



Fire Cover Review Pathfinder Trials Documentation

Special Services

Risk Assessment Toolkit

Version 1.0

Written by
Michael S Wright
Entec UK Ltd

Edited By
Bryan Johnson
FRDG

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Home Office
Fire And Emergency Planning Directorate
Fire Research And Development Group
Horseferry House
Dean Ryle Street
LONDON
SW1P 2AW

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ABSTRACT

The extrication of casualties from Road Traffic Accidents and other types of special service incidents is an important part of the fire services role. This toolkit provides an explanation of how to assess the risk to life and limb posed by special service incidents and how to balance the level of fire and emergency cover against this risk. It requires an understanding of the threat posed by different types of special service incidents and their frequency in different localities. Recommendations are given for both the time of attendance and the extrication time.

MANAGEMENT SUMMARY

The extrication of persons trapped in vehicles involved in road traffic accidents (RTAs) and attendance at other special service incidents where there is an imminent threat to the life comprises a very significant part of the fire services "life saving" work. It has been reported by the London Helicopter Emergency Medical Service that, in the 1990s, the fire service are involved in an estimated 7,500 extrications each year of persons from vehicles.

Persons are also rescued or released from other high risk situations, such as entrapment in machinery or confined noxious spaces, such as storage vessels. Taking Scotland as an example, 978 persons were reported as rescued from other emergency situations (without fire) in 1994-95, in addition to the release of about 595 persons at road traffic accidents. Thus, the UK fire service is probably involved in the rescue of over 15,000 persons per year from life threatening incidents.

The relative importance of "life risk" special services and the rescue of persons from fires can be illustrated by reference to 1995 UK Fire Statistics. It is reported that 4,259 persons were rescued by fire brigades from fires in 1995, compared to the estimated 7,500 extrications of persons from RTAs by the fire service.

Clinical research shows that the survival of casualties and the severity of injuries is influenced by both the method of extrication and the speed with which emergency clinical care is rendered to the casualty either in situ or after conveyance to hospital. Where the rendering of emergency medical care is dependent on the fire service facilitating access to the casualty and/or facilitating extrication, the actions of the fire service will strongly influence whether or not necessary clinical care can be rendered.

Against this background, the aim of risk assessment is to ensure that "life risk" special services are accorded an appropriate level of attention within the planning of fire and emergency cover along side other fire and emergency risks. As with other emergency incidents, the aim is to ensure that the disposition and capability of fire service resources is sufficient to reduce the loss of life and injury as low as is reasonably practicable (ALARP). This entails matching the level, type and disposition of fire and emergency resources to the frequency, type and severity of special service incidents within each area. As part of this, the assessment should establish whether "normal" fire cover can achieve an adequate special service response or whether additional provision is required.

Overview of Special Service Risk Assessment

The risk assessment process for special services comprises of the following 3 stages:-

- Stage 1 - Identify risk areas and assign special service risk categories
- Stage 2 - Assess and match fire and emergency cover to special services risk categories
- Stage 3 - Monitor and review special service risk

The main tasks to be carried out during these three stages are outlined below:-

Stage 1 - Identify Risk Areas and Assign Special Service Risk Categories

As “life risk” special services comprise a small fraction of all special services, it is important to first discriminate between those special services where there is an imminent or serious risk to life and those where there is no significant risk to life. Consequently, special services have been classified as follows:-

- Category A - Imminent life risk
- Category B - Serious life risk
- Category C - Other special services

Only Category A and B special services are assessed for fire and emergency cover purposes in the toolkit.

During this first stage, it is necessary for fire brigades to identify risk areas in which the maximum response time (including mobilisation time) to special service incidents is 10 minutes from a single point. These risk areas should be chosen with physical boundaries and historical incident data taken in to account.

The risk areas are then each assigned a special services risk category, ranging from very high to very low, based on the number of Category A incidents occurring per annum.

Stage 2 - Assess and Match Fire and Emergency Cover To Special Services Risk Categories

In the next step, brigades should assess for each risk area whether their current fire cover is sufficient to respond to special service incidents within the recommended response times, with the recommended response capabilities and with the recommended rescue times. If the fire and emergency cover performance requirements are not being achieved, then the toolkit contains suggestions on how fire and emergency cover levels could be modified and on incident prevention measures.

In some cases it may be concluded that the current level or type of fire and emergency cover is insufficient to achieve the performance requirements and that a different level of fire and emergency cover is required. Guidance on the assessment of the cost-effectiveness of various alternatives is provided in the separate Costings toolkit.

In this Special Services toolkit, the recommended fire and emergency cover is expressed in terms of recommended response times, rescue times and what the response should be capable of achieving. In addition, the toolkit contains advice on the identification of a Worse Case Planning Scenario (WCPS) for each special services risk area. The Worst Case Planning Scenario (WCPS) is the worst case for which fire and emergency cover is to be planned for a particular risk area, and reflects what is reasonable provision for the risk area. It is not the worst case that can be imagined. Reference should be made to the Brigade Response Options Software (BROS) for guidance on the resources required for the initial fire service response (in terms of personnel, equipment and specialist skills) to each WCPS.

Stage 3 - Monitor and Review Special Service Risk

The ultimate goal is to reduce the loss of life and severity of injuries as low as reasonably practicable (ALARP). Therefore, the response performance to special service incidents should be monitored over time to ascertain whether the fire and emergency cover performance is adequate.

