

APPENDIX 1

Organisations Contacted

BF Goodrich Chemicals (UK) Ltd

British Furniture Manufacturers Federation (UK)

British Shops and Stores Association (UK)

Consumer Product Safety Commission (US)

Corporate Intelligence on Retailing (UK)

FIRA International (formerly Furniture Industries Research Association) (UK)

Fire Protection Association (UK)

HMG Department of the Environment, Transport and Regions (UK)

HMG Department of Trade and Industry (UK)

HMG Home Office (UK)

National Bed Federation (UK)

National Fire Protection Association (US)

Office for National Statistics (UK)

Qualitas Furnishing Standards (UK)

US Bureau of Census (US)

APPENDIX 2

UK Demographic and Raw Fire Statistics Data

UK fire statistics were taken from the Home Office, Fire Statistics Reports; individual reports back to 1966 were consulted. UK population statistics were taken from the 1961, 1971, 1981 and 1991, decennial census reports. The Office for National Statistics Inter-census provided estimates of population. Data on the number and occupancy of households, including forecasts to 2016, were provided by the Department of the Environment, Transport and Regions (DETR) HDS Division. The rate of growth of the UK population figures slows down slightly between the 1971 and the 1981 census results, but has grown at a linear rate since then of about 0.2M per year (Fig A2.1)

In the following fire statistic figures, the number of fires is expressed as a number per 1000 households, account is taken of the increase in the number of households and corrections are made for the effect of smoke alarms. Similarly the number of deaths and injuries are expressed per million of the population and account is taken of the increase in population (Figs A2.2 and A2.3). We focus on those statistics that relate to fatal and non-fatal injuries in dwellings and those where the reported first point of ignition relate to upholstery or bedding. In all cases the progressive reduction in the demographically corrected fire deaths and injuries in dwellings (Figs A2.4 and A2.6) and fatal injuries in fires with upholstery as the first item ignited (Fig A2.5) after 1988 is very clear, despite the statistical fluctuations that are present in the data. The trends are less clear for bedding. There appears to have been a step reduction during 1988 and a slow slow reduction since (Figs A2.5 and A2.7).

Some care is required when examining this data because there was a change in the reporting procedures in 1969, which is shown by a break in the data at this date, and again in reporting first ignition source in 1978. Similarly, some definition changes occurred in 1977 and the categories of fires that continue in bedding and in furniture were introduced in 1985.

Mean squares average lines are drawn through the data in figure A2.2 in order to enable estimation of the variance in the data.

Figure A2.1 UK population demographics, census data and future projections

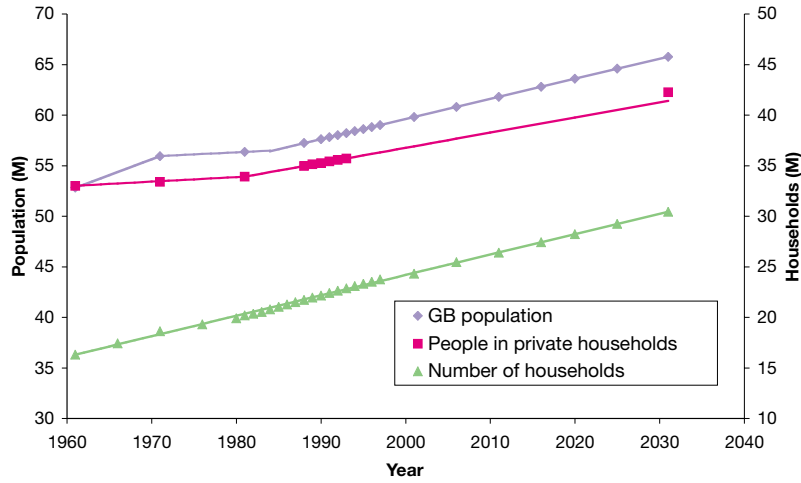


Figure A2.2 Overview of fire statistics 1960 to 1997 (arrow indicates change in definition)

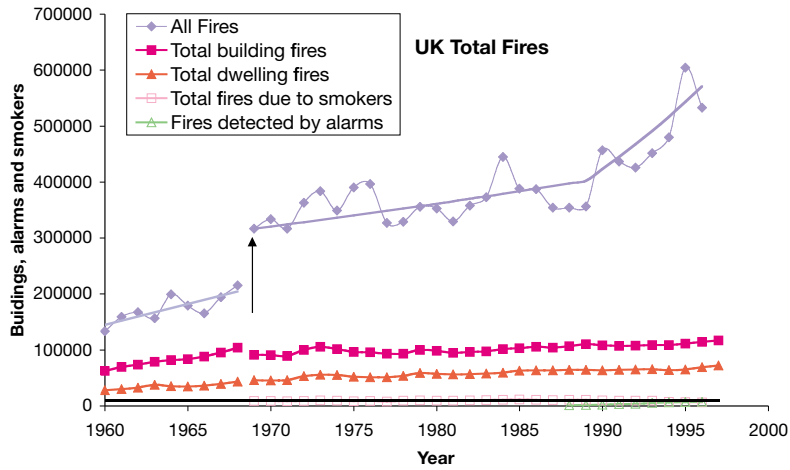


Figure A2.3 Causes of fire by source of first ignition and source of continuation (arrow indicates change in definition)

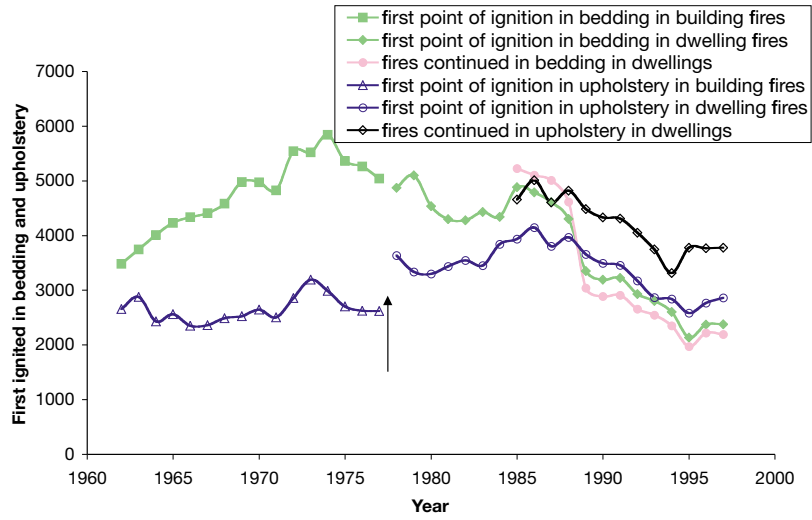


Figure A2.4 Deaths in dwellings by source of first ignition and continuation of fire

