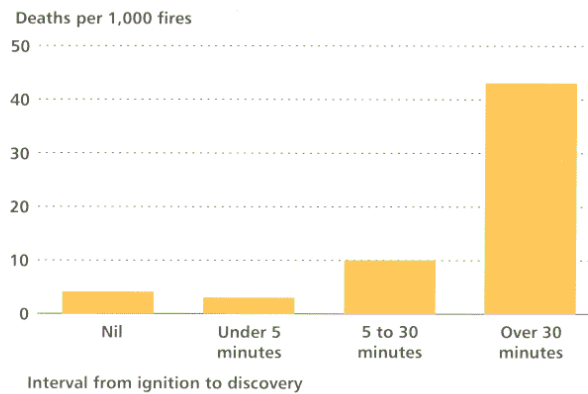


# Key points from Government Documents

## In the Line of Fire 1995 doc

*Exhibit 14*  
**Fire deaths related to the interval from ignition to discovery**

The time taken to discover a fire is a major factor in fire deaths over which the fire service has no direct control ...



Source: UK Fire Statistics, 1992

26. A key factor, over which the service has no direct control, is the length of time taken for a fire to be detected. This time interval has a dramatic effect on the likelihood of death as a result of fire. Fires in dwellings which take more than 30 minutes to be detected are 15 times more likely to result in a fire death than a fire which is detected within 5 minutes (Exhibit 14). This emphasises the benefits of smoke alarms, which reduce the likelihood of a death from a fire from 9 per 1,000 fires to 3 per 1,000 fires, and thus reflects the value of the campaigns by the Home Office and by individual brigades. Similarly, sprinklers are an effective means of combating fire. The water damage caused by sprinklers is not as great as many people fear; it is often possible to repair damp items, rarely burnt ones. Moreover, the probability of a sprinkler being activated in error is 1 in 500,000 per year (source: Loss Prevention Council). Many senior figures in the service are calling for increased use of sprinklers in commercial buildings and also in domestic property, and for their installation to be supported more by reduced insurance premiums.

27. Even better than detecting fires rapidly is preventing them in the first place. The public have a major part to play by the installation of fire safety measures in their homes, their choice of fire-resistant materials in furniture, care in extinguishing cigarettes and so on. A number of brigades have maintained vigorous publicity campaigns aimed at reducing the incidence of fires. Perhaps the most comprehensive programme of activities has been undertaken by the West Midlands Fire Service. Prompted by the level of deaths and a continuing rise in fire calls, the brigade analysed in detail the incidence of fires and, starting in 1991, has undertaken a wide range of campaigns focused on specific communities at risk (such as people with disabilities, the elderly, and ethnic minorities) and particular causes of fire (such as arson in schools and use of chip pans). Fire deaths and casualties have fallen by over 70 per cent in four years, and the brigade attributes this, at least

Around 600 people die as a result of fire each year in England and Wales. However, the risk is by no means evenly distributed across the population. In particular:

- ◆ Death rates from fire are consistently higher amongst the elderly and young children. For example, in 1991, fatal casualties per million population in England and Wales averaged 13, but for under-four-year-olds were 19, for 65-79-year-olds were 16, and for over-80-year-olds were 61 per million.
- ◆ There is a strong link between the presence of children in the household and the incidence of fires. The British Crime Survey in 1988 showed that the percentage of households reporting fires increased with the number of children:

#### Proportion of households reporting fires in 1987

	%
No children	2.2
1 child	4.6
2 children	5.6
3 or more children	7.4
<b>All households</b>	<b>3.3</b>

Source: *Household Fires - Findings from the British Crime Survey, 1988*.  
Home Office Research and Planning Unit Paper 57, 1990

- ◆ The risk of death from fire in multi-occupancy dwellings is generally accepted to be many times higher than in other dwellings (*Death Trap Housing*, National Consumer Council, 1991, quotes 10 times higher, but a precise figure is difficult to determine). A quarter of all fire deaths in 1992 occurred in dwellings in multiple occupation.
- ◆ Death rates are considerably higher in Scotland than the rest of the UK (and have been for many years):

#### Fatal casualties per million population

	1989	1990	1991	1992
England and Wales	15	15	13	13
Scotland	21	25	27	20
Northern Ireland	15	18	16	12
<b>UK average</b>	<b>16</b>	<b>16</b>	<b>14</b>	<b>14</b>