Where performance is unsatisfactory, a further review should be carried out to discern the reasons for this, such as:

- inadequate training and equipment,
- mismatch between disposition of fire and emergency cover and location of incidents.

The conclusions of this review should be used to identify further improvements in services, thereby maintaining satisfactory standards of service.

Scope of Application of the Special Services Toolkit

The toolkit provides background information on the procedures and calculations carried out in the Graphical Information System based Brigade Risk Assessment Toolkit Software (GIS BRATS), with regards to special services risk assessment.

The toolkit illustrates the approach which can be used to assess “special services” risks for the purpose of determining fire and emergency cover. The type of special service risks addressed here are those where there is an imminent threat of fatal or serious injury (in the absence of an emergency intervention) to no more than about five persons, such as:

- road traffic accidents,
- unsafe structures, such as storm damaged houses,
- trapped persons, e.g. in machinery,
- persons trapped in noxious or toxic environments, such as sewers or petrol storage tanks.

Incidents which involve a major loss of life, numerous casualties or widespread damage or disruption are covered by the Major Incident risk assessment toolkit and so should be excluded from this special services assessment.

Other Toolkits and Associated Fire Cover Review Items

The other toolkits that should be used in addition to the Special Services toolkit for the risk assessment of brigade areas during fire cover review are the Dwellings toolkit, Other Buildings toolkit, Major Incidents toolkit and the Costings toolkit.

The Costings toolkit provides guidance on determining the expenditure required for fire and emergency cover and fire safety initiatives in line with the results of the fire cover review risk assessments outlined in the other toolkits.

GIS BRATS mostly automates the procedures contained in the above risk assessment toolkits once brigade incident data, digital map data of the brigade area, census data for the brigade area and existing fire station location information has been loaded in to the software database.

The Brigade Response Options Software (BROS) contains a database of planning scenarios provided by the Central Fire Brigades Advisory Committee (CFBAC) covering a wide range of possible incidents and the activities likely to be required of the first attendance crew(s) to deal with each of them.

BROS interfaces with GIS BRATS in order to allow any of these CFBAC planning scenarios to be used as Worst Case Planning Scenarios (WCPS) for risk areas. BROS allows brigades to create their own database which may contain copied or edited CFBAC scenarios as well as new planning scenarios to reflect local requirements. BROS provides GIS BRATS with information on the resources, in terms of personnel, equipment and specialist skills, necessary to respond to each WCPS. GIS BRATS then assists brigades in determining the allocation of resources to stations.

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1 INTRODUCTION

1.1 Background

The extrication of persons trapped in vehicles involved in road traffic accidents (RTAs) and attendance at other special service incidents where there is an imminent threat to the life comprises a very significant part of the fire services “life saving” work. It has been reported by the London Helicopter Emergency Medical Service that, in the 1990s, the fire service are involved in an estimated 7,500 extrications each year of persons from vehicles. In addition, they report that more than half of spinal cord injuries in the UK are caused by RTAs, and that 40% of spinal fractures have associated neurological damage.

Persons are also rescued or released from other high risk situations, such as entrapment in machinery or confined noxious spaces, such as storage vessels. Taking Scotland as an example, 978 persons were reported as rescued from other emergency situations (without fire) in 1994-95, in addition to the release of about 595 persons at road traffic accidents. Thus, the UK fire service is probably involved in the rescue of over 15,000 persons per year from life threatening incidents.

The relative importance of “life risk” special services and the rescue of persons from fires can be illustrated by reference to 1995 UK Fire Statistics. It is reported that 4,259 persons were rescued by fire brigades from fires in 1995, compared to the estimated 7,500 extrications of persons from RTAs by the fire service.

Clinical research shows that the survival of casualties and the severity of injuries is influenced by both the method of extrication and the speed with which emergency clinical care is rendered to the casualty either in situ or after conveyance to hospital. Where the rendering of emergency medical care is dependent on the fire service facilitating access to the casualty and/or facilitating extrication, the actions of the fire service will strongly influence whether or not necessary clinical care can be rendered. In addition, the extrication and immobilisation of casualties has to be undertaken in accordance with appropriate casualty management methods to avoid increasing, in the case of spinal injuries, the degree of neurological damage.

Against this background, the aim of risk assessment is to ensure that “life risk” special services are accorded an appropriate level of attention within the planning of fire and emergency cover along side other fire and emergency risks. As with other emergency incidents, the aim is to ensure that the disposition and capability of fire service resources is sufficient to reduce the loss of life and injury as low as is reasonably practicable (ALARP). This entails matching the level, type and disposition of fire and emergency resources to the frequency, type and severity of special service incidents within each area. As part of this, the assessment should establish whether “normal” fire cover can achieve an adequate special service response or whether additional provision is required.

1.2 Overview of Special Service Risk Assessment

1.2.1 Introduction

The risk assessment process for special service incidents comprises of the following three stages:-

Stage 1 - Identify risk areas and assign special service risk categories

Stage 2 - Assess and match fire and emergency cover to special services risk categories

Stage 3 - Monitor and review special service risk

The main tasks to be carried out during these three stages are illustrated in Figure 1 and outlined below:-

1.2.2 Stage 1 - Identify Risk Areas and Assign Special Service Risk Categories

As “life risk” special services comprise a small fraction of all special services, it is important to first discriminate between those special services where there is an imminent or serious risk to life and those where there is no significant risk to life. Consequently, special services have been classified as follows:-

- Category A - Imminent life risk
- Category B - Serious life risk
- Category C - Other special services

Only Category A and B special services are assessed for fire and emergency cover purposes in this toolkit.