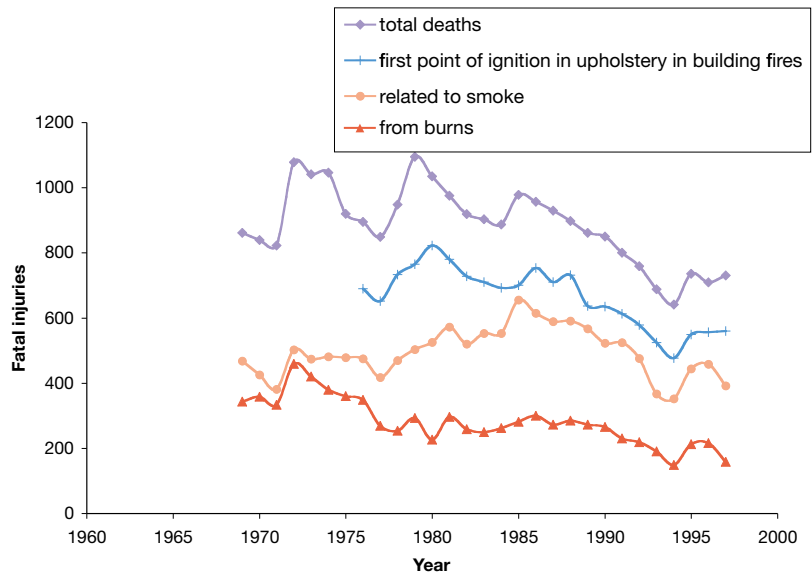


Figure A2.5 Total deaths, deaths in dwellings and causes of death

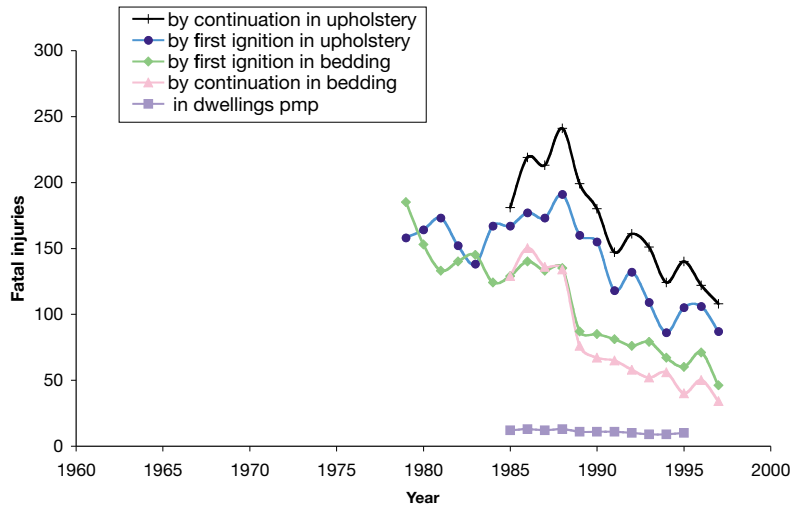


Figure A2.6 Total non-fatal injuries, injuries in dwellings and causes of injury

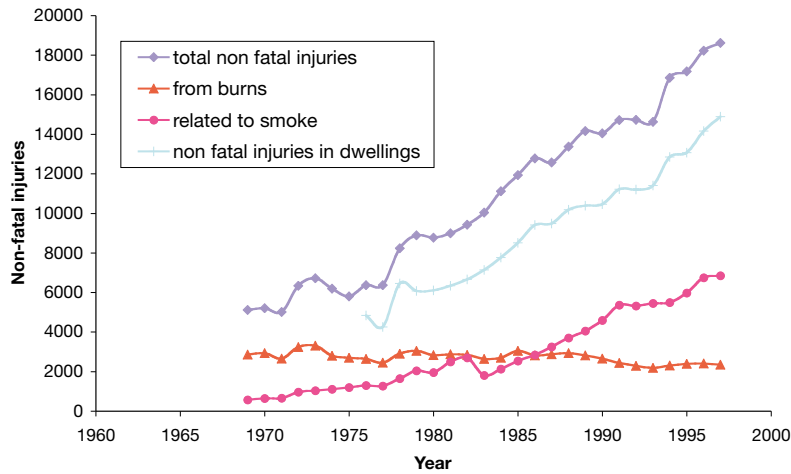
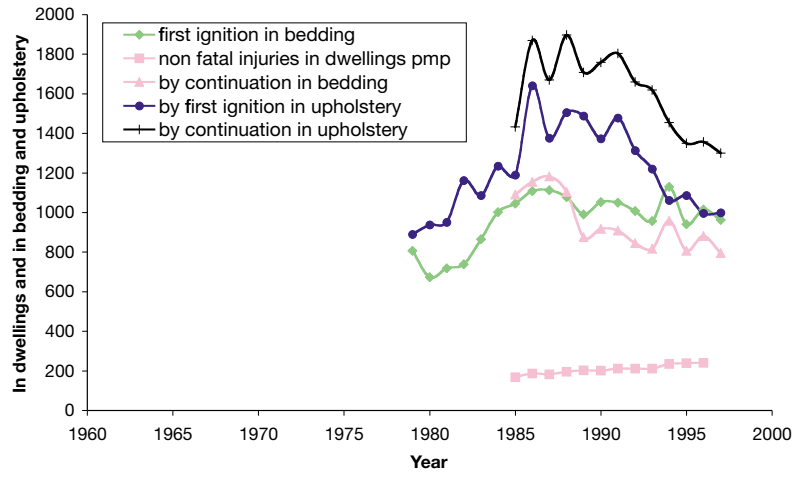


Figure A2.7 Non-fatal injuries by source of first ignition and source of continuation of fire



US Fire Statistics

1. US Fire and Demographic Statistical Sources

US fire statistics were provided by the Directorate for Economic Analysis, US Consumer Product Safety Commission in Washington D.C.. US population and household statistics were obtained from government census office web pages and updated using the web addresses at <http://www.census.gov/main/www/subjects.html#H>. Housing estimates were taken from the census office web site at <http://www.census.gov/population/estimates/housing/hsehold96.txt>

ST-96-24R Estimates of Housing Units, Households, Households by Age of Householder, and Persons per Household of States: Annual Time Series, 1 July 1991 to 1 July 1996 (includes revised census housing and population counts). These data were superseded by data released with Press Release CB97-112, July 7, 1997 and data released with Product Announcement CB96-166. Following other new information, these estimates were revised further. The revisions included small changes to the estimates of housing units, household population, and population per household. The household estimates were not affected.

Source: Population Estimates Program, Population Division, U.S. Bureau of the Census, Washington, DC 20233

Contact: Statistical Information Staff, Population Division, U.S. Bureau of the Census 301-457-2422

Internet release date: July 7, 1997

Revised release date: August 21, 1997

Internet release date: July 7, 1997

Revised release date: August 21, 1997

Future housing estimates were taken from the census web site at:

<http://www.census.gov/population/www/estimates/nation1.html>

Inter-censal Estimates of Total Households for the United States:

April 1, 1980 to April 1, 1990

Source: U.S. Bureau of the Census Release date: March 1996

Population Distribution Branch

Internet Release date: June 25, 1998

Consistent with Current Population Reports Series P25-1123, issued 10/94.