Source: *Fire Statistics, United Kingdom, 1992*, Home Office

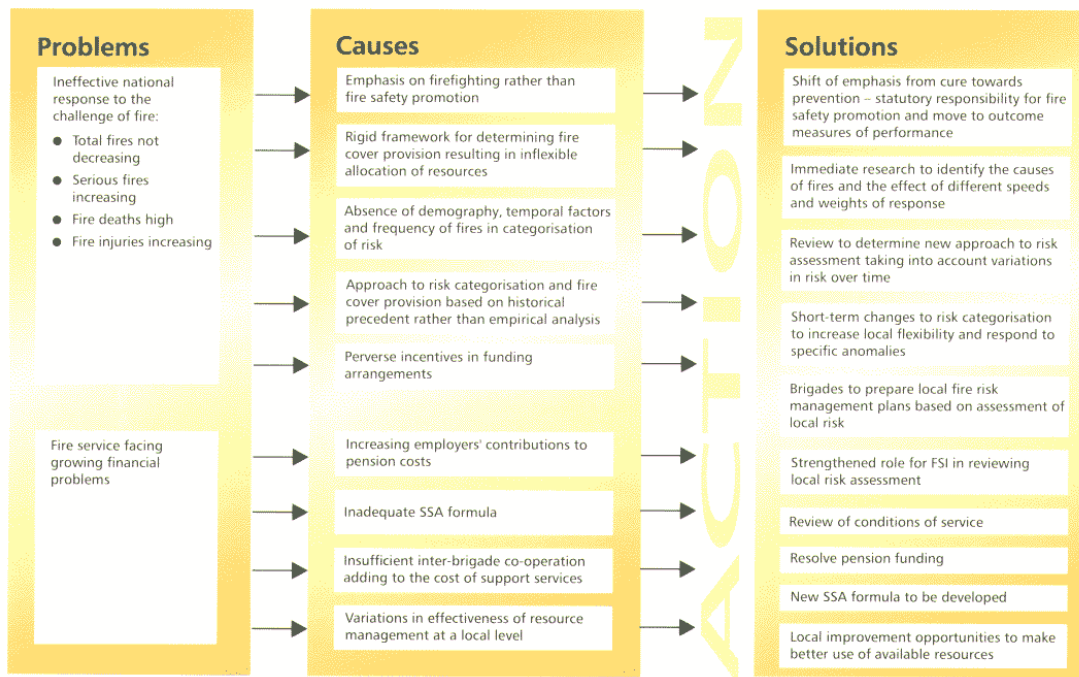
These research findings highlight the importance of and scope for well-focused education and publicity campaigns targeting specific population sub-groups (particularly the elderly, children and those in poor housing) and specific issues (such as the value of smoke detectors and providing information on common causes of fire).

35. The equipment needed to deal with fires in occupied buildings is, therefore, usually comparatively limited. It is common practice, however, for brigades to send two appliances to property fires, even in C and D risk areas where the standards of fire cover require only one pump. This is because, while the equipment carried by one pump may be more than sufficient to deal with a fire, the number of firefighters may not be adequate. On attending a typical house fire, for example, two members of the crew will don breathing apparatus and enter the building. A further firefighter will have responsibility for monitoring the firefighters within the building to ensure that they are operating safely and within the capacity of the breathing apparatus. A fourth crew member will be responsible for operating the pump, and the crew commander will have responsibility for managing the operation and for maintaining radio contact with the control room as necessary. A crew of five is thus fully stretched and would not be well-placed to deal with further demands such as attacking the fire from two points, rescuing individuals from a number of rooms or identifying additional supplies of water. In some senses, therefore, the second appliance functions primarily as a personnel carrier.

47. It may be appropriate to base the assessment of risk that forms the first part of a risk management plan on the approach that has been developed by the Health and Safety Executive. This follows three stages:

- ◆ identification of a hazard (i.e. something that might cause harm);
- ◆ assessment of the likelihood of risk arising from that particular hazard; and
- ◆ appraisal of the extent of the risk, the number of people who might be affected and the severity of harm that might arise.

There are solutions to each problem...



## ELABORATION OF A RISK ASSESSMENT TOOLKIT FOR THE UK FIRE SERVICE doc

### 3. National level risk assessment.

A system of nationally applied Risk Categorisation is retained but the process of defining risk categories and associated standards is significantly changed, as follows:

- a risk assessment would be carried out at a national level with the aim of deducing the optimal mix of preventive (fire safety education and building control regulations) and response measures to reduce risk, hence allowing identification of preventive measures which might in time **reduce the incidence and/or severity of fires**,
- this assessment would be used to define Risk Categories and response standards as well as designating priority areas for fire safety education and review of building regulations, giving proportionate weight to life risk, property risk and other risks such as environmental pollution and loss of heritage.
- the **risk assessment would be carried out for discrete classes of incidents** and premises which display significantly different levels or types of risk, with **distinctions made on the basis of occupant characteristics**, fire incidence, fire safety systems, building construction, building density and occupancy as appropriate,
- such risk assessment would draw on information contained in incident reports and real fire research, such as FDR1s, to ensure that due account is taken of observed fire behaviour, fire incidence rates and evidence regarding the effect of fire safety and fire safety education.

- revise the wording and subdivision of **Risk Categories to ensure they reflect variations in life risk arising from variations in occupant characteristics, fire safety systems, the incidence of fire**, etc, with the option of using **quantitative measures of fire severity** to judge the level of risk in an area or type of premise.
- extend the range of risk categories to include life threatening special service such as **RTAs and extraction from machinery**, and **high value non-premise fire risks**, such as **commercial forest fires**.
- include a reference to the need to target fire safety education and fire safety work in areas awarded higher risk categories with the goal of reducing the frequency of larger scale incidents,
- make reference to the **likelihood of serious fires** in the definition of risk categories and link **response standards to the scale of incidents**, such that the response standard operating in an area changes over time in reaction to changes in the frequency of larger scale incidents.

## **Predominance**

A number of approaches to the issue of predominating risk can be considered:

(i) As with the current points based system, an area could be surveyed using either risk categories and/or one or more of the risk assessment methods to develop a profile of the risk. A single initial response standard could thence be designated for the area for planning purposes on the basis of predominance, as at present. Predominance could be based on:

- the percentage of ground area covered by each type of premise,
- the **percentage of households** falling into each risk category within an area, and the percentage of floor space falling into each risk category for non-domestic premises,
- the percentage of each type of call in an area, (or the percentage of calls to confirmed fires from each type of occupied premises).