During the first stage, it is necessary for fire brigades to identify risk areas in which the maximum response time (including mobilisation time) to special service incidents is 10 minutes from a single point. These risk areas should be chosen with physical boundaries and historical incident data taken in to account.

The risk areas are then each assigned a special services risk category, ranging from very high to very low, based on the number of Category A incidents occurring per annum.

1.2.3 Stage 2 - Assess and Match Fire and Emergency Cover to Special Services Risk Categories

In the next step, brigades should assess for each risk area whether their current fire cover is sufficient to respond to special service incidents within the recommended response times, with the recommended response capabilities and with the recommended rescue times. If the fire and emergency cover performance requirements are not being achieved, then this toolkit contains suggestions on how fire and emergency cover levels could be modified and on incident prevention measures.

In some cases it may be concluded that the current level or type of fire and emergency cover is insufficient to achieve the performance requirements and that a different level of fire and emergency cover is required. Guidance on the assessment of cost-effectiveness is provided in the Costings toolkit (see Section 1.4.1).

In this toolkit, the recommended fire and emergency cover is expressed in terms of recommended response times, rescue times and what the response should be capable of achieving. In addition, this toolkit contains advice on the identification of a Worst Case Planning Scenario (WCPS) for each special services risk area. The Worst Case Planning Scenario (WCPS) is the worst case for which fire and emergency cover is to be planned for a particular risk area, and reflects what is reasonable provision for the risk area. It is not the worst case that can be imagined. Reference should be made to the Brigade Response Options Software (BROS) for guidance on the resources required for the initial fire service response (in terms of personnel, equipment and specialist skills) to each WCPS.

1.2.4 Stage 3 - Monitor and Review Special Service Risk.

The ultimate goal is to reduce the loss of life and severity of injuries as low as reasonably practicable (ALARP). Therefore, the response performance to special service incidents should be monitored over time to ascertain whether the fire and emergency cover performance is adequate.

Where performance is unsatisfactory, a further review should be carried out to discern the reasons for this, such as:

- inadequate training and equipment,
- mismatch between disposition of fire and emergency cover and location of incidents.

The conclusions of this review should be used to identify further improvements in services, in line with earlier guidelines, thereby maintaining satisfactory standards of service.

1.3 Scope of Application of the Special Services Toolkit

This toolkit provides background information on the procedures and calculations carried out in the Graphical Information System based Brigade Risk Assessment Toolkit Software (GIS BRATS), with regards to special services risk assessment.

The toolkit illustrates the approach which can be used to assess “special services” risks for the purpose of determining fire and emergency cover. The type of special service risks addressed here are those where there is an imminent threat of fatal or serious injury (in the absence of an emergency intervention) to no more than about five persons, such as:

- road traffic accidents,
- unsafe structures, such as storm damaged houses,
- trapped persons, e.g. in machinery,
- persons trapped in noxious or toxic environments, such as sewers or petrol storage tanks.

Incidents which involve a major loss of life, numerous casualties or widespread damage or disruption are covered by the Major Incident risk assessment toolkit and so should be excluded from this assessment.

1.4 Other Toolkits and Associated Fire Cover Review Items

1.4.1 Other Toolkits

The other toolkits that should be used in addition to the Special Services toolkit for the risk assessment of brigade areas during fire cover review are as follows:-

- Dwellings toolkit
- Other Buildings toolkit
- Major Incidents toolkit
- Costings toolkit

The Costings toolkit provides guidance on determining the expenditure required for fire and emergency cover and fire safety initiatives in line with the results of the fire cover review risk assessments outlined in the other toolkits.

1.4.2 Graphical Information System Based Brigade Risk Assessment Toolkit Software (GIS BRATS)

GIS BRATS mostly automates the procedures contained in all of the toolkits once the following information has been loaded in to the software database :-

- Brigade incident data
- Digital map data of the brigade area
- Census data for the brigade area (by enumeration district)
- Existing fire station locations

1.4.3 Brigade Response Options Software (BROS)

The Brigade Response Options Software (BROS) contains a database of planning scenarios provided by the Central Fire Brigades Advisory Committee (CFBAC) covering a wide range of possible incidents and the activities likely to be required of the first attendance crew(s) to deal with each of them. Each scenario contains a list of the tasks likely to be performed to deal with the incident selected, and identifies the sequence in which they will be performed and the resources required in terms of crew, equipment and specialist skills. Note that this software, and the associated CFBAC database, is provided as a planning tool, and does not represent a 'standard' or 'approved' method of tackling the incident.

BROS interfaces with GIS BRATS in order to allow any of these CFBAC planning scenarios to be used as Worst Case Planning Scenarios (WCPS) for risk areas. BROS allows brigades to create their own database which may contain copied or edited CFBAC scenarios as well as new planning scenarios to reflect local requirements. BROS provides GIS BRATS with information on the resources, in terms of personnel, equipment and specialist skills, necessary to respond to each WCPS. GIS BRATS then assists brigades in determining the allocation of resources to stations.

2 STAGE 1: IDENTIFY RISK AREAS AND ASSIGN SPECIAL SERVICE RISK CATEGORIES

2.1 Classifying Special Services

2.1.1 General

As “life risk” special services comprise a small fraction of all special services, it is important to first discriminate between those special services where there is an imminent or serious risk to life and those where there is no significant risk to life.

