



HOME OFFICE

# State of the Art Review of the Procedures and Techniques Used in Fire Investigation

J A Milward

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STATE OF THE ART REVIEW OF THE PROCEDURES AND TECHNIQUES  
USED IN FIRE INVESTIGATION

J A Milward

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Home Office  
Scientific Research and Development Branch  
Horseferry House  
Dean Ryle Street  
LONDON SW1P 2AW

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# STATE OF THE ART REVIEW OF THE PROCEDURES AND TECHNIQUES USED IN FIRE INVESTIGATION

## MANAGEMENT SUMMARY

### 1 Introduction

This report reviews the procedures and techniques currently being used in fire investigation. The study was undertaken by the Scientific Research and Development Branch on behalf of G2 Division of the Home Office.

Concern has been expressed about the number of fires being classified as of doubtful or unknown origin. It is felt that many of these fires may be the result of arson and that improved post fire identification could act as a deterrent, leading to a reduction of arson.

However, before considering what can be done to improve the detection of arson, information is required on current knowledge, procedures and techniques. The aim of the study was therefore to gather this information and to suggest possible areas for further consideration.

### 2 Study method

Officers from the Fire, Police and Forensic Science Services were contacted to determine their roles in fire investigation, and a questionnaire was sent out to all fire brigades in the United Kingdom asking about current fire investigation procedures and policy. The training of the officers was also covered, and the course on fire investigation at the Fire Service College was attended.

A visit was made to Sweden to review the procedures and techniques in use in that country and information about fire investigation and arson detection in the United States was also gathered.

### 3 Current procedures

The fire officer in charge of an incident is requested by the Home Office to complete a fire report form giving various details about the fire, including the supposed cause. As soon as the fire officer has reason to suspect that the fire is the result of arson, he should contact the police. It is the responsibility of the police to investigate the (supposed) crime.

Two fire brigades have established full-time fire investigation teams. In other brigades, officers take on responsibility for fire investigation in addition to their other duties. Some fire brigades and police forces have set up liaison panels to improve co-operation between the services and to tackle the arson problem.

The Forensic Science Service is available to the police in cases of fires which are believed to be the result of arson to carry out scientific analyses of samples or to help examine the scene of the crime.

There appears to be scope for at least one officer to be involved with fire investigation full-time within each brigade. This officer would be responsible for all aspects of brigade work relating to fire investigation, including training, liaison and education. Some guidance from the Home Office on the structure and use of fire investigation teams would be beneficial if such teams are to become an established part of the brigade activities.

#### **4 Training**

The Fire Service College operates a one week training course on fire investigation which is offered to the more senior ranks within the Fire and Police Services. It is the responsibility of these officers to disseminate this information to other officers involved in fire investigation.

Aspects of fire investigation are covered in other courses but not in very much detail.

The amount of training given by the brigades varies greatly; most, however, have produced a fire investigation manual which is given to all officers who have responsibility for fire investigation.

It seems that the degree of training given across the brigades should be standardised, and more training should be given to those officers who have to complete a fire report form as well as those officers designated as fire investigation officers. In particular, some form of recognised qualification in fire investigation for which fire officers could study would be of benefit.

#### **5 Techniques**

The techniques used by fire officers in determining the cause of a fire do not vary greatly between brigades. The stages of locating the seat of the fire and excavating the debris around the seat are followed by all officers.

Police officers are more involved with the taking of samples, recording of evidence, and interviewing witnesses than with determining the cause of the fire.

The forensic scientists are usually concerned with analysing samples to test for the presence (and type) of an accelerant.

The fire officer investigating an incident can only request the help of the Forensic Science Service through the police in the case of a (suspected) arson fire. Some fire officers felt that the Fire Service should have such a scientific facility available to them for all fires.