Note: The base population of April 1, 1990 is 248,765,170. The April 1, 1990 population includes count resolution corrections processed through August, 1997 and does not include adjustments for census coverage errors except for adjustments estimated for the 1995 test census in various localities in California, New Jersey, and Louisiana. Estimates for dates prior to April 1 1990, do not reflect these corrections, which amount to a total of 55,297 persons.

Source: U.S. Bureau of the Census Release date: March 1996

2 US FIRE STATISTICS

US residential fire statistics are dominated by the effects of smoke alarms (see figure 4 in the main report). In the period since 1976, when data for fire alarms were first recorded and there was an active public policy for their introduction, the number of homes containing fire alarms has increased to over 90% of the total (although they may not all be working effectively). Over 50% of domestic fires are now first detected by a smoke alarm, as shown in figure 5 in the main report. The original data are shown uncorrected in figure A3.2. This has had the effect of progressively reducing the annual number of fires, deaths and injuries. In order to make comparisons with the UK fire data, the US data has been corrected for the effect of smoke alarms as follows: the raw data has been multiplied by $(1 + \text{the fractional proportion of fires detected by smoke alarms})$. So, if 25% were first detected by an alarm, the data were multiplied by 1.25. A similar correction was applied to the UK data for consistency, although, in practice, it had little effect.

Total US residential fire property loss costs are shown below in figure A3.1. These are currently running at \$3b to \$4b per annum.

Figure A3.1 US fires costs in residential property

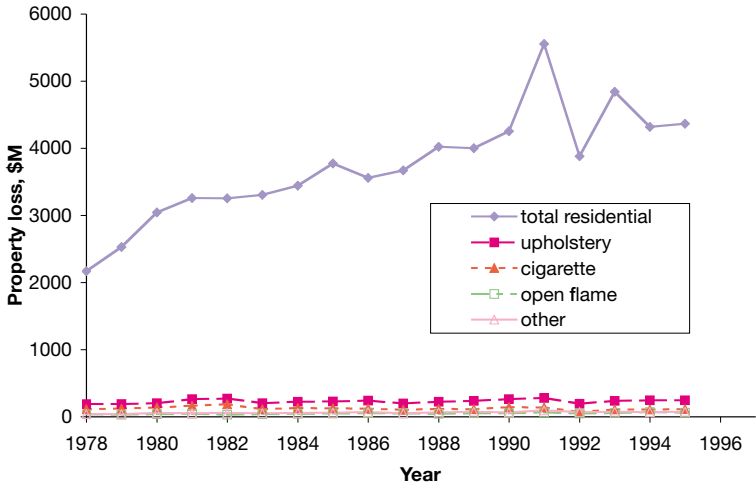
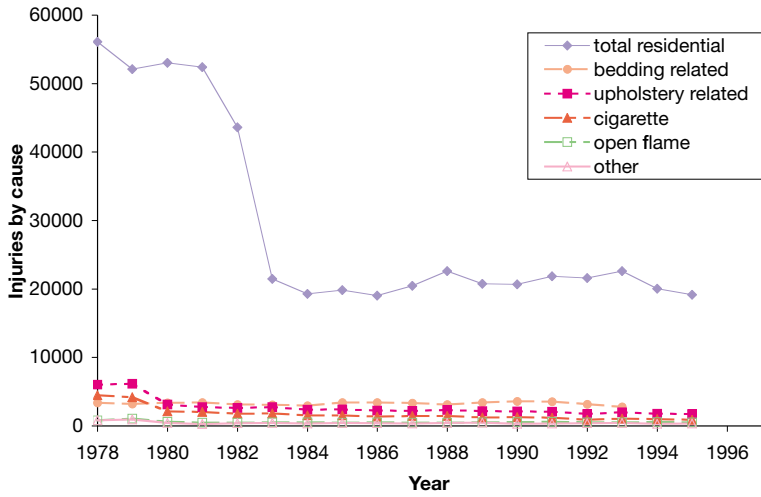
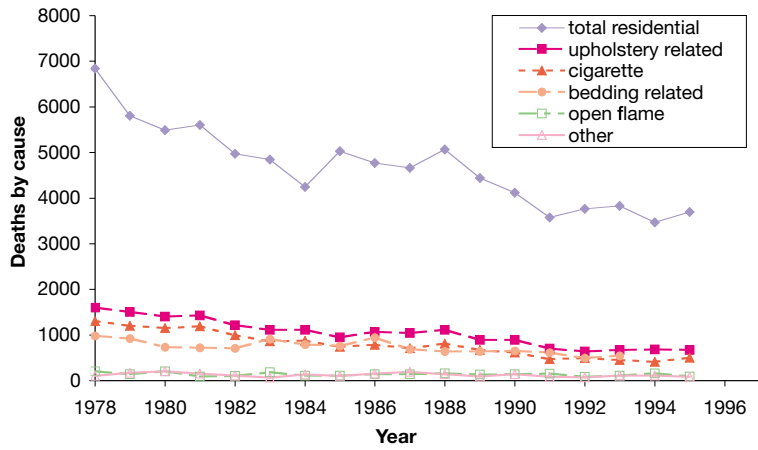


Figure A3.2 US fire deaths and injuries, uncorrected for effects of smoke detectors and alarms



APPENDIX 4

Statistical Trends in UK Household Fires, with Pre and Post 1988-Trend Projections

The UK raw fire trend data are reproduced in figures A4.1 to A4.3, which show total fires, total building fires and fires by source of first ignited. Some care is required when examining this data because there was a change in the reporting procedures in 1969, which is shown by a break in the data at this date, and again in reporting first ignition source in 1978. Similarly, fires that continue in bedding and furniture were first reported in 1985.

In these plots, which are corrected for population and household demographic changes, the total number of fires, deaths and injuries have continued to increase and indeed accelerated away since 1988, but the numbers associated with fires first ignited or continued in furniture and bedding show a significant decrease. The step change in the bedding trend across 1988 probably occurs as a result of reporting changes and it is not possible to use these data future projections.

In the following figures the number of fires is expressed as a number per 1000 households and account is taken of the increase in the number of households. In addition, corrections are made for the effect of smoke alarms. Similarly the number of deaths and injuries are expressed as a number per million of the population and account is taken of the increase in population. In all cases the progressive reduction in the demographic corrected fire deaths and injuries after 1988 is very clear despite the statistical fluctuations that are present in the data.

These data can be directly compared to the US data previously presented. The modified US fire data, corrected for the number of households and injury data, corrected for the population increase, still show a slow downward trend (figure A3.1), but the striking downward turns, which are evident in the UK data are not present. The significant decreases in the fire injury data between 1982 and 1984 probably reflect a change in reporting.

