11–J.14 detail the number of claims (including nils) notified and the average settled cost (excluding nils) from the 2009 and 2020 Surveys against the Scenario 2B. Please note that average cost in Scenario 2B have been adjusted to be on an including nil claims basis using the assumption in Table J.2.

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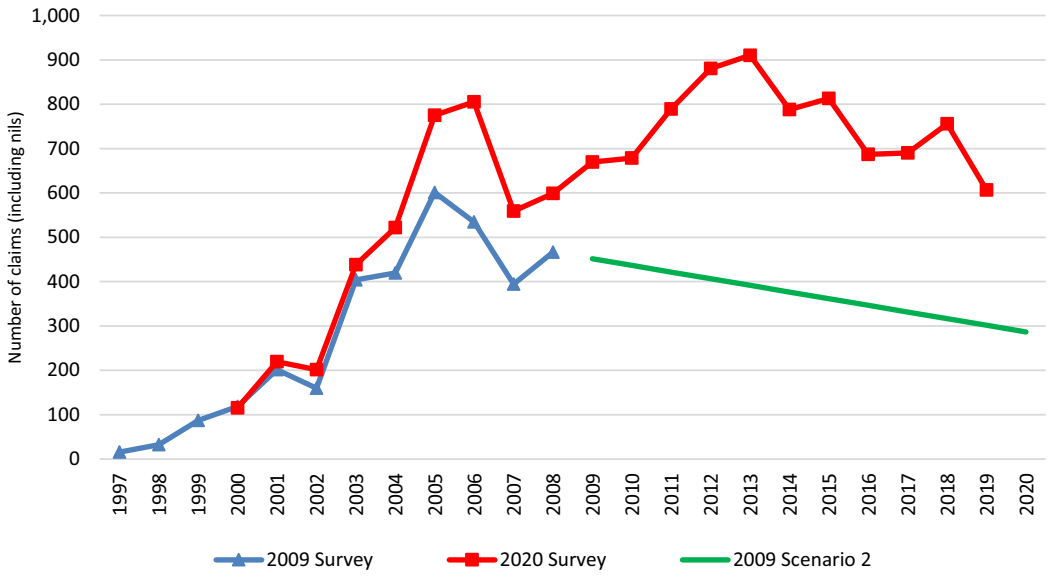


Figure J.11. Pleural thickening number of claims experience by notification year.

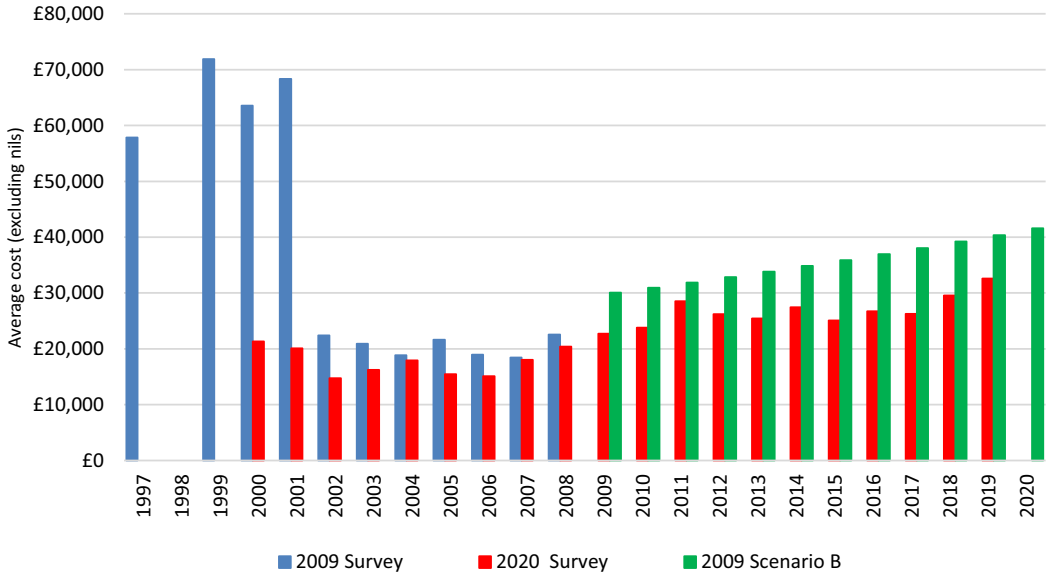


Figure J.12. Pleural thickening average cost experience.