A classification of the more common and most serious special services is given in Table 1. The recommended fire and emergency cover performance requirements are based on the number of incidents which pose an imminent risk to life. Therefore, incidents are classified according to the risk to life as follows:-

- Category A - Imminent life risk
- Category B - Serious life risk
- Category C - Other special services - no significant risk to life

All subsequent assessment are confined to Category A and B incidents and these are further explained below. Category C incidents pose no significant risk to life and so are not assessed further.

a) Category A “Imminent Life Risk”

Category A “imminent life risk” incidents include situations where a seriously injured person requires assistance to avert death or escalation of an injury, and situations where persons are very likely to suffer fatal or severe harm unless they are rescued within minutes. Common examples of imminent life risks responded to by the fire service, include:

- extrication of injured persons trapped in motor vehicles, particularly cars, vans and coaches,
- extrication of injured persons trapped in/under machinery or equipment at places of work, agricultural premises, etc.,
- extrication of persons (unconscious, unable to escape unassisted or otherwise incapacitated) from toxic, noxious or oxygen deficient confined spaces (e.g. sewers, factories, storage vessels, silos),
- extrication of persons from collapsed structures including collapsed buildings, seating stands (such as in arenas), tunnels, bridges, etc.,

- rescue of persons caught in severe fast moving flood waters.

b) Category B “Serious Life Risk”

Category B “serious life risk” incidents include those situations where persons are very likely to be exposed to a life threatening hazard unless they are assisted. Common examples include:-

- facilitating access to properties occupied by vulnerable persons such as children (i.e. high life risk lockouts), and lockout of “at risk” persons (e.g. women locked out at night in high crime areas),
- rescue of persons or their evacuation from places experiencing severe flooding, or at imminent risk of severe flooding - where such flooding poses an imminent threat of drowning or structural collapse of occupied buildings,
- making safe structures at risk of imminent collapse, in occupied areas such as storm damaged or explosion damaged structures in residential areas and town centres,
- rescue of uninjured persons from heights (where they are unable to move to a safe location unassisted).

2.2 Subdivide Brigade Areas Into Risk Areas

In order to assess the case for local fire and emergency cover, brigade areas need to be sub-divided into “risk areas” for more detailed consideration. Guidance is provided here on how on how to carry out this subdivision. The aim is to create risk areas in which the maximum number of incidents can be attended within the recommended response time from a single point. At the outset of an assessment, local professional judgement should be used to match the boundaries of risk areas to the local distribution of incidents and physical features such as hills and rivers. Thus, the size and boundaries of the area to be surveyed are determined by at least two considerations, namely:

1. travel time, and
2. incident frequency.

The recommended response time for special service incidents involving an imminent risk to life is no more than 10 minutes including mobilisation time (see Section 3.1.2). Therefore, as a general rule, the surveyed area should be sub-divided into individual risk areas, each of which can be traversed in approximately 20 minutes less twice the mobilisation time. The shape of risk areas may not necessarily be regular as the layout of the local road network may produce variable travel speeds in different areas.

It is strongly advised that Category A and B special service incidents (as defined in Section 2.1) are plotted on a map, particularly RTAs, people trapped in machinery and vulnerable people involved in lock-outs/lift rescues. This should help to designate the boundaries of risk areas in a

logical manner. For example, if there are two clusters of incidents, perhaps due to road accident black spots, located within 5 minutes of one another, it may be logical to keep these locations within a single risk area. Such a plot would also help to identify physical boundaries, such as rivers or hills.

However, there are a number of exceptions to this rule, as follows:

1. where an incident that requires special resources, such as HAZCHEM incidents, occurs at a relatively low frequency, it may be necessary to complete a more strategic review of (say) a whole division of a brigade or part of an urban conurbation. It is likely that HAZCHEM incidents, line rescues, rescues requiring heavy lifting equipment, rescues from collapsed structures and rescue of persons from noxious or toxic spaces such as storage tanks, would most usefully be assessed across a large area - although there may be exceptions.
2. brigade areas which experience very few incidents, such as remote rural areas. Areas that can be traversed in 20 minutes containing less than 1 category A special service incident every two years are likely to fall into this category. In this case the division of the brigade area into risk areas will serve little purpose as the risk can be better assessed by considering the larger brigade area as a whole. A large brigade area of (say) 500km² or more could be assessed in one go, especially if the travel speed is approximately the same across the area. However, care should be taken to identify "clusters" of incidents due to, for example, rural trunk roads and by-passes with high level of traffics and accidents. Again, a geographic plot of incidents should help identify clusters of incidents which may deserve separate review.

Also, where it is thought that incidents are approximately evenly distributed over a large area and the travel time is approximately the same across this area, the area may be subdivided into equal sized risk areas, for the purpose of the risk assessment. The diameter of each risk area should be equivalent to the distance that can be travelled in 20 minutes less mobilisation time. Thus, for example, with a travel speed of 20 mph the risk areas would be about 6 miles in diameter, allowing 1 minute for each of two mobilisations. As this simplification may overlook some local variations in travel times, a check should be made that the recommended response time to clusters of incidents and/or to areas experiencing a high number of incidents are not exceeded.

The approximate risk area diameters that can be reached in 10 minutes from a central point at different speeds are given below. These allow for mobilisation times of 1 and 5 minutes.