Pre-1988 and post-1988 UK trends have been projected forward to 1997 using a simple linear least squares fitting model. These projections are shown in figures A4.1 onwards. By subtracting the pre- and post-1988 projections provides an estimate of the number of fires, deaths and injuries saved (lower graphs in figures A4.1 – A4.3).

Approximate percentage errors in the estimates have been calculated from the scatter in the pre-1988 data, by calculating the standard deviation from the line. The figures are tabulated below in Table A4.1.

Table A4.1

Calculated errors in estimates for incidence of fires saved since 1988

Metric	Percentage Error (%)
Fires saved/1000 households	10
Bedding fires saved	10
Upholstery fires saved	10
Total deaths per million of population	12.5
Deaths due to smoke	7.5
Deaths from fires first ignited in bedding	7.5
Deaths from fires first ignited in upholstery	5
Total injuries	10
Injuries due to smoke	7.5
Injuries from fires first ignited in bedding	7.5
Injuries from fires first ignited in upholstery	7.5

Figure A4.1

Total dwelling fires and fires with first point of ignition and continuation in furniture and bedding

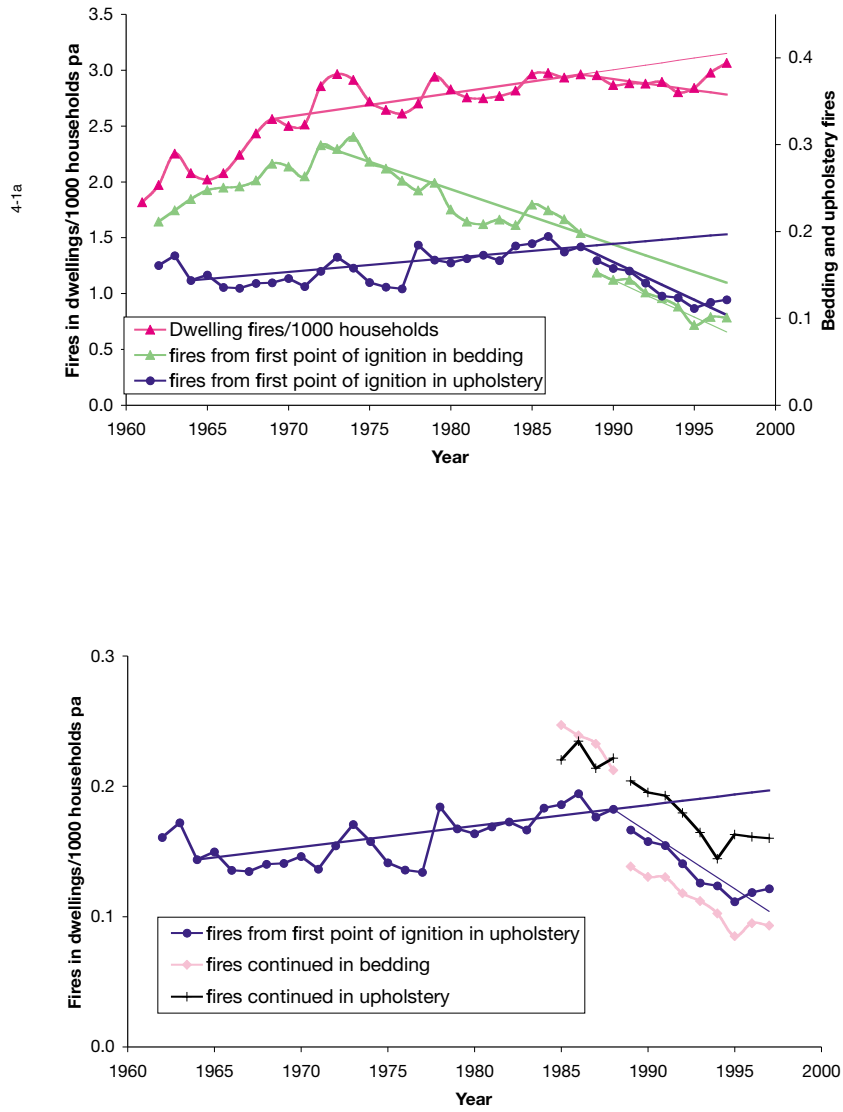


Figure A4.2 Fatal injury related fires in upholstery and bedding

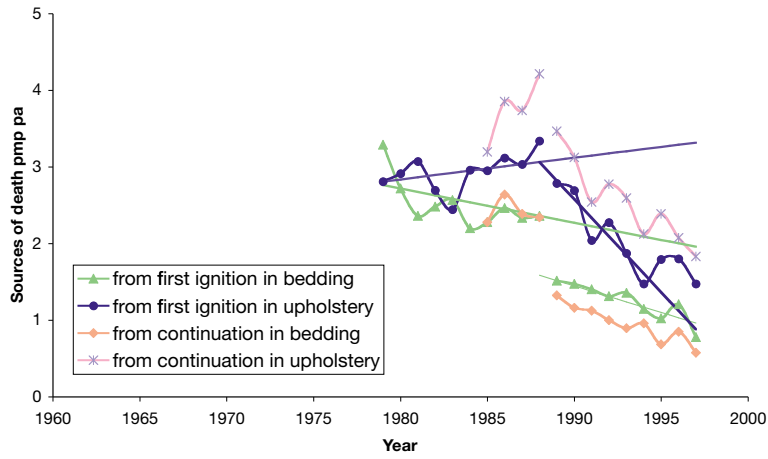
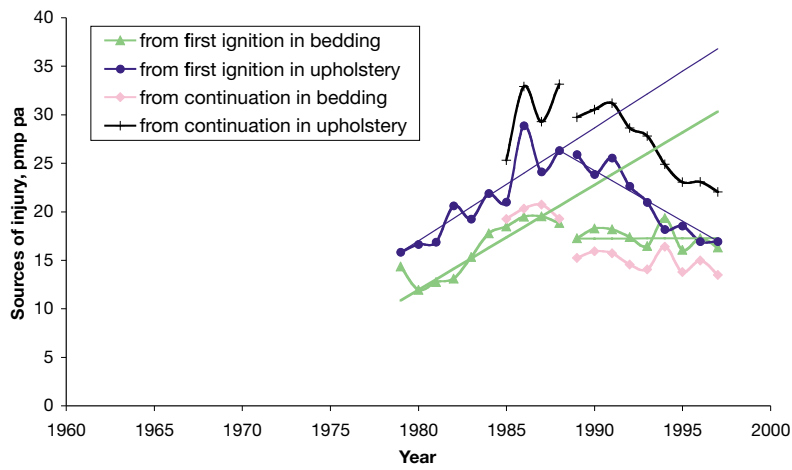


Figure A4.3 Non-fatal injury related to fires in upholstery and bedding



APPENDIX 5

Future Projections of Savings

In the following figures, model market penetration scenario data for the period 1988 to 1997 (based on furniture half lives of 8, 11 and 16 years as defined in the main report) are projected to the year 2050, using the following methodology:

- i) the best fit lines to the 1988 to 1997 fires, fatal and non-fatal injuries saved data were calculated by a linear least squares fit. The fires saved lines are shown in figure A5.1, with the 95% confidence limits dotted. Lives and injuries saved are reproduced in the main report (figs 6 and 7).
- ii) points from the best fit lines were then plotted, furniture penetration and a simple power law function fitted to the data by least squares regression. The equations of the best fit lines are given in the upper graphs in figures A5.2 to A5.6.
- iii) the power law parameters were then used to construct estimates of fires, lives and injuries saved post 1997, for each of the penetration scenarios (plotted in the lower graphs). The power law functions clearly must all fit the 1988 to 1997 data (denoted "existing data" in the graphs) and give a measure of the effectiveness of the fire retardants, which is then manifested as a separation of the projections post 1977. The data are extended to 2100 to demonstrate levelling off of the projections for all 3 scenarios.
- iv) finally the same data are reproduced in a different format to show the model projections of total fires, fatal and non-fatal injuries, post 1988, compared to linear projections of the pre-1988 data (figs A5.7, A5.8 and A5.9). The fact that the fatal injury projections go to zero (and negative) in figure A5.8 indicates that the 16y half-life scenario is untenable.

Figure A5.1 UK Total building fires saved per million households (dotted lines show 95% confidence limits)

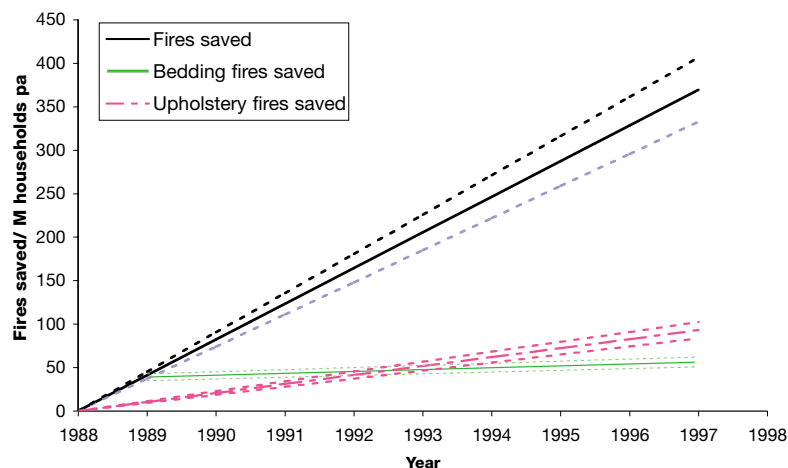


Figure A5.2 Fires saved as a function of market penetration of fire retarded furniture

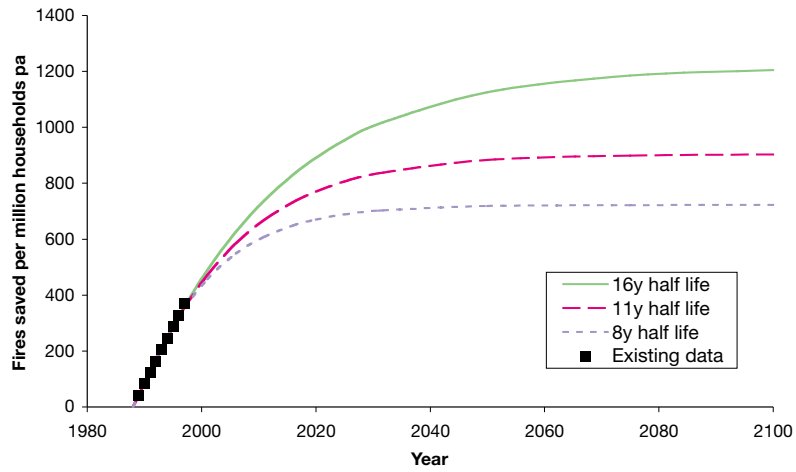
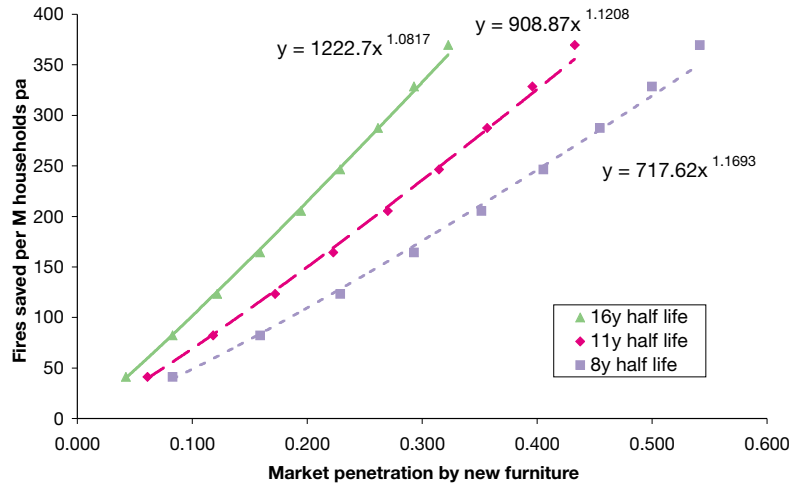


Figure A5.3 Lives saved as a function of market penetration of fire retarded furniture

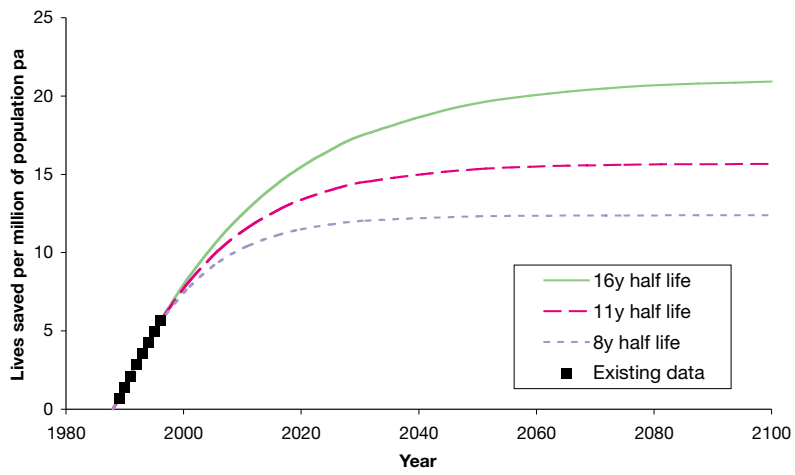
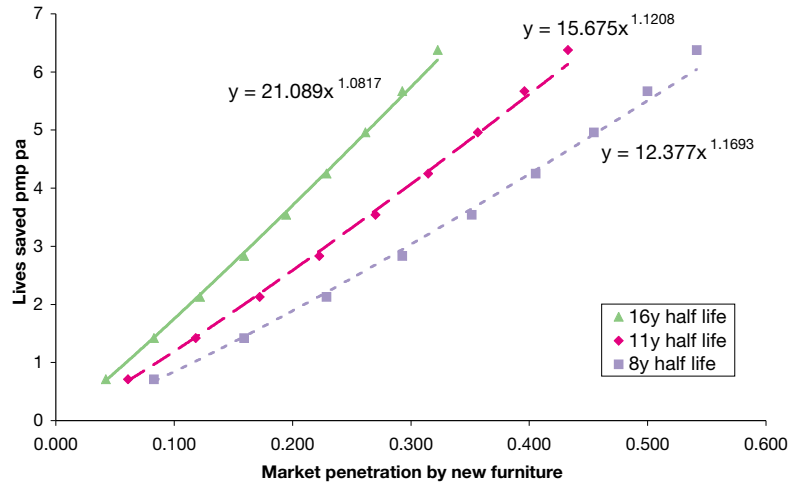