Pleural thickening experience has grown from less than 100 notified claims pre-2000 to levels reaching 600–900 claims in recent years. Similar to asbestosis, there has been a clear change in the level of claims notified in the 2020 Survey versus that in 2009, again likely owing to a change in how claims were recorded for one or more survey participants. Asbestosis and pleural thickening experience since 2009 are discussed separately but are combined for future projections in Section 9.2, given the similarity of their claim characteristics.

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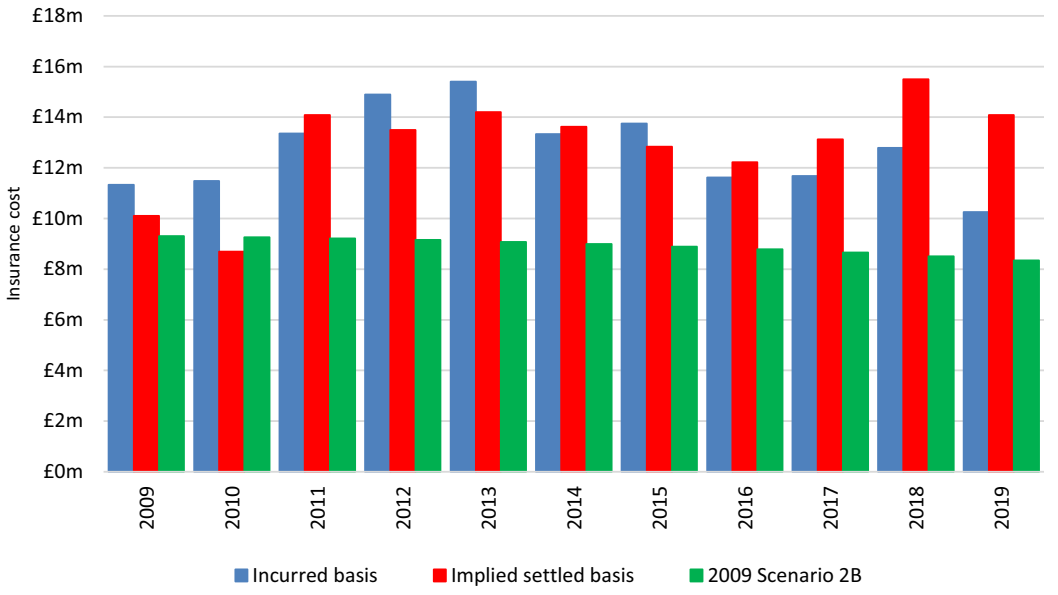


Figure J.13. Pleural thickening – Actual versus expected experience.

Pleural plaques (Scottish and Northern Irish exposure only) numbers and average costs

Figure J.14 details the number of claims (including nils) notified and the average settled cost (excluding nils) from the 2020 Survey.

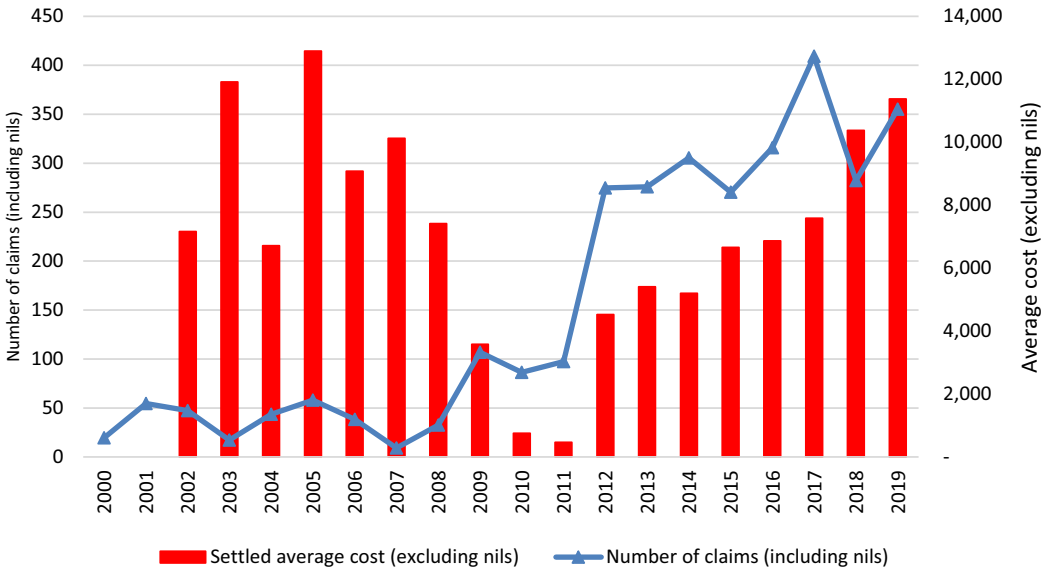


Figure J.14. Pleural plaques experience.