(ii) Alternatively, planning could be carried out on the basis of being able to meet a range of response standard in the area as per the risk category of the premises. Again, this could involve either:

- seeking achievement of each response standard on each call excluding 2nd and other calls in an area or;
- **meeting the response standard on a set percentage of occasions. This would also allow account to be taken of the impact of 2nd and 3rd calls on station grounds, periods of peak loads and major incidents on the standard of fire cover and allow a common response standard to be set for, (e.g.) dwellings regardless of location**

## **Operational capacity**

A reference to operational capacity in the response guidelines, linked to a finite range of “design tasks” and scenarios, would require assessment of response standards to address both the “quality/capacity” of the response as well as the timeliness and weight of the response. It would also imply that:

- the initial attendance should be capable of carrying out a defined set of tasks and managing the full range of hazards which can reasonably be expected on arrival,
- the expected range of capacities possessed by a team does not need to exceed those required to handle a finite range of tasks and scenarios, where it can be assured that they are unlikely to encounter other demands and that appropriate support (i.e make-up) would be available to handle other hazards and scenarios.

## **SOCIAL-DEMOGRAPHIC FACTORS**

### **The 1988 and 1992 British Crime Surveys**

The findings of the 1988 and 992 British Crime Surveys, as summarised below and in Table 2.1, clearly indicate that risk varies significantly according to social-demographic factors:

“The risk of household fires seems greater for the socially disadvantaged. Risks were higher in council housing areas, among single parents and among manual workers. Household composition also makes a difference. Young families with children were more prone to fires, perhaps reflecting more crowded living and heavier catering demands.”

“The indications are that Afro-Caribbean families have more fires than white households, and Asian families have fewer.”

“(Smoke) Alarm ownership was lowest among adults living alone, couples without children, single parents, elderly households, and council tenants. Lower incomes is likely to underlie these patterns. Alarm ownership was lower among Afro- Caribbean and, in particular, Asians than among whites.”  
(United Kingdom Fire Statistics, 1992)

They conclude that:

“The risk of residential fire is strongly related to the type and quality of housing. Fire risk is greater for those living in the poorest council housing and in temporary accommodation

**Table 2.3 Fatal and non-fatal injury rates per incident for various types of occupied premises (1992 data)**

	<b>Fatal injuries per incident</b>	<b>Non-fatal injuries per incident</b>
<b>Dwelling</b>		
Single occupancy	1 in 100	1 in 5
Multi-occupancy	1 in 100	1 in 5
Elderly persons homes	1 in 100	1 in 6
Hotels, boarding houses etc	1 in 143	1 in 7
Children’s homes, disabled homes etc	1 in 143	1 in 13
Psychiatric hospitals	1 in 143	1 in 25
Banking, insurance etc	1 in 500	1 in 17
Industria	1 in 1111	1 in 16

## **2.6 VARIATIONS IN LIFE LOSS**

It is also interesting to note that there is a statistically significant, if low again correlation of 0.287 ( $p < 5\%$ ) between the number of fires and the number of deaths and injuries per 1000 FDR1s, i.e. the more fires that occur the greater the likelihood of a death or injury per fire. Thus, not only do more populated areas have more fires but each fire is more likely to involve a casualty.

### **TABLE 2.8 SUMMARY OF FIRE RISK FACTORS**

#### **Occupancy**

- fire loading,
- ignition sources,
- toxicity/flammability of materials,
- spacing between flammable materials,
- number of occupants,
- sleeping risk.

#### **Occupants**

- mobility and mental agility,
- vulnerability to effects of smoke and fire,
- fire related behaviour,
- fire education,
- familiarity with building layout.

#### **Fire safety management**

- hot work control,
- storage and separation of materials,
- fire drills & staff training,
- building security & security of fire protection,
- emergency management and fire officers,
- maintenance of fire doors, duct seals, exits and sprinklers etc.

#### **Engineered fire safety/protection**

- AFD & smoke & heat detectors,
- smoke control, (forced ventilation, shutters etc)
- fire suppression,
- fire protected escape routes,
- sprinkler water supply reliability (mains vs pumped, secured vs unsecured)

#### **Locality risk**

- level of arson in area,
- nature of adjacent risks,
- water supplies,
- proximity to adjacent risks.

## **Construction**

- structural fire resistance,
- compartment size and separation,
- number of floors, atria, open staircases,
- fire doors, roof voids, ducts etc
- internal layout & distance to “safe” areas.

It is concluded that a risk assessment toolkit needs to be sufficiently flexible to support:

- assessment of qualitatively different types of risk,
- assessment of areas predominated by a uniform type of risk as well as the assessment of areas with a wide range of risks,
- identification of areas where risk is sensitive to occupant factors as opposed to building stock factors,
- modelling of different temporal variations in risk

The principles of the toolkit design are that:

- all risk categories and associated standards should be based on empirical assessment of risk, taking account of the number of fires, occupant characteristics and fire safety, as well as construction, occupancy and number of occupants,

## **DESIGNATION OF HIGH AND LOW RISK**

The toolkit would include guidance on what comprises HIGH, INTERMEDIATE and LOW risk, based on an assessment of the variation in the rate of deaths, injuries and large fires both across the UK, between discernible groups of people and between occupancies/building stock. The guidance would be based on a statistical analysis of historical records, namely fire service reports and census information.

Subsequently, these criteria could be used to identify discernible groups of people and premises who are experiencing a high level of risk as well as designating areas experiencing high levels of other events, such as RTAs, for the purposes of both targeting fire safety education and fire cover review. Such groups could comprise occupants of certain types of dwellings, age groups, ethnic groups or socio-economic groups, areas of a socio-economic status and types of commercial properties etc.

The purpose of assessing the risk of death and injury for sub-categories of people can be illustrated by the following comparison of child fire deaths amongst social classes. Given that there is factor of 13 difference in the rate of child death from fire between social class I and V (with social class I rate being one third of the average for all children), and a rate of death of 15 per million children aged 1 to 4, if it is assumed that the social class disparity applies to all age groups, this would suggest that the annual rate of death for children aged 1 to 4 is:

- 1 in 200,000 (5 per million) amongst social class I, and;
- 1 in 14,400 (69.6 per million) amongst social class V.