Figure A5.4

Lives saved as a function of market penetration of fire retarded furniture in fires due to first ignition in upholstery

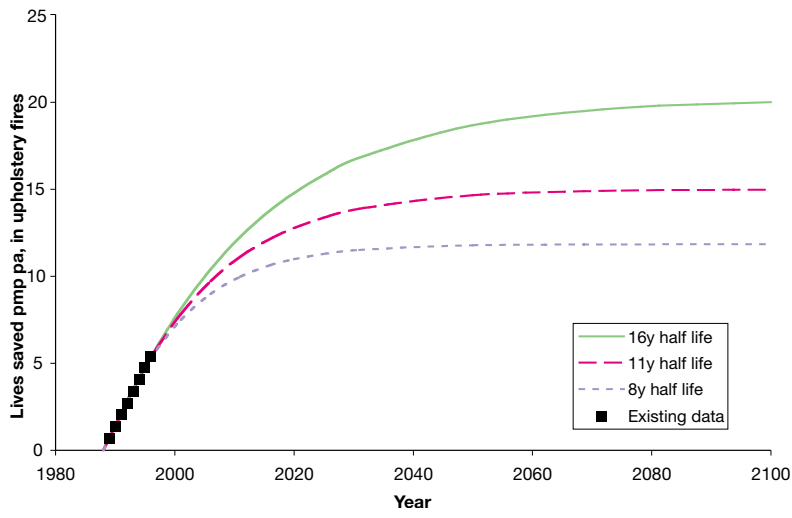
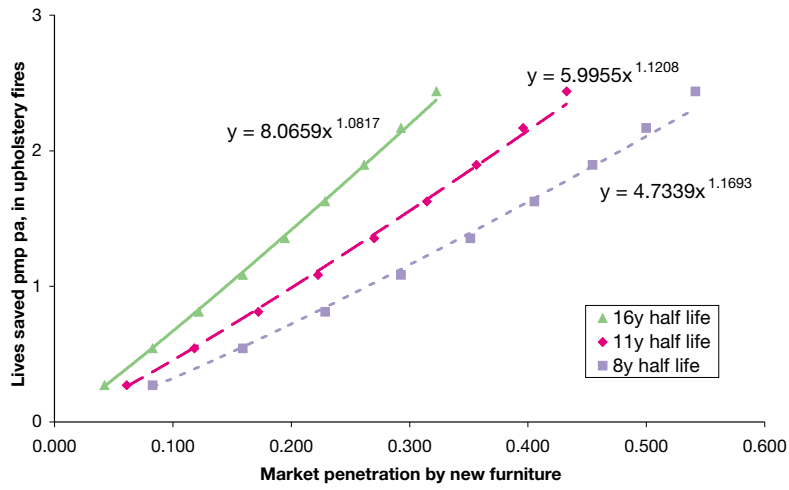


Figure A5.5 Injuries saved as a function of market penetration of fire retarded furniture

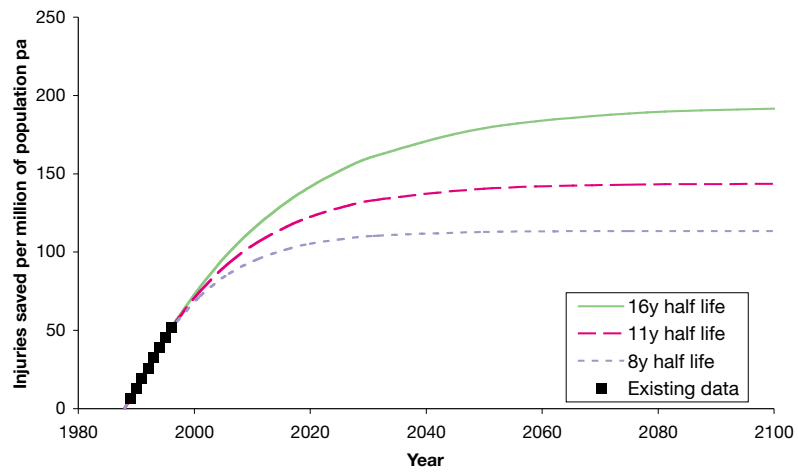
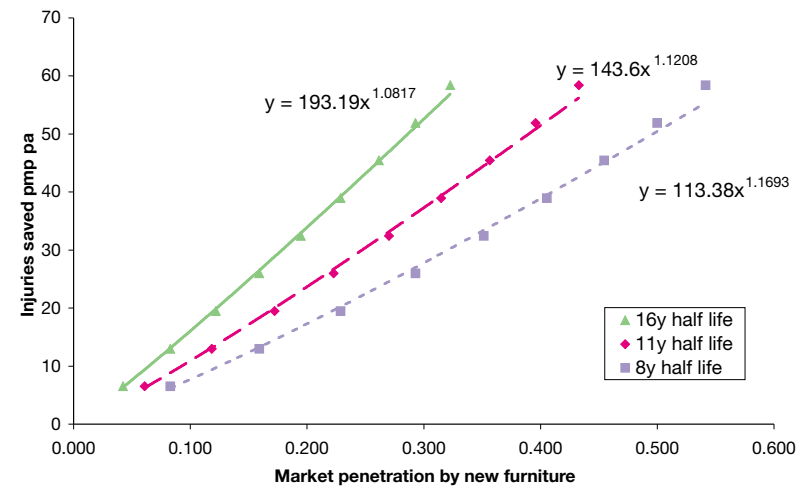


Figure A5.6

Injuries saved as a function of market penetration of fire retarded furniture in fires due to first ignition in upholstery