Average travel speed (mph)	Mobilisation time (minutes)	
	1	5
10	3 miles	1.7 miles
20	6 miles	3.3 miles
30	9 miles	5 miles
40	12 miles	6.7 miles

2.3 Assessing Frequency of Incidents

2.3.1 Information Sources

The number of life risk special service incidents can be estimated by at least 2 methods, namely:-

- review of fire brigade incident records, and
- extrapolation for new risks from other similar areas.

It is likely that the review of fire brigade incident records will provide a basis for identifying the vast majority of special service life risks, especially RTAs, lock-outs, making safe, HAZCHEMs and persons trapped in machinery. However, extrapolation may be required where a new development is proposed, such as a new by-pass, new town or industrial estate.

2.3.2 Review of Fire Brigade Incident Reports

For the identified risk areas, produce print outs of all Category A and B special service calls (see Table 1) over the past 3 to 5 years at which there was an imminent threat to life. In order to ensure that the numbers of years and the size of the risk area reviewed should be sufficient to provide a statistical robust record of events, the following guidelines should be followed:

- the average number of Category A incidents per annum should be calculated using a minimum sample size of 20 incidents from a period of at least 3 to 5 years,
- where the number of Category A incidents in the past 5 years in one risk area falls below 20, consideration should be given to calculating an average rate of incidents for a group of similar risk areas with similar rates of incidents.

The number of Category B incidents can be compared with the number of Category A incidents for the purpose of cross-validation, especially where there appears to be a change in the number of Category A incidents. In this case, a corresponding trend in Category B incidents may be used to establish whether a higher or lower risk category should be assigned to an area (see Section 2.4).

2.3.3 Extrapolation

The number and type of incidents that may occur with a new development can be predicted by:

1. Identifying all structures and activities in the proposed development which present a potential for one or another of the defined imminent life risk incidents, such as road traffic accidents, industrial processes involving moving machinery or noxious/toxic chemicals etc.
2. Identifying an appropriate rate of incidents from Appendix A. Different accident rates are given for different types of roads and activities.

Multiplying the rate of incidents by the size of the proposed development, such as miles of road.

2.3.4 Calculating Rates

The formula for calculating incident rates is shown in the 3 right hand columns of Table 1, and is explained below.

a) Risk Area Specific Assessment

As a general rule, the average number of all Category A incidents and the average number of Category B incidents per year should be estimated for each 20 risk area. The average is given by:

$$\frac{\text{Total number of Category A incidents}}{\text{Number of years surveyed}}$$

Thus, for example, with 30 category A incidents over 5 years, the average number of is $30/5 = 6$ per year. This calculation is performed in column 4 of Table 1.

b) Strategic Assessment

A more “strategic” approach should be taken in the circumstances specified below.

1. Low frequency incidents, such as HAZCHEM incidents, occurring across a large area. The average number of incidents should be calculated for the whole of the surveyed brigade area.
2. Where the number of incidents across a series of risk areas with similar travel times and incident numbers have been added together, such as remote rural areas and urban risk areas. This approach may be justified in two circumstances, namely:
 - where incidents are approximately evenly distributed across risk areas,
 - where the number of incidents in a risk area is less than 1 every 2 years,

- where less than 3 years of historical data is available and the number of incidents per risk area is less than 5 per annum.

The average number of incidents per “20 minute” risk area should be calculated as follows:

$$\frac{\text{Number of incidents across all surveyed risk areas}}{\text{Number of risk areas} \times \text{number of years}} = \text{average number per year per risk area}$$

For example, with 200 Category A incidents in 5 years across 40 risk areas there would be $200/[40 \times 5] = 1$ incident per year per risk area.

As a rule, incidents (of the same risk category) which demand a similar set of resources can be grouped together for the purpose of fire and emergency cover review. However, where a type of incident demands a unique type of resource, such as line rescues, the number of incidents should be assessed separately and any geographic clusters should be identified. For example, a cluster of line rescues at a specific tourist attraction should be highlighted and, in the first instance, assessed separately to determine the case for a localised line rescue team. Where the incidents are more widely spread across a brigade area, such as across a division of a brigade, the assessment should proceed in two stages:

1. are there a sufficient number of incidents in certain risk areas to warrant a more local response? or
2. what level of response can be justified for the brigade area as a whole given the overall number of incidents?

The aim here is to assess whether there are risk areas experiencing a high number of incidents for which, for example, height appliances should be located, or whether special resources should be evenly distributed across the whole area.

2.4 Risk Categorisation of Special Services Risk Areas

Once the frequency of incidents has been calculated (see Section 2.3), each special services risk area should be assigned a risk category, ranging from Very High to Very Low, as follows :-

Special service risk category	Average number of Category A incidents per annum
Very High	Over 10
High	Between 7 and 10 per year
Medium	Between 3 to 6 per year
Low	Between 1 and 2 per year
Very Low	1 every 2 years
Negligible	Less than 1 every 2 years

3 STAGE 2: ASSESS AND MATCH FIRE AND EMERGENCY COVER TO SPECIAL SERVICES RISK CATEGORIES

3.1 Recommended Performance Requirements For Special Services Fire and Emergency Cover

3.1.1 General

For special services, the recommended performance requirements for fire and emergency cover have three elements, namely:

1. initial response time,
2. response capability and rescue time,
3. response options (Worse Case Planning Scenarios (WCPS)).

These are described below.

3.1.2 Initial Response Time

The response time should be measured from receipt of the call by the 999 operator to arrival of the initial fire service response at the incident.