#### **6 Fire investigation in Other Countries**

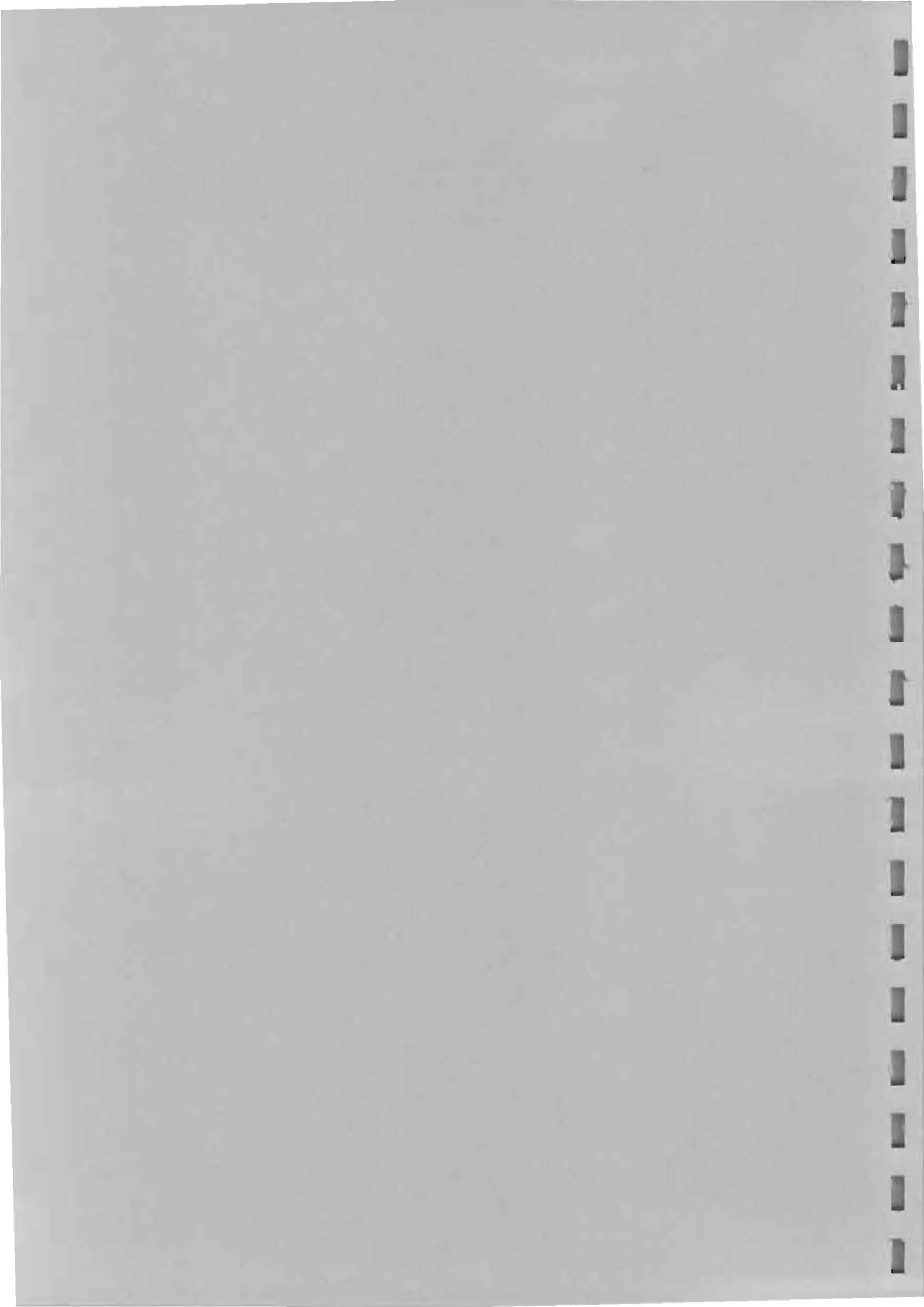
It appears that the actual techniques used in fire investigation in other countries are comparable to those used in the United Kingdom. However, the people responsible and the procedures followed differ.

In Sweden, where there is a particularly high incidence of arson, the police are responsible for investigating the cause of all fires. The Fire Service are relied upon for their expertise in fire behaviour



and fire spread, but are not expected to be involved with fire investigation.