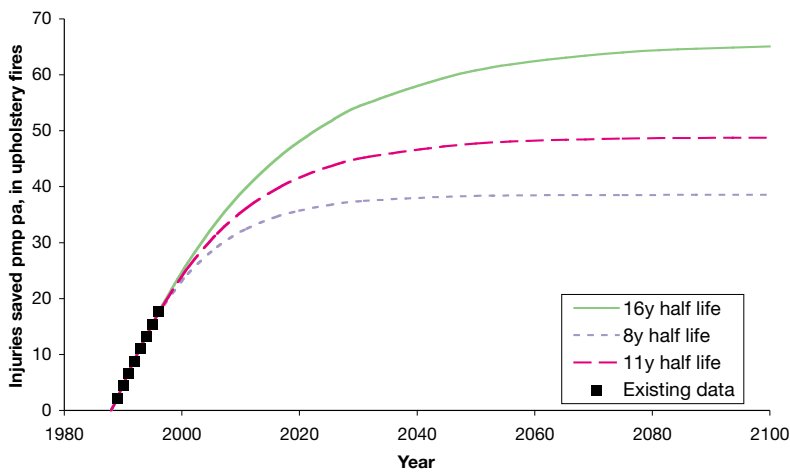
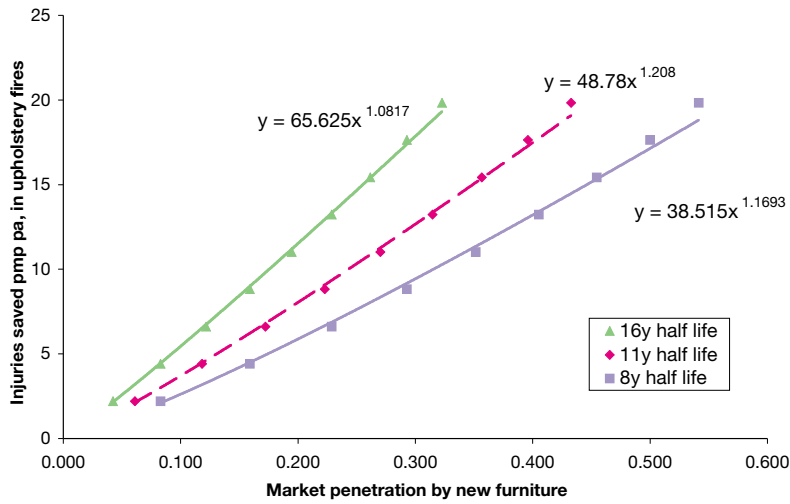


Figure A5.7 UK Total building fires per 1000 households pa

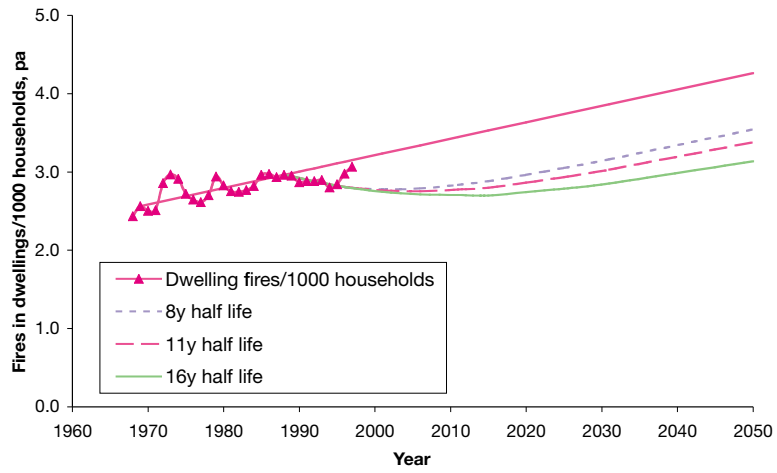


Figure A5.8 UK Fatal Injuries per million of population

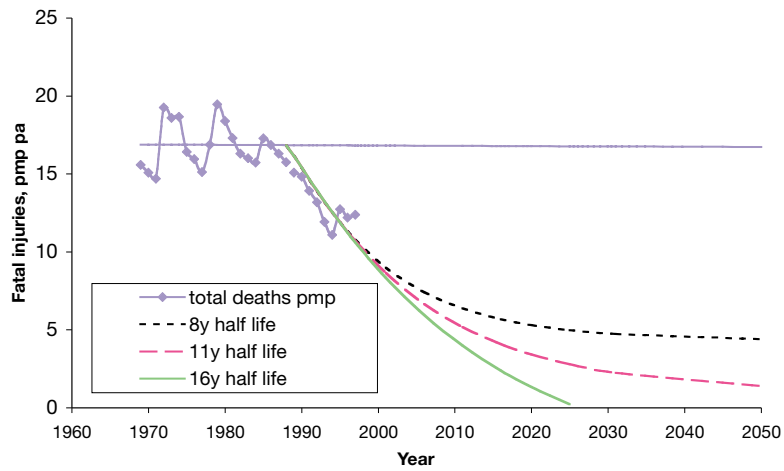
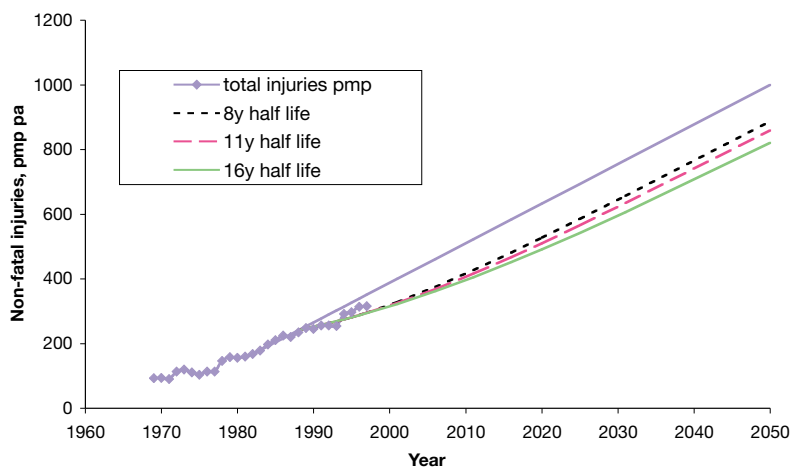


Figure A5.9 UK Non-fatal Injuries per million of population



APPENDIX 6

Long Term Cost Benefit Assessments

In the UK at this time we can only estimate the costs associated with insurance industry calculations, which are based on loss-adjusted fire claims. We can also account for the costs associated with loss of a statistical life. We have not been able to obtain any accepted method or data for calculating the cost of injuries, indirect costs and externalities associated with household fires. Our figures must therefore be seen as lower estimates.

For loss-adjusted cases data exists for two cases (Fire Protection Association, private communication):

- (i) the total cost of a fire exceeded £50k and/or there was a fatality, or
- (ii) the total cost exceeds £25k and/or there was an injury (FPA data).

We will refer to these as "loss adjusted fires". The raw data are plotted from 1984 to 1997 in figure A6.1, with the numbers of fires, deaths and injuries on the right axis and the total costs on the left axis. Once again there is a downward trend from 1998, despite the rising cost of individual events (figure A6.2). The reason is that the number of loss adjusted fires, as a fraction of the total number of household fires, has decreased steadily since about 1984 (figure A6.4). Combining the trends in loss adjusted fire costs of figure A6.1, with the projected numbers of future fires saved in figure A5.7, we can estimate lower and upper bounds of costs saving on loss adjusted fires (fig A6.5).