Clearly, any additional effort focused on social class V households with children would be much more cost effective than comparable effort spread across all households, assuming the effort was equally successful across all social classes. Consequently, any cost benefit analysis which does not distinguish between households in terms of social class is likely to over state the cost to benefit ratio for manual social classes. Moreover, any review of the tolerability of

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risk which similarly fails to distinguish between social classes and age groups will underestimate the risk incurred by “the most exposed group”, namely children aged 1 to 4 in manual class households.

## **DEVELOPMENT AND TRIAL OF A RISK ASSESSMENT TOOLKIT FOR THE UK FIRE SERVICE doc**

### **Measures of risk**

There are two common measures of risk to life used in the analysis of accidents. They attempt to measure the different way that people respond to accidents that may affect them or others in their community (which may be a small district or a whole country):

- **Individual Risk** measures the risk to a single person, real or hypothetical, from the hazard under consideration. This person may be representative of a group (such as the workers on a plant with a typical range of activities and locations) or it may be a theoretical marker such as the risk to a person spending 100% of their time at a fixed location (such as the boundary fence of a potentially hazardous facility, or a room within an old persons home).
- **Societal Risk** measures the risk of multiple fatalities and so takes account of the presence of large numbers of people who may be affected and the public response to disasters. The societal risk from an activity or type of hazard is normally expressed as a cumulative risk, that is plotted as the frequency of accidents causing N or more fatalities against N.

It is likely that the most appropriate use of individual risk will be for private dwellings and societal criteria are best suited where large numbers of people may be present. Both types of criteria should be used when considering levels of fire cover and fire safety initiatives. Thus, these measures are not mutually exclusive, rather they supplement one another.

### **Stage 1: Relationship between emergency response time and rate of fatality.**

The Individual Risk of death from fire in dwellings has been estimated by first developing a plot of the likelihood of fatality per fire against fire brigade attendance times, using data on attendance times and casualties in dwelling fires reported to the Home Office in 1995. A total of over 13,000 fire reports were used, namely all dwelling fires where a person was reported as a casualty, fatality or being rescued by the fire service in 1995 in the UK. This involved calculating the percentage of casualties who were fatally injured when the fire was attended within a given time by the fire service. To simplify the calculation, attendance times were banded into 5 minute ranges, namely 1 to 5 minutes, 6 to 10 minutes, etc. Thus, for example, in about 8,200 fires attended within 5 minutes, just under 4% of casualties died, compared with 5.5% of casualties in fires attended in 11 to 15 minutes. The probability that there is a death per fire, given that a person was reported as a casualty or a rescue, increased as follows:

Response time (mins) Probability of death per (persons reported) fire

<b>1 to 5</b>	<b>0.038</b>
<b>6 to 10</b>	<b>0.042</b>
<b>11 to 15</b>	<b>0.055</b>
<b>16 – 20</b>	<b>0.072</b>
<b>&gt; 20</b>	<b>0.16</b>

Thus, for example, there is a **1 in 6** chance (a **0.16** probability) of a death in a dwelling fire where a person is reported as a casualty or a rescue when attended in over **20 minutes**, and a **1 in 26** (a **0.038** probability) chance of death per fire when attended in under **5 minutes**.

**The following will be the arguments the brigade puts forward :**

A summary of the findings regarding the social and demographic factors underlying fire experience in the home is given in Exhibit 3.2. It is suggested that:

- the apparent variation in the relationship between social-economic-demographic variables and fire incidence **means that national fire standards cannot be related** in any straight forward manner to any single set of social-economic variables,
- the variation in fire incidence and fire casualty rates could be measured directly for the purpose of assessing fire cover needs, with assessment of local social-economic and demographic factors completed for the purpose of targeting fire safety education and prevention work on the highest risk households, such as deprived single parents.

Therefore, it is concluded that it would be inappropriate to link fire cover for dwellings to any single set of social, demographic or economic indicators, as this could overlook local anomalies. Instead generalised social demographic and economic risk factors should only be used to produce a “first cut” of fire risk, with validation of risk levels achieved through a direct statistical analysis of fire reports in “first cut” areas. Clearly the need for validation of fire risk by means of surveys and statistical analysis is greater where the costs of over provision or preventable losses from under provision are high.

**If the service uses this argument then the angle to come from in brigades ( primarily Surrey ) is that statistics show these area’s are in 2 pump station grounds and that lowering the standard will increase casualties and fatalities.**

**EXHIBIT 3.2: EXTENT OF VARIATIONS IN RATES OF FIRE AND FIRE CASUALTY**

1. To what extent can social-demographic fire risk factors be mapped or predicted in such a way that fire cover and fire safety education can be related to variations in fire risk?

There are some associations between socio-economic variables and fire incidence, such as unemployment, socio-economic group and owner occupation, which can be mapped.

Deprived single parents, households with children, young affluent households and council tenants experiencing hardship having highest experience of fires.

Variations in rates of fire can be mapped at the level of boroughs, electoral ward and smaller units. Thus, whilst there are occasions where the area of housing presenting a high rate of fire is substantial, there are also occasions where a very small area of housing accounts for a very high proportion of fires.

2. To what extent do social-demographic variations in fire risk follow common patterns across the UK, allowing national guidelines to be developed on the basis of social demographic factors alone?