Special Service Risk Categories	Response Time
A. Imminent life risks	8 to 10 minutes
B. Serious life risk incidents	15 minutes
C. Other	No Standard

3.1.3 Response Capability and Rescue Times

Fire brigades should aim, where there is a significant life risk, to be able to:

- In the event of an injured person trapped in a RTA, machinery etc. :-

Make the scene safe from fire and vehicle instability and extract the injured person within 30 minutes of the initial attendance if no invasive life support is required - or allow medical access to casualties within 5 minutes of initial attendance for purpose of resuscitation or other invasive in-situ life support measures. The initial response needs to be able to make an assessment of the clinical needs of the casualty within a few minutes to allow a decision to be made on whether to rapidly extract the casualty or stabilise the casualty in-situ, with the response dictated by the medical needs of the casualty unless there is an immediate threat to life from fire or vehicle instability.

- In the event of unsafe structures or chemical incidents:-

Make the area safe within 30 minutes - or prevent access to the area within 5 minutes of the initial attendance.

- In the event of person trapped in a noxious, toxic or oxygen deficient atmosphere :-

Provide an oxygen supply for the person, or move the person to a “safe” area within 5 to 10 minutes of the initial attendance (i.e. prior to irreversible brain damage to the trapped person due to oxygen starvation). This assumes that there is direct access to the casualty through, for example, an open hatch.

3.1.4 Response Options and Worse Case Planning Scenarios (WCPS).

The Worst Case Planning Scenario (WCPS) is the worst case for which fire cover is to be planned for a particular risk area, and reflects what is reasonable provision for the area. It is not the worst case that can be imagined.

WCPSs need to be identified for each risk area in order to determine the operational resources (in terms of personnel, equipment and specialist skills) that are required for the initial fire service response to that area. How these resources are allocated within brigades and/or station grounds, is discussed further in a separate document and is dealt with within the GIS BRATS software (see Section 1.4).

The WCPS for special service risk areas should take in to account the relevant response time, response capability and rescue time detailed above.

The make-up of the resources required for the initial fire service response to WCPSs is not defined in this toolkit. Reference should be made to the Brigade Response Options Software (BROS) which contains a database of planning scenarios provided by the Central Fire Brigades Advisory Committee (CFBAC) covering a wide range of possible incidents and the activities likely to be required of the first attendance crew(s) to deal with each of them. Each scenario contains a list of the tasks likely to be performed to deal with the incident selected, and identifies the sequence in which they will be performed and the resources required in terms of crew, equipment and specialist skills. Note that this software, and the associated CFBAC database, is provided as a planning tool, and does not represent a 'standard' or 'approved' method of tackling the incident.

BROS interfaces with GIS BRATS in order to allow any of these CFBAC planning scenarios to be used as Worst Case Planning Scenarios (WCPS) for risk areas. BROS allows brigades to create their own database which may contain copied or edited CFBAC scenarios as well as new planning scenarios to reflect local requirements. BROS provides GIS BRATS with information on the resources, in terms of personnel, equipment and specialist skills, necessary to respond to each WCPS. GIS BRATS then assists brigades in determining the allocation of resources to stations.

3.1.5 Reviewing Performance Requirements For Fire and Emergency Cover

A review should be completed of whether it is possible to achieve these performance requirements without incurring a significant risk to the health and safety of personnel using equipment, procedures and skills possessed for the purposes of fire fighting. The current response capability (for existing fire cover) is ideally assessed in two stages.

Firstly, the achievement of initial response times should be assessed, i.e. are Category A incidents attended within 10 minutes of notification? Ideally, actual response times should be examined. However, where this is not possible, a computer prediction of response times using GIS BRATS should suffice. This would comprise plotting category A incidents on a map along with a plot of the area(s) that can be attended within 10 minutes by existing fire cover. As part of this assessment, it is necessary to confine the analysis to those units which have a capability to assist in the extrication of casualties, i.e. units which do not have the resources to assist in the extrication of (say) an RTA casualty cannot be included.

Ideally, the latter response time review would be augmented by an examination of the percentage of casualties extricated in the target time without incurring additional injury due to the extrication procedure, i.e. are 50%, 75%, 90% or 100% of casualties extricated safely within 30 minutes? An analysis of “stop times” may suffice, in the interim, as a measure of extrication times until a more accurate measure is available.

The number of incidents included in the assessment should be large enough to provide a statistically reliable measure. Preferably the review should be based on 50 or more incidents. This sample may be drawn from:

- the past 3 to 5 years experience within a single risk area in which over 50 incidents have occurred, or
- a number of risk areas, even a whole division of a brigade, where there are insufficient incidents within any one part of the brigade to provide a reliable measure of performance.

Care should be taken to avoid overlooking sub-standard performance in certain localities by merging the results of a group of areas. Thus, as far as is reasonable, the performance of different parts of a fire authority area should be evaluated separately, especially where attendance times, staffing arrangements and resources differ.

3.2 Developing Fire and Emergency Cover and Prevention Options

Upon concluding whether the recommended fire and emergency cover performance requirements are being met, consideration should be given to the need to modify fire and emergency cover levels, including response times, extrication performance and incident prevention. As part of this, consideration should be given to:

1. increasing travel speeds by, for example, improved traffic management schemes such as traffic control outside of stations and “green light” systems,
2. strategic positioning of emergency appliances during peak incident times at accident blackspots,
3. having a mix of first response units and “normal” response units,
4. shared resources with (for example) ambulance services, especially initial response units,
5. varying level of cover between day-night, weekday Vs weekend to match variation in travel speeds and incident frequencies, i.e. less dense cover during periods when travel speeds are faster.