Figure A6.1 Lost adjusted costs of UK dwelling fires

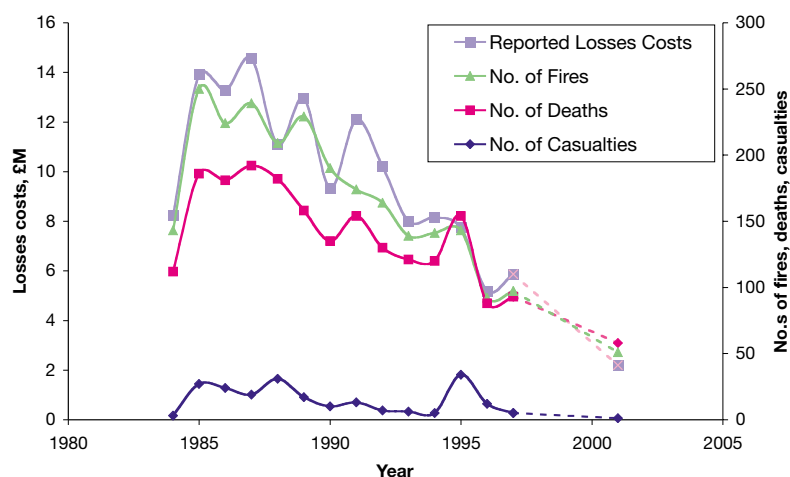


Figure A6.2 Lost adjusted costs of UK dwelling fires

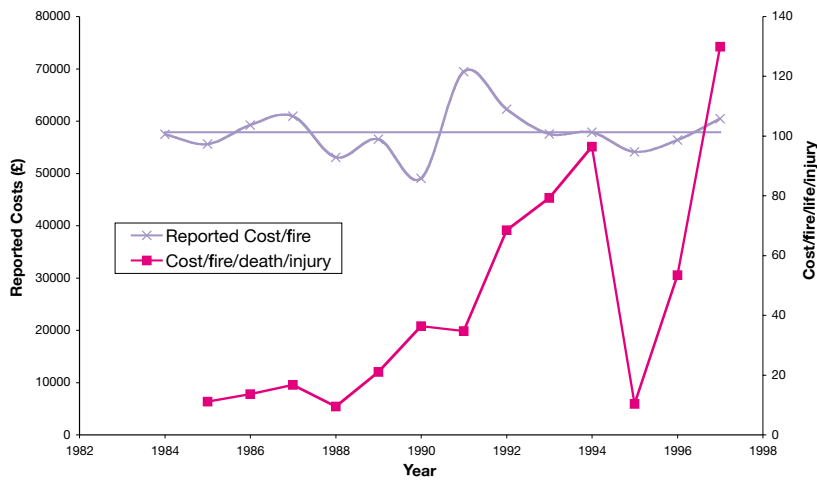


Figure A6.3 Projected costs per loss adjusted fire/death/injury

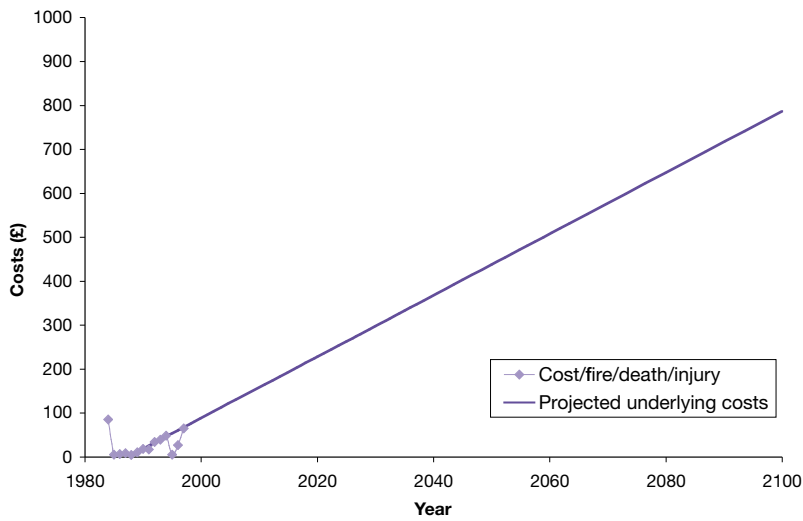


Figure A6.4 Fraction of fires resulting in loss adjusted claims

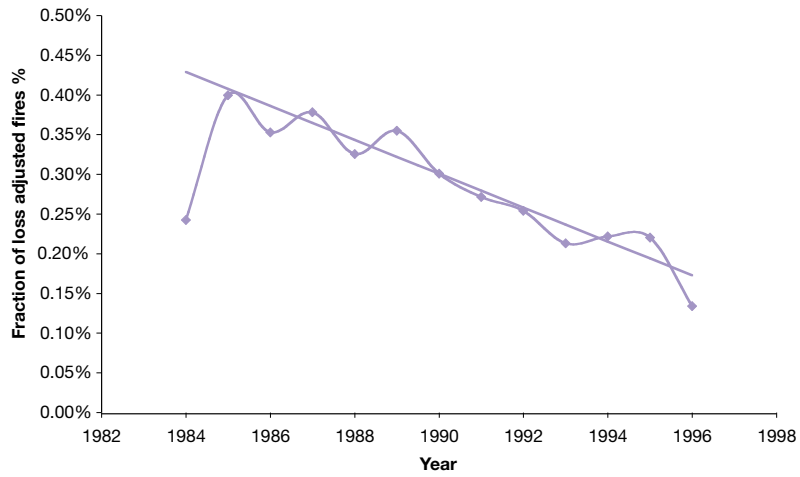
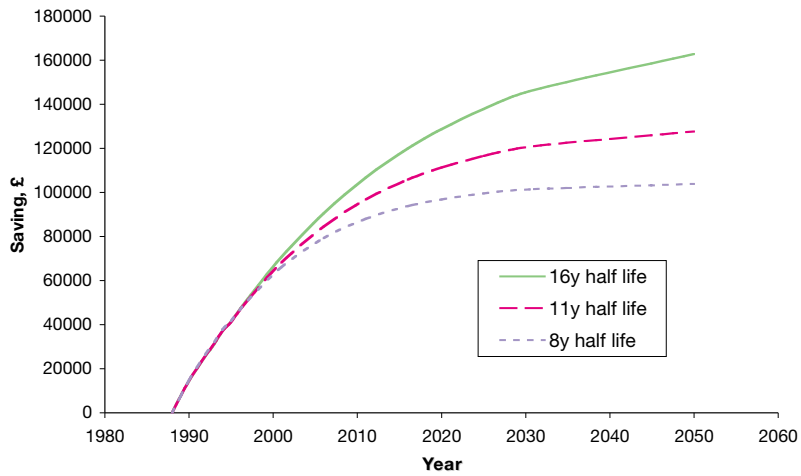


Figure A6.5 Annual cost savings on loss adjusted claims only



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