The influence of certain socio-economic and demographic variables on the incidence of fire does not appear to be consistent across the UK. This is probably because it is not deprivation or social class per se which leads to a higher risk but the lower levels of education and self-esteem and higher levels of social stress, which can but are not always

associated with deprivation. Thus, factors such as unemployment and income levels are not consistently related to fire incidence. This is in part explained by the interaction of household type with income levels, such that deprivation and children combine to give high rates of fire as does having younger single person households. In addition, there are also local anomalies within cities where fire incidence is not related to factors such as unemployment, apparently due to over-riding effects of community stability.

3. Can social-demographic influences on fire risk be modelled directly or by a surrogate? Whilst certain surrogates such as ACORN typology (used by the British Crime survey) of areas usually provide a reliable indication of likely rate of fire per person, care must be taken that there are not local anomalies due to local initiatives or social-economic factors.

### **Stage 3: Development of risk model.**

Next the fatality rates for each response time are multiplied by the rates of fire casualty to derive a prediction of the risk of death (per person per year) for each combination of response time and rate of fire casualty. The calculation is:

Probability of fatality per (persons reported) fire x Likelihood of a dwelling fire involving a person per year = Likelihood of death per year per person

This calculation is illustrated below using two combinations of response times and rates of fire.

**Example 1:** 16 - 20 minute response time and Medium rate of fire  $0.072 \times 0.0003 = 2.16 \times 10^{-5}$  (ie 1 in 50,000 per person per year)

**Example 2:** 6 - 10 minute response time and Very high rate of fire  $0.042 \times 0.002 = 8.4 \times 10^{-5}$  (ie 1 in 12,000 per person per year)

**I would suggest this following is the answer for the service to deal with the risk of reduced response times in brigade rural area's:**

### **Stage 4: Impact of a sample of fire safety measures on fatality rates.**

Next the need to reduce risk further has been examined, remembering that fire cover alone does not appear to reduce risk to tolerable levels in all cases. Indeed, it is estimated that the risk in highest risk parts of the UK needs to be reduced by more than half (about 70%) to reach the upper risk criteria of 1 death per 50,000 persons, even with a response time of under 10 minutes. Estimates have been derived on the percentage reduction in risk which a sample of alternative fire safety options may achieve, and the impact of such measures on the loss of life from fire in the home in the UK if they were to be applied across the nation. Fire safety measures are ranked in terms of those which would appear to avert the greatest number of fire deaths and those which are the most cost-effective. The most cost-effective measures are highlighted as candidates for implementation either locally by fire brigades, where practical, or nationally by central government. Guidance is then provided on the combination of fire safety measures required to reduce risk to tolerable levels in higher and lower risk areas. Higher levels of fire safety, and expenditure on fire safety education, are suggested for higher risk areas. Typically a combination of fire safety education, smoke detectors and other initiatives are required in higher risk areas, whilst one option may be sufficient in lower risk areas.

**Table 3.1: Guidelines on risk categorisation of residential areas**

Life Risk Category	Quantitative measure of risk.	Tolerability of risk	Typical characteristics
Very high risk	<p>Rate of casualties per year per person = 1 in 1,000 or more.</p> <p>Rate of fire per year per dwelling = Over 1 in 200</p>	Risk in this region is clearly intolerable and must be reduced by all effective means	Typically exhibit very high levels of malicious false alarms (over 20% of all calls), deliberate fires (including rubbish fires), very high levels of deprivation, large numbers of young single parent households, heavy drinkers and poor quality rented housing (private and public housing). Often found in inner city areas but can also be found in towns and out of town local authority estates.
High risk	<p>Rate of casualties per year per person = 1 in 2,000 to 1 in 1,000</p> <p>Rate of fire per year per dwelling = 1 in 400 to 1 in 200</p>	Risk in this region is clearly intolerable without a minimum of fire cover, and remains high even with a high level of fire cover.	These areas share same characteristics as Very High Risk Areas but to a somewhat lesser degree, with an above average but not extreme proportions of malicious false alarms (about 5 to 15% of all calls) and above average proportions of “at risk” households, such as between 5 and 1% of households being single parent, 1 to 10% being bedsits, 30 to 40% rented or local authority. Often found in inner cities but may also be found in towns and larger villages, and affluent urban areas with large numbers of young persons in

			flats and bedsit type accommodation.
Medium Risk	Rate of casualties per year per dwelling = 1 in 5,000 to 1 in 2,000  Rate of fire per year per dwelling = 1 in 800 to 1 in 400	Risk is high and would be intolerable without a minimum of fire cover and should be reduced substantially (as low as reasonably practicable).	More settled areas of affluent family housing, better off council estates, home owning areas of skilled workers in both metropolitan and rural areas. Likely to have average proportions of “at risk households” such as 5% being single parent households. Lower rates of malicious false alarms and deliberate fires, maybe even less than 5% of all calls are malicious false alarm
Lower Risk	Rate of casualties per year per person = Under 1 in 5,000  Rate of fire per year per dwelling = Under 1 in 800	Risk is tolerable given a minimum of fire cover but should be reduced as low as Reasonably practicable.	Typically found in wealthy suburbs and middle aged homeowners areas with low rates of malicious false alarms and deliberate fires, false alarm malicious may be less than 3% of all calls, and below average proportions of “at risk persons”.

**By moving the second pump from 2 pump stations will certainly effect the targeting of groups in v.high and high risk categories:**

As regards the targeting of fire safety, measures are targeted both geographically and according to household type. Thus, areas are first be ranked according to their risk category – from highest to lowest. As previously noted, fire safety initiatives are required in addition to fire cover in high and very high risk areas to reduce risk to tolerable levels. Secondly, “at risk” households can be targeted within or across these areas. Guidance is provided on which types of households are most “at risk”, based on a review of research into the link between household types, the behaviour of individuals and their fire risk. The identification of “at risk” households in surveyed areas is achieved by use of local census data, local authority surveys (such as social service surveys) and fire reports, as well as the judgement of local fire offices. Fire safety can be further targeted onto key risk factors. This entails an analysis of the causes and circumstances of fires, again drawing on local fire reports.