Options 1 and 2 should be awarded particular attention when incidents are occurring just outside of the 10 minute response time of existing fire and emergency cover, whilst options 3 and 4 should be awarded special consideration for sparsely populated areas.

However, fire and emergency cover is not a substitute for proper risk management. Where a very high number of incidents occur in a certain locality the possibility of preventing incidents should be raised with the pertinent authorities, such as the Highways Agency/Local Authority for RTAs, Health and Safety Executive for workplace incidents and Heritage Department for incidents at tourist attractions and so on.

Particular attention should be awarded to incident prevention in the following circumstances:

- where the achievement of the recommended fire and emergency cover performance requirements incurs financial or operational difficulties, such as providing fire and emergency cover for road accidents in remote rural areas,
- there is a significant number of incidents occurring just outside of the 10 minute response time of existing fire and emergency cover, e.g. within 12 or 13 minutes, and;
- where attendance to Category C incidents creates a significant risk of fire and emergency cover being unavailable for more serious fire and rescue incidents. In this case particular attention should be awarded to prevention of, or even non-attendance to, such incidents.

3.3 Evaluating the Cost-effectiveness of Proposals

In some cases it may be concluded that the current level or type of fire and emergency cover is insufficient to achieve the performance requirements and that a different level of fire and emergency cover is required. Guidance on the assessment of cost-effectiveness is provided in the Costings toolkit (see Section 1.4.1). This will assist in informing decisions where the cost and practicality of fire and emergency cover is of concern.

4 STAGE 3 : MONITOR AND REVIEW SPECIAL SERVICES RISK

The ultimate goal is to reduce the loss of life and severity of injuries as low as reasonably practicable (ALARP). Therefore, the response performance should be monitored over time to ascertain whether the disposition and performance of fire and emergency cover is adequate. Performance for the more common incidents, such as road traffic accidents and people trapped in machinery, can be assessed at two levels, namely:

1. are the recommended fire and emergency cover performance requirements being achieved, with extrications completed in accordance with current best practice?
2. the benchmarking of survival rates and severity of injuries.

The achievement of response times and extrication rates can be assessed by a historical review of performance for either individual risk areas or groups of risk areas. Ideally this would be updated annually.

A check can be made on performance standards by benchmarking the survival rates of seriously injured casualties in a particular area of concern with those reported elsewhere. Care must be taken to avoid confounding factors, such as variations in traffic speeds, when benchmarking performance. This can be achieved by comparing survival rates for persons with similar categories of injury. For example, latest research indicates that about 80 to 90% of severely injured casualties survive. Severe injury is indicated by the Injury Severity Score (ISS) or Abbreviated Injury Score awarded patients by medical staff. An ISS score of 16 or more is equivalent to a major trauma. Similarly, the percentage of severely injured persons who suffer irreversible disabling injuries, such as complete spinal cord severance, can be compared. This requires information to be obtained from health services, particularly accident and emergency departments, about the Injury Severity Scores assigned to injured persons at the incident scene, and the survival rate of casualties and the severity of their injuries.

It is likely that a review of performance at less common incidents, such as HAZCHEM incidents, will depend on qualitative assessment, due to the insufficient number of incidents to provide a statistically reliable measure.

Where performance is unsatisfactory, a further review should be carried out to discern the reasons for this, such as:

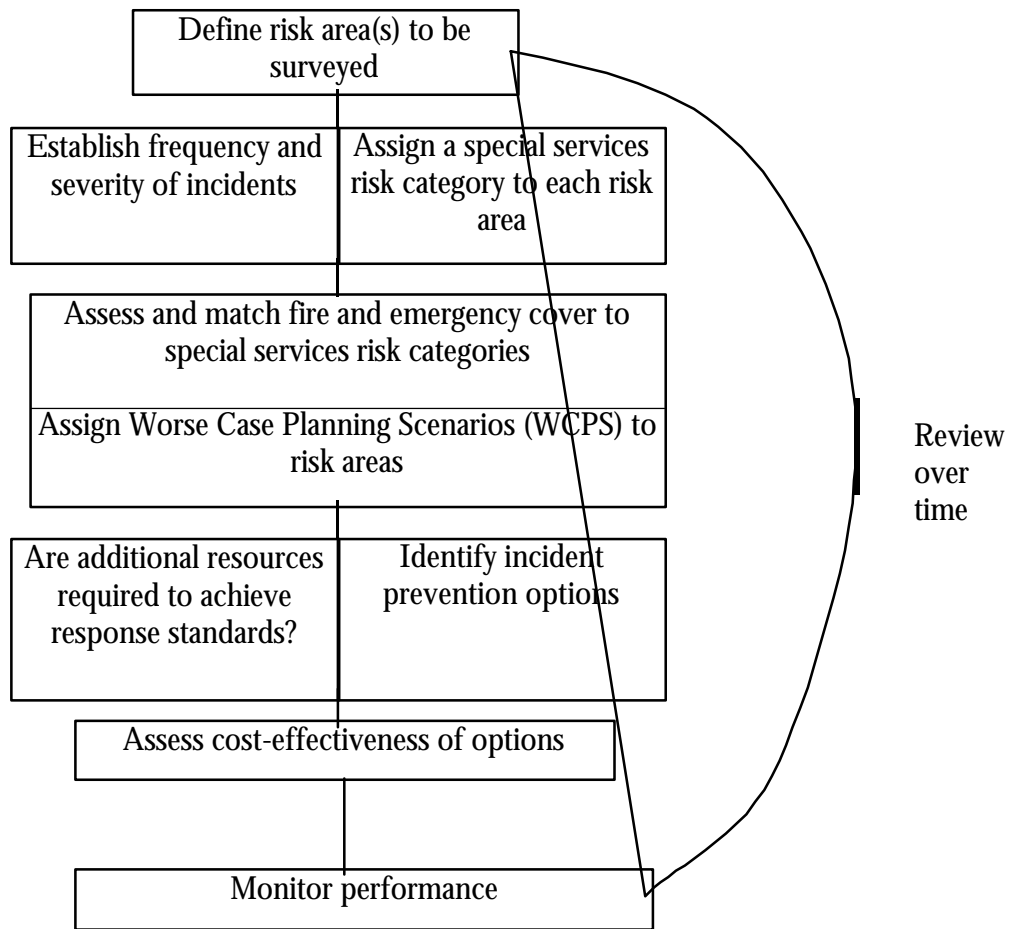
- inadequate training and equipment,
- mismatch between disposition of fire and emergency cover and location of incidents.