The 2009 Working Party projections did not include pleural plaques, given the House of Lords' judgment in 2007 that dismissed all claims for symptomless pleural plaques. Between 2009 and 2011, however, the Scottish and Northern Irish governments introduced bills to make pleural plaques compensable again, with a market framework established shortly after the legislation was passed to agree the level of indemnity and costs, enabling the substantial backlog of cases to be cleared. See Section 5.2.10 for more details on pleural plaque claims.

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Average age

Average claimant ages were not collected from survey participants in the 2009 Survey but they were collected in the 2020 Survey. Therefore, this section will not compare to 2009 but will focus on discussing trends in the current data. It is worth noting that not all survey participants completed information on average claimant ages. Depending on the report year data was provided by 8 of the survey participants. The 2008 and post report years are populated by 8 participants.

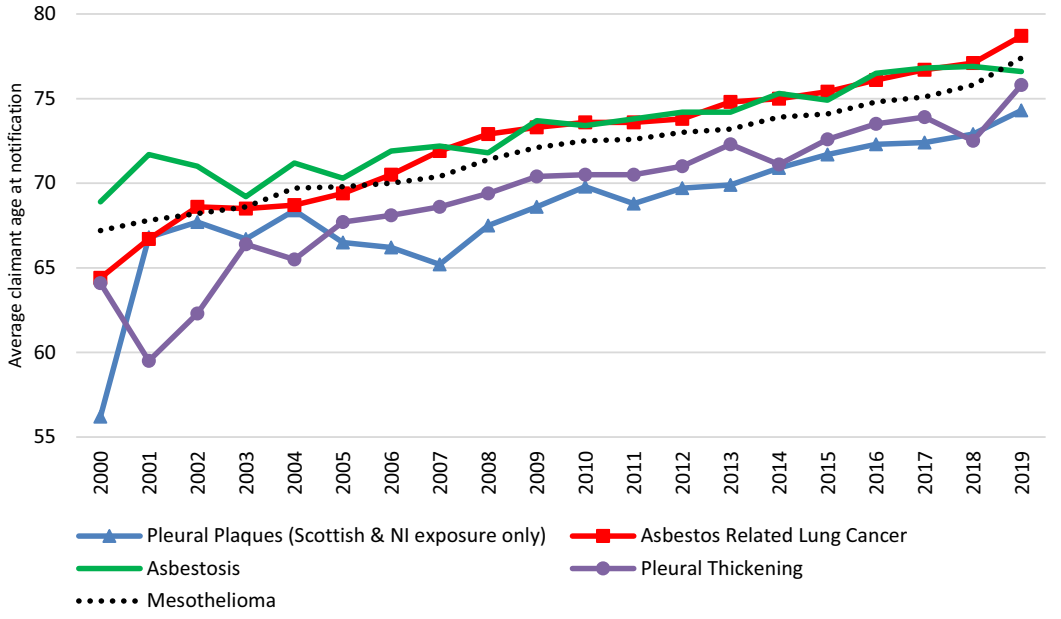


Figure J.15. Average claimant age by disease type and year of notification.