There are a number of special projects relating to arson which are currently being undertaken in Sweden and which may be of interest to the UK. These are not concerned with improving investigation techniques but rather with the prevention of arson. A great deal of emphasis is being placed on public education about arson, and many of the approaches being used have been adopted from the United States.



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## 1 INTRODUCTION

### 1.1 The Study

Information on the cause of certain fires attended by the Fire Service is collated by the Home Office. The cause of the fire may be classified by the fire brigade as accidental, deliberate, doubtful (where arson is suspected but cannot be proven) or unknown.

Concern has been expressed recently about the number of fires that are being classified as of doubtful or unknown origin. Many of these fires may be the result of arson, and Fire and Emergency Planning Department believes that improved post fire identification could act as a deterrent, leading to a reduction of arson in the long term.

This study was commissioned by G2 Department of the Home Office, who stated in their problem description that 'before considering what, if anything, can be done to improve the detection of arson, detailed information is required on current knowledge, procedures and techniques'. The objective of the study was therefore to provide a review of fire investigation in the United Kingdom and world-wide. This review does not aim to provide a guide for fire investigators, though it will identify some of the points to consider. A comprehensive guide to fire investigation is given by Cooke and Ide<sup>1</sup>.

This review concentrates on fires in occupied buildings, although statistics are collected on fires in ships and in some other cases.

### 1.2 Background

The reasons for investigating the cause of a fire can be summarised as:

- to determine whether the fire was due to some dangerous industrial process or operation, to allow authority to devise safety measures or precautions to prevent a recurrence;
- to determine whether the fire was due to faulty storage, carelessness or neglect, to bring the cause to light thus obviating a recurrence;
- to determine whether the fire was maliciously started, to detect the offender and prevent repetition of the crime.

By virtue of Section One of the Criminal Damage Act 1971, it is an offence, chargeable as arson, for any person without lawful excuse to destroy or damage any property by fire whether belonging to himself or another

- a) intending to destroy or damage such property or being reckless as to whether such property would be destroyed;
- b) intending by the destruction or damage to endanger the life of another, or being reckless as to whether the life of another would be endangered.

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<sup>1</sup> Cooke and Ide, Principles of Fire Investigation, Institution of Fire Engineers (1985).

Arson is a complex problem in which social behaviour and crime prevention play a significant role. However, improved post fire identification of the crime may lead to a better understanding of the magnitude of the problem.

Arson is possibly the most difficult crime to solve; the fire must first be recognised as arson, and the offender must then be found. In either case, much of the available evidence has been destroyed either by the fire or by the fire-fighting operation.

The cause of a fire may be obvious. In many arson cases, accelerants such as petrol, diesel or paraffin are used and any traces remaining after the fire indicate that a crime has been committed (unless of course there is a reason for such substances to be present). The most difficult cases of arson to detect are where 'natural' substances (ie. those that are already on the premises) have been used.

Home Office circular 9/1985 outlines the responsibilities in fire investigation. The leading fireman, or officer in charge of the incident, is required to determine the supposed cause of the fire. Once a fire has been classified as arson - or even as suspicious - it is the responsibility of the police to investigate the (suspected) crime.

A symposium on arson was held recently in Brussels organised by the Conference of Fire Protection Associations in Europe and attended by members from 15 countries. A Working Group was set up to study the problem of arson, and to put forward recommendations to prevent and control fire-raising. The objectives are to promote improved investigation of fires, provide better guidance on how to protect property against arson and to increase public awareness. Most of this work is to be carried out in Belgium, France, Germany, the Netherlands, Sweden, Switzerland and the United Kingdom.