## **Response times**

An attempt was made, using a single years FDR1 data for the UK, as part of this study to put the relationship between the initial attendance time of the fire brigade and the likelihood of a death in a shop, factory or office fire. However, the number of occasions on which a fatality occurred was insufficient to allow any meaningful conclusions to be reached. Consequently it has proved necessary to rely on evidence regarding the timing of events such as time to “flare up” of fires, survival times and time to flashover, as summarised in exhibit 4.2. The times of critical events have been used to indicate:

- the interval in which an emergency response is required, in the event of persons failing to evacuate from an uncontrolled fire, for the loss of life to be minimised.
  - the interval in which a fire needs to be controlled if conflagration is to be averted.
- Whilst the times of critical events may vary to some extent between buildings, a “core set” of times have been offered for use by those brigades who lack other sources of timings, namely;
- within 5 minutes for high risk buildings/areas,
  - 5 to 10 for medium risk buildings/areas and
  - 10 minutes for low risk buildings/areas.

A brigade needs to demonstrate it can respond within the given time to a fire of given features with sufficient resources to minimise loss of life and/or property

## **DWELLING FIRE COVER RISK ASSESSMENT 2.1**

One aim of the risk assessment is to provide risk-based national guidelines on the level of fire cover that can be warranted for the purpose of protecting life from fire in the home. The Individual Risk of death from fire in dwellings has been estimated by first developing a plot of the likelihood of fatality against fire brigade attendance times, using data on attendance times and casualties in dwelling fires reported to the Home Office in 1995. The likelihood that a casualty will be fatal has been plotted against attendance times in Figure 2.1 and Table 2.1. Thus, the likelihood that a casualty will be fatal, ranges from 3.76% for attendance's within 5 minutes to 7.2% for attendance's in 6 to 10 minutes. Thus, for every 1000 fires in dwellings involving casualties attended in 1 to 5 minutes it is expected that there will be 37.6 fatalities. This is a generalised relationship between attendance time and fatality rates which does not take account of how variations in the discovery time of fires, vulnerability of persons or behaviour of people may or may not influence the relationship between attendance time and fatality rates.

**Table 2.1: Relationship between attendance time and fatality rates across the UK (Source: 1995 FDR1s for dwellings submitted to Home Office).**

Attendance time (mins)	Non-fatal casualties (include brigade rescues)		Fatal casualties (including brigade rescues)		Rescues with Brigade assistance (no injury)		Total	
	Number	%	Number	%	Number	%	Number	%
1 to 5	7438	90.3	310	3.76	486	6	8234	100
6 to 10	4592	92.4	210	4.2	170	3.4	4972	100
11 to 15	490	92.8	29	5.5	9	1.7	528	100
16 to 20	74	88.6	6	7.2	3.5	4.2	83.5	100
>20	78	83	15	16	1	1	94	100
	12672		570		670			

**I would use this argument when closing stations at night and moving to day manned stations :**

### **Impact of changes in current fire cover levels on loss of life**

When considering the impact of changes in fire cover standards it is important to appreciate that, according to 1995 UK FDRI reports, about 60% of attendance's are within 5 minutes and 35% are within 6 to 10 minutes, ie 95% of fires in dwellings were attended within 10 minutes of the call to the fire brigade. The impact of changing response times by an average of 5 minutes is estimated here for the whole UK by applying the following approximations:

- for a 5 minute increase in times, assuming the fatality rate for fires attended in 6 to 10 minutes applies to those currently attended in 1 to 5 minutes, the fatality rate for fires currently attended in 11 to 15 minutes applies to those currently attended in 6 to 10 minutes, and so forth. It is assumed here that the fatality rate for fires currently attended in over 20 minutes remains unaltered.
- for a 5 minute decrease in attendance times, by assuming the fatality rate for fires attended in 1 to 5 minutes applies to those currently attended in 6 to 10 minutes, and so forth. The fatality rate in fires currently attended in under 5 minutes is assumed to remain unaltered, whilst the fatality rate for fires attended in 16 to 20 minutes is assumed to apply to those currently attended in over 20 minutes.

The results are:

- there would be a 20% increase in the number of fire related deaths per annum, 115 additional deaths, with a 5 minute increase (slower) in attendance time nationwide,
- there would be 7% decrease in the number of fire related deaths nation-wide per annum, 39 lives saved, with a 5 minute reduction (faster) in attendance times

## **FIRE COVER MODELLING FOR BRIGADES doc**

**This following point from this document is absolutely key in arguing against cutting / the second pump from the two pump stations :**

### 3.3.1 The effect of workload on response times

In the response time calculation described above, the model calculates the time needed to respond to a call from a particular node, by appliances at each station. Normally, a zone will be served by the station which is nearest in time. But there will be occasions when the nearest station's pumps are already attending another call, so that a station further away may need to be called out.

The response time of this more distant station will be greater than that of the nearest station, and so the average response time to the node being considered will be greater than the response time from the nearest station. The extent to which the response time is increased depends on the proportion of time that the nearest station is attending calls - that is, its workload.

For example, consider the case of an area with two stations, A and B, each with one pump, in which calls never require more than one pump to respond. Consider a single node X in the area, which has a response time from the nearer station, A, of 4 minutes, and of 8 minutes from the other station. If station A has a workload which keeps it busy attending calls for 25% of its day to nodes other than the nearest to it, then the proportion of calls at node X which are served by station B will be 25%, with 75% served by the nearer station A.