Mesothelioma insights: Claimant gender

Figure J.15 shows the proportion of mesothelioma claimants that are male against those that are female, where gender is known by report year, from the 2020 survey:

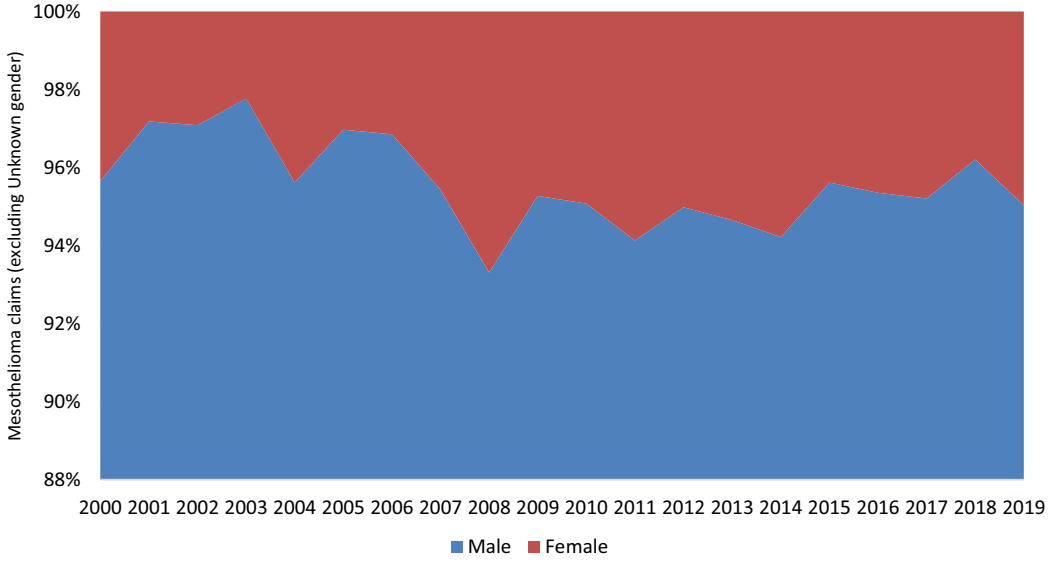


Figure J.16. Mesothelioma claimant gender (excluding unknown).

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The percentage of male claimants varies between 94% and 98% of the total known population. The majority of mesothelioma claimants are male because the industries where asbestos was used extensively were predominantly male dominated.

There does appear to be a slight step change around 2007–2008, where the 2006 and prior report years have an average proportion of male claimants of 97%. While the 2007 and post report years the average is 95%. This increasing trend in the proportion of female to male claimants is also evident in the HSE data (see Section 6.2), albeit with differing proportions. The male to female ratio in the HSE data is between 16% and 21% with the differing proportions owing to the fact that many female mesothelioma deaths are not directly employment related.

Mesothelioma insights: country of exposure

The following graph shows by report year the proportion of mesothelioma claims by country of exposure. Note that, as with claimant gender, this information was not filled out by all survey respondents. Only between 2% and 22% of records reported to the 2020 survey have a country of exposure attached. In the most recent report years (2014 and post) this is more consistent and averages around 21%

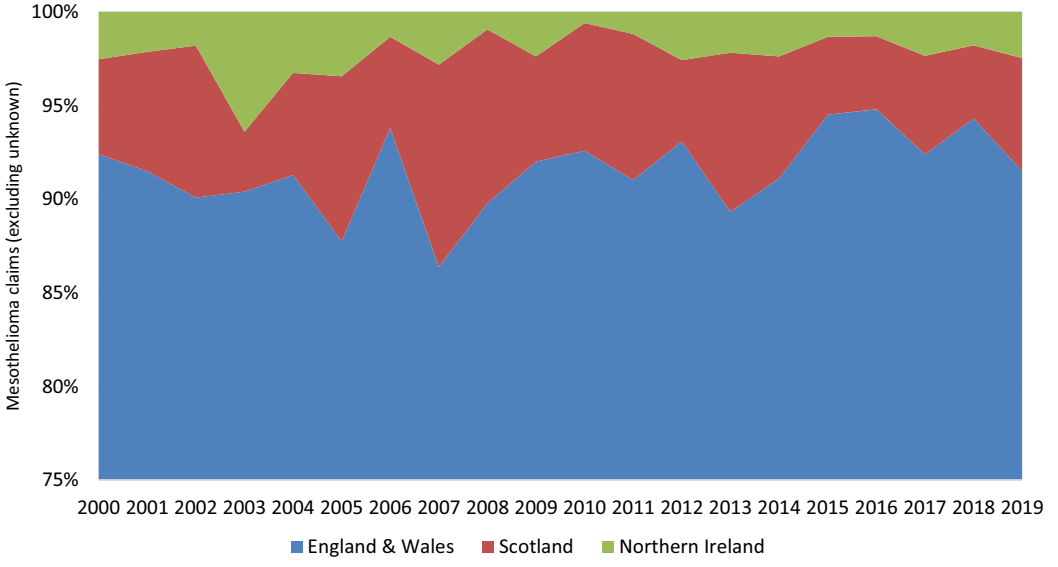


Figure J.17. Mesothelioma claims by country of exposure.