### 1.3 Statistics

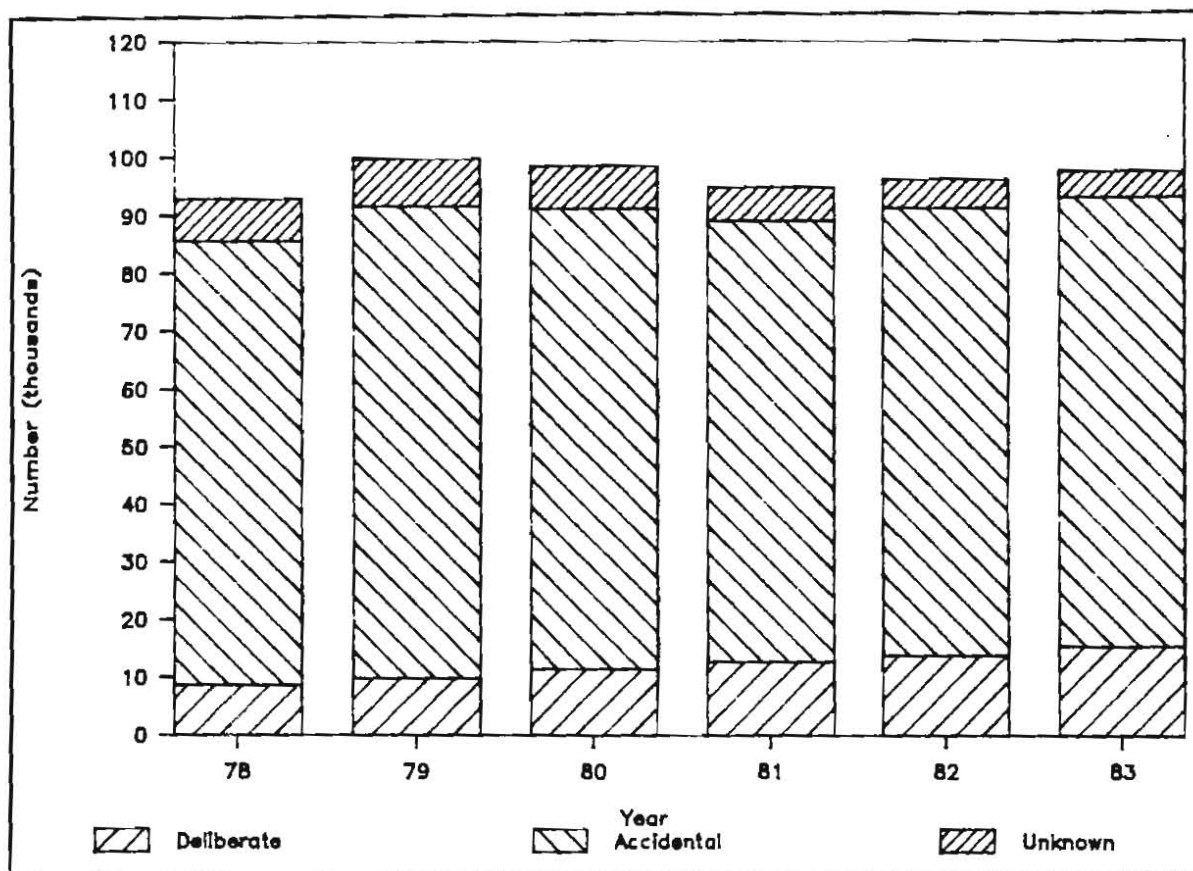
In 1978, a new fire reporting system was introduced which provided information not previously available. After attending certain fires (mainly those in occupied buildings), the officer in charge of the incident is requested to complete a form FDR1 (see Appendix A) giving details about the fire, including its supposed cause. The form is then sent to the Home Office where the United Kingdom Fire Statistics are collated.

The number of fires classified as being of deliberate ignition has been increasing in recent years. Figure 1.1 shows how the proportion of arson fires in occupied buildings in the United Kingdom has increased over recent years whilst the total number of fires has shown no such trend. (The figures have been obtained from Fire Statistics United Kingdom 1983<sup>1</sup>.)

The proportion of deliberate fires in occupied buildings increased from 9.4% in 1978 to 15.9% in 1983, whilst the proportion of fires of unknown cause fell over the same period. This latter phenomenon may be a result of improved fire investigation or simply a response to the policy of avoiding (wherever possible) classifying a fire as of unknown origin.