The average response time to node X will be the weighted average of the response time from station A (4 minutes) and that from B (8 minutes), that is: average response time at node X = 75% x 4 + 25% x 8 = 3 + 2 = 5 minutes

This response time compares with the 4 minutes expected on the simple assumption that the nearer station is always available.

If the workload on station A is decreased, say to 10% instead of 25%, then the average response time becomes:

$$\begin{aligned} \text{average response time at node X} &= 90\% \times 4 + 10\% \times 8 \\ &= 4.4 \text{ minutes.} \end{aligned}$$

This illustrates that when stations have a light workload, the response time is very little more than the minimum response time.

<b>Station A</b>		<b>Station B</b>
<b>4 mins</b>	<b>X</b>	<b>8 mins</b>

Figure 3-4: Workload and response times

This "simplest case" illustration contains two difficulties which need to be examined. First, the next-best station's own workload has been ignored.

Second, the workload calculation needs explanation.

Dealing first with the next-best station's workload, it is apparent that if station A's workload is 25% and station B's is 10%, then on average for 10% of 25% of calls, that is 2.5% of calls, both pumps will be busy and no response is possible. But this is because our example is too simplistic. In practice there are more than two stations, and the model simply deals with all that have been included in the study area. That is to say that the

model calculates the proportion of calls from node X that will be attended by the nearest station, the second nearest, third nearest, ... and so on. In practice, the probability that a one-pump call from node X will need to be serviced by the station which is the fourth nearest to node X is virtually zero. But the model can, and does, include this. In this way, the workload on every station is allowed to have its influence on response times.

## Out of the Line of Fire Modernising the Standards of Fire Cover doc

### GOVERNING PRINCIPLES

Public protection from fire must be maintained and, if possible, enhanced.

The safety of firefighters must not be compromised.

The primary focus of fire cover should more directly address the risk to life. (This represents a shift from the current property-based approach.)

Recommendations should be cost effective and consistent with the principles of best value for public money.

### RESPONSE

We agree with the Audit Commission that the current prescriptive approach on the type, speed and weight of responses to be provided to various locations on the basis of present risk categories is inflexible. As a result, it does not always provide either the most efficient or the most operationally effective fire cover.

In future, brigades should plan the type, weight and speed of response to be provided to a particular location on the basis of an explicit “**worst case planning scenario**”. This should be decided on the basis of experience and professional judgement.

The firefighter resources and equipment required to **intervene adequately and safely in any given scenario should be determined by reference to lists of standard tasks** for which staffing levels have been agreed nationally. This can be done by further validation of data collected by our review and the validation work should therefore be taken forward in a series of **pathfinder projects**.

When planning fire cover, a firefighting response must be provided which meets the local risk. This means that more firefighting resources will be required when there is a high risk of fire than when the risk is low. However, a house fire, say, in a low risk area requires similar firefighting resources to a house fire in a high risk area, which tends to mean in practice that where risk is low the firefighting resources required for a given weight of firefighting intervention will have to cover a greater geographical area than when they are high. In such circumstances, whilst the weight of response for a given type of fire will remain the same, response times will tend to be longer in low risk areas. Two factors must therefore be considered:

- | weight and type of response
- | time to respond

The *weight and type* of response will depend on the kind of fire likely to be encountered, whilst the response *time* will depend upon the availability of resources and their disposition relative to the fire.

However, these two factors are not independent, since longer response times give greater opportunity for fires to develop.

*If longer response times are envisaged, the weight and type of response planned must be adjusted accordingly, to ensure that firefighter safety is not compromised.*

In order to plan a suitable weight and type of response for fire cover purposes, it is necessary to make a judgement about the size and nature of the worst fire for which fire cover is to be planned (the 'worst case planning scenario'). Professional judgement and local knowledge are required to decide the appropriate worst case planning scenario for a particular area.

**Answer : increase the weight of response.**

**These two following points will be used by brigades so caution and understanding in the stats is required:**

Next the fatality rates for a range of response times were multiplied by the rates of fire to derive a prediction of the risk of death for each combination of response time and rate of fire. This is illustrated in *Figure 4-1*. Thus, in areas with higher rates of fire a fast response time gives the same risk of death as a slower response time in areas with lower rates of fire. The predicted rates of death were compared with reported rates of death as a test of the model's accuracy, and were found to compare favourably.

The limits of tolerability of risk are also shown in *Figure 4-1* to show the impact of alternative response times on exposure to risk. Thus, even the fastest response time fails to reduce risk to tolerable levels in those areas with the highest rates of fire, whilst a moderate response time is sufficient to maintain a tolerable level of risk in areas with lower rates of fire. A minimum response time is required in all areas to ensure that the risk remains tolerable.

**What needs to be remembered is that the reduction in fire cover in areas of higher rates of fire will increase the risk of death higher proportionally to area's of low fire rates.**

### **Balancing fire safety and fire cover**

The Audit Commission recommendation of shifting the emphasis from response to prevention raised the question of how it might be anticipated that the risk assessment process would support such a shift. In our view:

- **fire cover should not be reduced in anticipation of educational fire safety interventions reducing risk.** Rather, a significant period should pass during which a sustained reduction in fire risk was demonstrated before fire cover could be changed to match the new (lower) level of risk. This should guard against educational interventions failing to achieve expected results.
- it should be possible to plan a change (reduction) in fire cover to coincide with implementation of a fire safety measure previously proven to bring about an immediate reduction in risk, such as might be achieved with installation of sprinkler systems across an estate.
- **where it is considered that risk levels should be reduced, fire authorities should be**

encouraged to adopt fire safety measures, where they are cost effective, rather than increase fire cover levels, although the outcome of this approach should be the subject of continuous review.