When looking at frequency, the majority of claims arise from exposures in England and Wales (between 86% and 95% for any particular report year). There are no discernible changes in the proportions of claims coming from the different countries in the latter half of the survey data. There is some more volatility in the earlier report years but the very low numbers of claims for which country of exposure is known in the 2020 Survey most likely drives this.

The percentage of claims arising from English and Welsh exposures averages 92% across the entire period. Over the same period Scottish exposures account for 6% of claims and the remaining 2% of claims come from Northern Ireland. Figure J.18 shows by report year the proportion of the total incurred mesothelioma claims by country of exposure.

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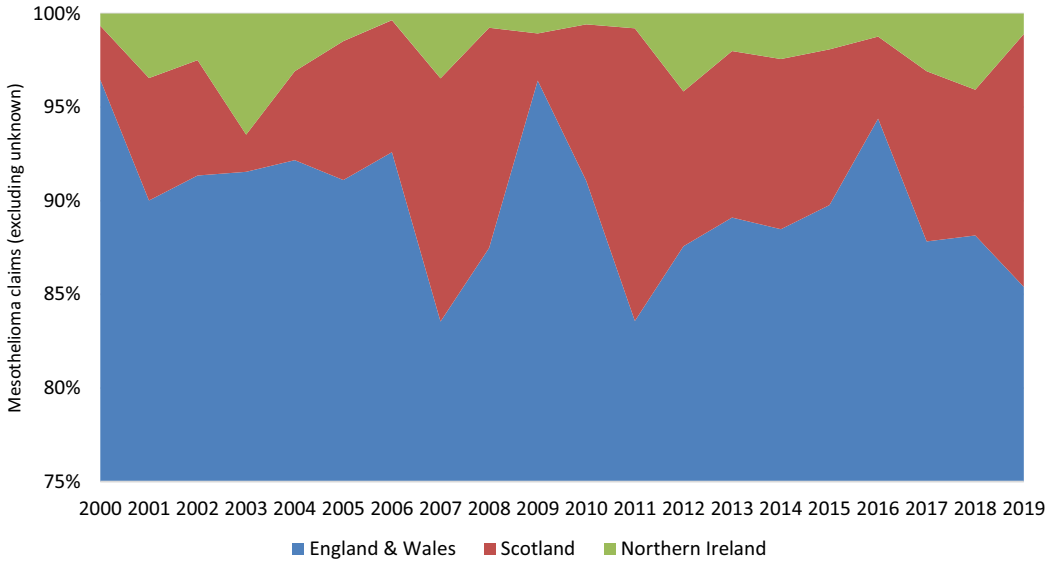


Figure J.18. Mesothelioma incurred by country of exposure.

It is important to remember when looking at Figures J.18 and J.19 that these are incurred values by report year, where the most recent report years contain open claims that have not yet reached their ultimate value. Given this, the graph shows results proportionally rather than in absolute amounts, and so mitigates this impact somewhat.

It can be seen that the proportion of the total mesothelioma incurred claims coming from English and Welsh exposures averages 91% for the 2000 to 2010 report years. From 2011 onwards, the average is 88%, albeit there is no similar reduction in frequency proportions.

Figure J.19 illustrates this changing trend more clearly, by showing the average mesothelioma incurred by report year for each of the countries separately and the total average (including the claims where the country is unknown).