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1 Fire Statistics United Kingdom, Home Office (1983).



NB: Figures include estimates during periods of industrial action.

FIGURE 1.1 Causes of fire in occupied buildings 1978 - 1983

The publication "Fire Statistics United Kingdom" also gives an analysis of the causes of fires in each brigade. A resume of the figures giving the percentage of fires of deliberate and unknown origin for each brigade is shown in Table 1.1. It can be seen that within the brigade areas, the proportions range from 5.9% (Dyfed, Powys and Dumfries and Galloway) to 26.9% (Merseyside) for deliberate fires and from 0.7% (Central) to 15.8% (Northern Ireland) for fires of unknown origin. The reasons for this variation are not obvious. The proportions do not appear to be related to the size of the brigade or to the number of fires attended. However they might be related to the different policies of the brigades some of whom may be more committed to fire investigations and determining the actual cause of a fire.

#### 1.4 Literature

A great deal has been written about arson - both books and articles in journals. The topics covered include motives for arson, the psychology of an arsonist, and guides to fire investigation, together with information on specific arson fires such as incendiarism and vandalism in schools. It has not been possible to review all these books or articles, though many are available from the Fire Protection Association, the Fire Service College or the Fire Research Station. A list of some of the literature available is provided in the Bibliography.

BRIGADE	DELIBERATE	UNKNOWN
Avon	12.9	6.5
Bedfordshire	13.5	8.1
Berkshire	10.7	8.6
Buckinghamshire	13.7	4.5
Cambridgeshire	13.6	1.8
Cheshire	12.4	4.2
Cleveland	15.0	2.8
Cornwall	6.1	5.7
Cumbria	8.4	7.5
Derbyshire	12.8	5.6
Devon	10.1	6.8
Dorset	7.7	7.7
Durham	13.2	6.1
East Sussex	11.2	3.9
Essex	15.2	3.3
Gloucestershire	7.1	5.9
Hampshire	12.2	6.0
Hereford and Worcester	10.5	4.1
Hertfordshire	12.7	4.9
Humberside	16.3	3.1
Isle of Wight	20.8	5.5
Kent	15.3	6.7
Lancashire	11.3	2.8
Leicestershire	14.1	1.8
Lincolnshire	9.1	3.6
Norfolk	8.5	5.3
North Yorkshire	9.8	2.8
Northamptonshire	21.1	5.3
Northumberland	10.2	7.6
Nottinghamshire	19.1	4.4
Oxfordshire	9.1	6.4
Shropshire	11.6	5.2
Somerset	6.3	7.6
Staffordshire	13.9	2.4
Suffolk	9.1	4.7
Surrey	15.7	3.3
Warwickshire	13.2	5.0
West Sussex	8.5	5.3
Wiltshire	8.4	5.4
Greater Manchester	17.5	1.5
Merseyside	26.9	2.6
South Yorkshire	10.7	2.7
Tyne and Wear	22.2	2.0
West Midlands	16.3	8.2
West Yorkshire	19.1	0.8
Greater London	18.1	7.0
Clywd	10.4	4.2
Dyfed	5.9	2.6
Gwent	11.5	2.8
Gwynedd	8.5	3.2
Mid Glamorgan	20.5	2.0
Powys	5.9	6.5
South Glamorgan	16.5	4.6
West Glamorgan	12.7	11.0
Northern Ireland	22.1	15.8
Strathclyde	22.6	2.3
Highlands and Islands	6.9	11.5
Grampian	7.7	0.9
Tayside	12.6	1.3
Lothian and Borders	22.9	1.7
Fife	10.9	1.5
Central	15.4	0.7
Dumfries and Galloway	5.9	5.5

TABLE 1.1 Percentage of fires of deliberate and unknown origin, by Brigade



## 1.5 Method of the Study

This study was concerned with fire investigation and the detection of arson. Although this involves the Fire, Police and Forensic Science Services, the main emphasis within the study was placed on the work of the Fire Service and the role that it plays in fire investigation.