The conclusions of this review should be used to identify further improvements in services, in line with earlier guidelines, thereby maintaining satisfactory standards of service.

Table 1 : Identification and frequency of imminent life risk special services

Risk area (s)	Numbers of risk areas (c):		
	Historical frequency per year		
Type of Special Services	No of incidents (a)	No of years (b)	Average p.a. = a/(bxc)
Category A - imminent life risk			
Injured persons trapped in RTAs.			
Injured persons trapped in machinery.			
Persons trapped in collapsed structures.			
Seriously ill person trapped in lift.			
Persons caught in flood waters.			
Lock-out with child under 6 or seriously ill person left unattended inside.			
Persons trapped (or incapacitated) in toxic/noxious, oxygen deficient spaces.			
Injured persons trapped at height (over 3m) unable to escape unaided.			
HAZCHEM incidents where persons were exposed to or were in immediate vicinity of harmful substance.			
Other - locally identified category A incidents.			
SUB-TOTAL : Category A - imminent life risk			
Category B - serious life risk			
Persons trapped at height unable to escape unaided.			
Other vulnerable persons lockouts/lift rescues, including elderly, children over 6, women in high crime areas and disabled.			
Rescue of persons at imminent risk of drowning or injury due to presence in severely flooded area.			
Persons at risk of entrapment/injury due to structural damage/falling objects caused by explosion or storm.			
RTAs with uninjured trapped person(s).			
SUB-TOTAL : Category B - serious life risk			
Category C - other special services			
HAZCHEM incidents in unoccupied areas.			
Making structures safe in inaccessible areas.			
Evacuation of persons in areas at risk of severe flooding.			
Other lift rescues (of non-vulnerable persons).			
Rescue of animals.			
Other lock-outs (of non-vulnerable persons).			
RTAs without any persons trapped.			
Other special services.			
SUB-TOTAL - Category C - other special services			

Figure 1 : Overview of special service risk assessment



Appendix A : Generic incident rates

Generic Road Traffic Accident rates

Information is given here for the purpose of predicting the number of road traffic accidents requiring fire service assistance to extricate casualties (Category A incidents) that may occur in a planned development for which historical data is not available.

The average rate of road traffic accidents (per kilometre of highway) which demand extrication of casualties is illustrated below:

- Motorways 0.12 per kilometre per year
- A roads 0.08 per kilometre per year
- Other roads 0.01 per kilometre per year

These rates could be used in the absence of data on the number of vehicles movements per year. However, the accident rate varies enormously according to traffic levels and ideally, the number of accidents should be predicted using the following per ¹vehicle kilometre rates:

- Motorways 0.53 per 100 million vehicle kilometres
- Other roads 2 per 100 million vehicle kilometres

The number of accidents (requiring extrication) per year can be estimated using the following formula:

$$= (\text{Number of vehicle kms}/100 \text{ million}) \times \text{rate per } 100 \text{ million vehicle kms}$$

For example, with 50 million vehicle kilometres driven per year in a given (non-motorway) area the rate would be:

$$(50 \text{ million vehicle km} / 100 \text{ million}) \times 2 \text{ per } 100 \text{ million} = 1 \text{ incident per annum.}$$

In order to complete this calculation, information on the predicted number of vehicle kilometres driven per year is required. This should be sourced from the local area planning or highways agencies.

If data is only available on the number of vehicle movements per year in the area, an approximation of the number of vehicle kilometres can be given by multiplying the number of movements by the diameter of the surveyed area. For example, with 1 million movements per year in an area of 50km diameter, there would be about 50 million vehicle kilometres per year.

¹This is the number of kilometres driven per annum by vehicles in the surveyed area.

Other rescue generic rates

It is reasonable to assume that there will be a 1:1 ratio of RTA releases to releases of people from other emergency situations without fire in areas with large expanses of potentially hazardous activities, such as industrial estates. This excludes effecting entry to premises and lift rescues.

Note: this is a preliminary piece of guidance subject to change upon receipt of analysis of further information.

Appendix B : Standard report proforma

STANDARD REPORTING FORMAT

Area:	Risk category:	Category A incidents p.a.	Category B incidents p.a.
Target response time	% of incidents attended in target time:		
Target extrication time	% of casualties extricated in target time:		
Predominant category A incident types in area:			
Special resource needs:			
Recommendations:			