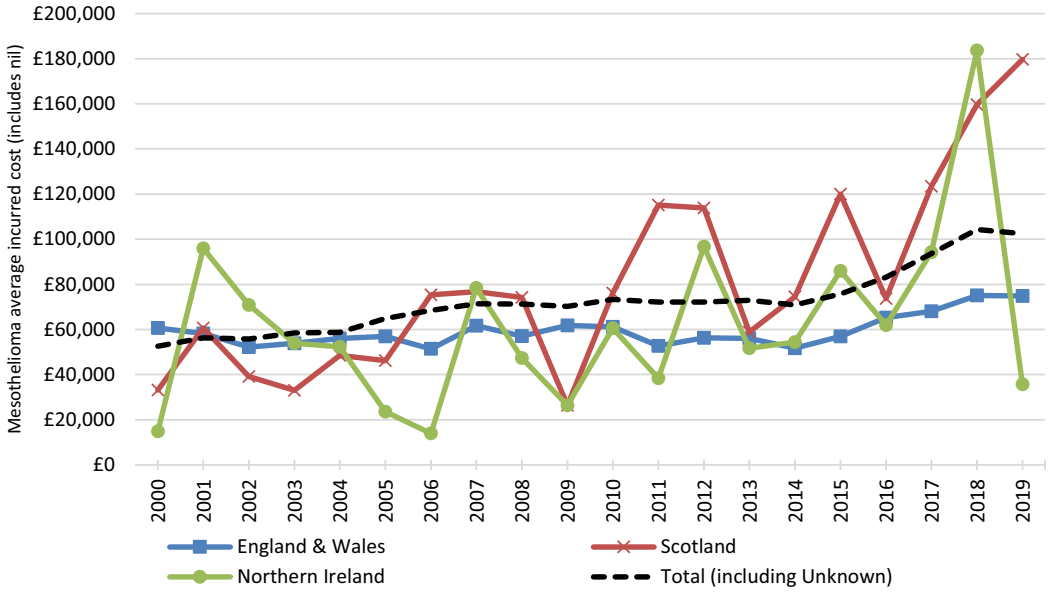


Figure J.19. Mesothelioma: average incurred by country of exposure.

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Figure J.19 shows that in the 2010 and prior report years the average incurred mesothelioma claim size was broadly consistent across all countries. Since then, the Scottish and Northern Irish claims have seen increases in average claim size but the average incurred for English and Welsh claims has stayed broadly similar. The increasing average claim size in Scotland is driven by the increasing loss of society awards after the Damages (Scotland) Act came into force in April 2011. This is explained in more detail in Section 5.2.14. The higher average claim size of Northern Irish mesothelioma claims is most likely driven by the higher figures in the guidelines issued by the Judicial Studies Board for Northern Ireland compared to those issued by the Judicial College in England and Wales. These guidelines are explained in more detail in Sections 5.3.8, 5.3.9 and 5.3.10.

Mesothelioma insights: living claims at the time of reporting a claim

Figure J.20 shows the proportion of mesothelioma claimants that were living and those that were deceased at the time the claim was made by report year. Note that, as with claimant gender and country of exposure, this information was not filled out by all survey respondents. Only between 33% and 44% of records reported to the 2020 Survey, have a living status attached. In the most recent report years (2012 and after), however, this is more consistent and averages around 43%.

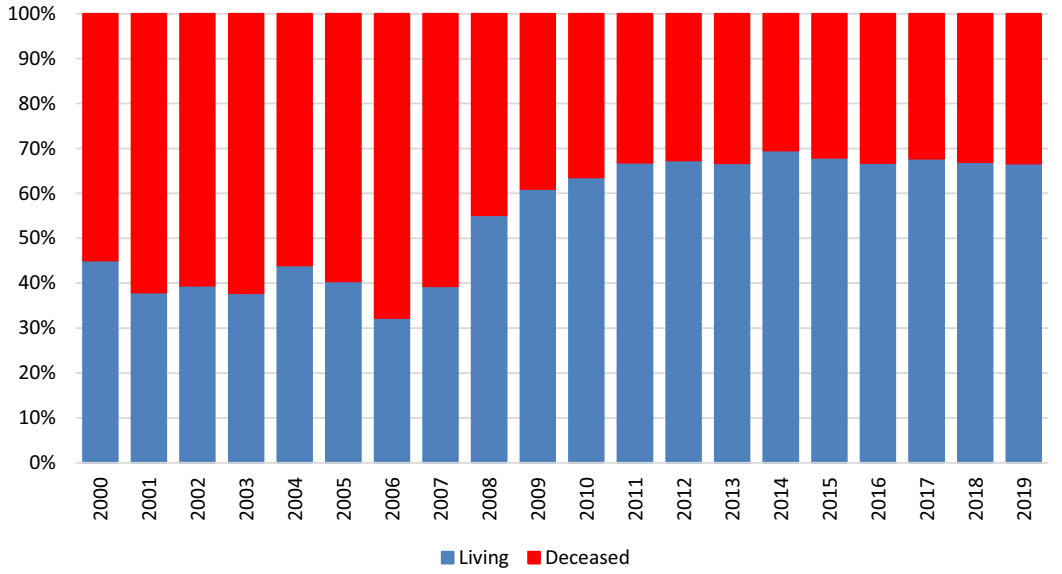


Figure J.20. Mesothelioma claimant status at notification, by notification year.