## **Dwelling Risk Assessment Toolkit doc**

It is implicit within this process for dwellings that fire authorities should:

- focus resources onto those areas experiencing the highest risk to life,
- identify the most cost-effective package of fire cover and fire safety measures required to keep risk down to levels generally considered tolerable by society, and; MS 1
- review performance on an ongoing basis, in terms of the loss of life and injury, and adjusting policy as necessary.

Areas with tower blocks or HMOs and apartment blocks of 3 or more storeys and areas with large numbers (4%) of households with over 6 residents should be identified for subsequent assessment of the potential for large loss of life, as discussed in the “High Occupancy Premises Toolkit”.

### b) Social-demographic Community Profiling

Areas with higher rates of fire and fire casualty tend to share certain features, as noted in the descriptions of the typical characteristics of dwellings given in Table 1. Therefore, an alternative to a) above is to identify risk areas according to their social-demographic and fire call profiles, as detailed in Table 1. This option may be preferred where it is difficult to judge the annual rate of fire casualty without first consulting fire reports or compiling statistical analysis of candidate areas. **This has been done by Bryn and the Coroner.**

### 2.3.2 Information needs

Table 2 shows the fire report data and census data required to calculate fire and fire casualty rates and other statistics. At a minimum, it is necessary to collect:

1. Census data on the number of residents and number of dwellings in each risk area.
2. Number of reported (FDR1) fires in dwellings in each risk area over the past 4 to 5 years.
3. Number of fatal and non-fatal casualties and rescues with brigade assistance from dwellings in past 4 to 5 years in each risk area.

**5. Fire cover should not be reduced in anticipation of new community fire safety initiatives reducing risk** Following the introduction of new community fire safety initiatives, fire authorities should allow a sufficient period of time to pass-by during which a sustained reduction in the rate of fire/casualty (over say 3 years) must be achieved before fire cover can be changed to match the new lower rate of fire/casualty.

# **Response time fatality rate relationships for dwelling fires doc**

**Table 1. – Number of casualties as an indication of data available in each category.**

<b>Risk Category</b>	<b>Area Classification</b>	<b>Number of Casualties</b>	
Group A Urban		6,798	
Group B Urban		37,312	
Group C Urban		89,432	
Urban:			133,542
Group D Rural		10,406	
Remote Rural Rural		122	
Rural:			10,528
Non Specified		3,594	Total: 147,664

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## **Fire and Rescue Services Act 2004**

### **Core functions**

#### **Fire safety**

(1) A fire and rescue authority must make provision for the purpose of promoting fire safety in its area.

(2) In making provision under subsection (1) a fire and rescue authority must in particular, to the extent that it considers it reasonable to do so, make arrangements for—

(a) the provision of information, publicity and encouragement in respect of the steps to be taken to prevent fires and death or injury by fire;

(b) the giving of advice, on request, about—

(i) how to prevent fires and restrict their spread in buildings and other property;

(ii) the means of escape from buildings and other property in case of fire.

#### **Fire-fighting**

(1) A fire and rescue authority must make provision for the purpose of—

(a) extinguishing fires in its area, and

(b) protecting life and property in the event of fires in its area.

(2) In making provision under subsection (1) a fire and rescue authority must in particular—

(a) secure the provision of the personnel, services and equipment necessary efficiently to meet all normal requirements;

(b) secure the provision of training for personnel;

(c) make arrangements for dealing with calls for help and for summoning personnel;

(d) make arrangements for obtaining information needed for the purpose mentioned in subsection (1);

(e) make arrangements for ensuring that reasonable steps are taken to prevent or limit damage to property resulting from action taken for the purpose mentioned in subsection (1).

### **Road traffic accidents**

(1) A fire and rescue authority must make provision for the purpose of—

- (a) rescuing people in the event of road traffic accidents in its area;
- (b) protecting people from serious harm, to the extent that it considers it reasonable to do so, in the event of road traffic accidents in its area.

(2) In making provision under subsection (1) a fire and rescue authority must in particular—

- (a) secure the provision of the personnel, services and equipment necessary efficiently to meet all normal requirements;
- (b) secure the provision of training for personnel;
- (c) make arrangements for dealing with calls for help and for summoning personnel;
- (d) make arrangements for obtaining information needed for the purpose mentioned in subsection (1);
- (e) make arrangements for ensuring that reasonable steps are taken to prevent or limit damage to property resulting from action taken for the purpose mentioned in subsection (1).

### **Emergencies**

(1) The Secretary of State may by order confer on a fire and rescue authority functions relating to emergencies, other than fires and road traffic accidents in relation to which the authority has functions under section 7 or 8.

(2) An order under this section may require functions conferred on a fire and rescue authority under this section to be discharged outside the authority's area.

(3) An order under this section may make provision as to what a fire and rescue authority must or may do for the purpose of a function conferred under this section, and may in particular require or authorise a fire and rescue authority—

- (a) to secure the provision of personnel, services and equipment;
- (b) to secure the provision of training for personnel;
- (c) to make arrangements for dealing with calls for help and for summoning personnel;
- (d) to make arrangements for obtaining information needed for the purpose of discharging the function;
- (e) to make arrangements for ensuring that reasonable steps are taken to prevent or limit damage to property resulting from discharging the function.

(4) An order under this section may confer a function, including a function of providing particular equipment, on a particular authority.

(5) Before making an order under this section the Secretary of State must consult any persons he considers appropriate.