The proportion of living mesothelioma claimants has been gradually increasing over time. However, there is a clear step change in the trend pre and post 2007. In the 1997 to 2007 report years, there is a range in the proportion of living claimants, which drops as low as 32% but never goes above 45%. In 2008, the proportion of living claimants was 55% and in the 2009 and post report years the proportion was between 61% and 70%. This changing trend is consistent with the introduction of the NHS' mesothelioma framework (in 2007), which served to increase sufferers' awareness and improve the diagnosis of mesothelioma claims.

Across the most recent report years (i2015 to 2019) the average proportion of living claimants was 67%, at the time the claim was reported. However, when claims are settled the proportion of living claimants reduces to under 50%.

The following graph shows the proportion of mesothelioma claimants that were living and those that were deceased at the time the claim was settled, by settlement year. Note that, as with claimant gender and country of exposure, this information was not filled out by all survey respondents. Only between 0% and 19% of records reported to the 2020 survey, have a living status attached. In the most recent report years (2013 and beyond), however, this is more consistent and averages around 16%.

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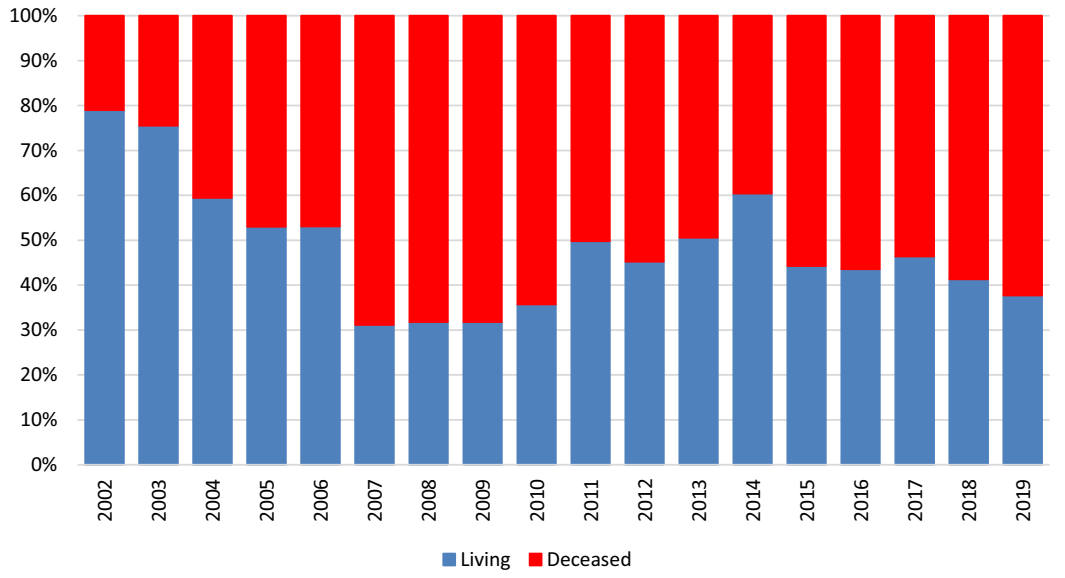


Figure J.21. Mesothelioma claimant status at settlement, by settlement year.

Across the most recent report years (2015 to 2019) the average proportion of living claimants was 43%, at the time the claim was settled. This is lower than was originally anticipated. In the 2009 market estimate, it was assumed that living mesothelioma claimants at settlement would make up 50% of all settled claims.

K. Working Party 2009 CRU calculations

Tables K.1–K.7 detail the assumptions and data used by the Working Party in 2009.

Table K.1. 2009 CRU claimants: compensator

	2002Q1–2003Q1	2003Q1–2004Q1	2004Q1–2005Q1	2005Q1–2006Q1	2006Q1–2007Q1	2007Q1–2008Q1	2008Q1–2009Q1
Non-state	520	669	702	825	1,005	1,098	1,393
State	124	148	162	177	228	239	250
Mixed	29	31	44	62	78	64	57
Current Government %	*19.3%*	*18.1%*	*18.8%*	*17.7%*	*18.5%*	*17.9%*	*15.2%*
Min Government %	*18.4%*	*17.5%*	*17.8%*	*16.6%*	*17.4%*	*17.1%*	*14.7%*
Max Government %	*22.7%*	*21.1%*	*22.7%*	*22.5%*	*23.3%*	*21.6%*	*18.1%*

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Table K.2. 2009 CRU claimants: status

	2002Q1–2003Q1	2003Q1–2004Q1	2004Q1–2005Q1	2005Q1–2006Q1	2006Q1–2007Q1	2007Q1–2008Q1	2008Q1–2009Q1
Live	10	13	57	109	240	549	1,216
Settled	591	757	760	858	971	803	434
Withdrawn	72	78	91	97	100	49	50
Current Withdrawn %	*19.3%*	*18.1%*	*18.8%*	*17.7%*	*18.5%*	*17.9%*	*15.2%*
Min Withdrawn %	*18.4%*	*17.5%*	*17.8%*	*16.6%*	*17.4%*	*17.1%*	*14.7%*
Max Withdrawn %	*22.7%*	*21.1%*	*22.7%*	*22.5%*	*23.3%*	*21.6%*	*18.1%*

Table K.3. 2009 CRU claimants: gender

	2002Q1–2003Q1	2003Q1–2004Q1	2004Q1–2005Q1	2005Q1–2006Q1	2006Q1–2007Q1	2007Q1–2008Q1	2008Q1–2009Q1
Male	633	814	859	1,005	1,212	1,297	1,513
Female	39	34	49	59	99	104	187
Unknown	1	0	0	0	0	0	0
Male %	94.1%	96.0%	94.6%	94.5%	92.4%	92.6%	89.0%

Table K.4. 2009 CRU claimants: males by age band (live, settled and withdrawn)

Age Band	2002Q1–2003Q1	2003Q1–2004Q1	2004Q1–2005Q1	2005Q1–2006Q1	2006Q1–2007Q1	2007Q1–2008Q1	2008Q1–2009Q1
<45	0	9	6	1	3	4	3
45–54	30	42	22	43	40	42	41
55–59	85	100	80	96	99	89	84
60–64	110	134	151	154	173	190	224
65–69	107	159	163	192	242	256	265
70–74	120	144	173	193	233	234	306
75–79	111	132	147	166	198	250	285
80–84	46	66	85	112	156	145	194
85+	24	28	32	48	68	87	111

Table K.5. 2009 CRU claimants: conversion to calendar year

Calendar Year	2002Q1–2003Q1	2003Q1–2004Q1	2004Q1–2005Q1	2005Q1–2006Q1	2006Q1–2007Q1	2007Q1–2008Q1	2008Q1–2009Q1
2003	30%	70%					
2004		30%	70%				
2005			30%	70%			
2006				30%	70%		
2007					30%	70%	
2008						30%	70%

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Table K.6. 2009 CRU claimants: male by calendar year

	2003	2004	2005	2006	2007	2008
All males	760	846	961	1,150	1,272	1,448
Selected Government %	*20.0%*	*20.0%*	*20.0%*	*20.0%*	*20.0%*	*16.0%*
Males (ex Government)	684	757	865	1,035	1,144	1,303
Selected Withdrawn %	*10.0%*	*10.5%*	*10.0%*	*10.0%*	*10.0%*	*10.0%*
Males (ex Government and Withdrawn)	**547**	**605**	**692**	**828**	**915**	**1,095**

Table K.7. 2009 derivation of claims to claimant ratio

Year	UK EL Insurance Market Claims (Ex Nils)	Male GB Claimants (ex Government and Withdrawn)	Female % of Male	GB Claimants	NI % of GB	UK EL Insurance Market Claimants	Claims to Claimants Ratio
2003	1,540	547	0.8%	551	3.1%	568	**2.7**
2004	1,584	605	1.5%	615	3.2%	634	**2.5**
2005	1,723	692	1.1%	700	2.3%	716	**2.4**
2006	1,931	828	1.5%	841	2.9%	865	**2.2**
2007	2,066	915	2.4%	937	2.0%	956	**2.2**
2008	2,411	1,095	3.2%	1,130	2.2%	1,154	**2.1**

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