A number of fire brigades were visited, though these tended to be brigades in which fire investigation teams had been established, or where liaison between the services was good. Police scenes of crime officers and scientists from the Forensic Science Service were also consulted.

As background to the work of the Fire Service, and as an introduction to fire investigation, a week was spent at the Fire Service College as a guest on the fire investigation course (see Appendix D). This also gave an opportunity to discuss the problems of fire investigation with officers from a large number of brigades, as well as with the guest speakers.

In order to gain insight into the various attitudes on fire investigation, a questionnaire (a copy of which is attached at Appendix C) was sent out to all brigades requesting details such as information about their fire investigation policy, the officers involved in fire investigation and the training given to fire officers. This survey has been analysed, and is commented upon in several places within the report. A summary of the responses to the questionnaire is provided in Appendix B.

In order to obtain some information about what is happening in fire investigation in other countries, a visit to Sweden was arranged and discussions were held with various organisations involved in fire investigation, fire prevention and arson prevention. Sweden has a particularly high incidence of cases of arson and currently is pursuing a number of projects aimed at preventing arson.

As far as possible, information about fire investigation in the United States has also been incorporated into this review. This information was obtained from journals, magazines and from contacts in the United States. Because of all the available information, it was not felt necessary to visit the USA to view the current trends at first-hand.

## 1.6 Guide to the Report

Section 2 of this report gives a brief indication of the arson problem: the reasons for arson and the most common targets. Section 3 gives an outline of the various organisations involved in fire investigation and arson prevention and the role that they play, whilst section 4 expands on the role of the fire investigation teams in the Fire Service. Section 5 describes the training given to the officers in the various services, and comments upon ways in which this could be improved. Section 6 gives a brief introduction to the techniques used in fire investigation and the equipment available. Some of the problems involved in fire investigation which are to some extent outside the control of the Police and Fire Services are highlighted in section 7. Section 8 gives brief details of the activities being undertaken in Sweden. Section 9 lists a number of recommendations that could be further developed, and section 10 summarises the conclusions reached during the course of the study.



## 2 ARSON : THE PROBLEM

### 2.1 Reasons for Arson

There are two main categories of arson fires; (i) motiveless attacks, and (ii) where some gain can be defined.

#### 2.1.1 Arson without a Motive

The vast majority of fires that are started deliberately without any apparent motive are the result of vandalism. Certain targets are prone to vandalism by fire, notably schools, places of public entertainment, hotels, restaurants, clubs and pubs, the construction industry as well as urban areas where other forms of vandalism are high.

Alternative examples of seemingly motiveless arson fires are those where the fires have been started by a pyromaniac. This can be suspected where a number of fires are started by the same method, similar properties in different areas are fired, or the same person is seen at, or connected with, more than one fire.

#### 2.1.2 Arson with a Motive

Where a fire has been deliberately started, there may be a motive, and an expected gain of some sort. This can be financial (eg. where a business property is burnt to raise money from the insurance); emotional (eg. where the arsonist has a grudge or a grievance against the owner of the property); political (eg. as acts of terrorism); or as a cover-up of some other crime that has been committed. In such cases, much evidence can be gained from careful observation of witnesses and suspects, close examination of comments or statements made, and an analysis of the situation of the parties involved. This aspect of the investigation is usually left to the police, who have experience in criminal investigations. However, the police are not formally involved until the fire has been classified as deliberate or possibly deliberate, so many fire officers are being encouraged to consider this aspect when classifying the fire.

### 2.2 Targets of Arson

In 1983 almost two-thirds of all fires were in dwellings. However, only one-third of deliberate fires occurred in dwellings, together with a similar proportion of fires of unknown origins (table 2.1). It is possible to calculate the number of fires that would be expected in each category if the cause of the fire was independent of its location (ie. the proportion of fires of a certain cause is constant across locations). When this is done (figures shown in brackets in table 2.1) it can be seen that there are a number of discrepancies between the number of fires expected in each category and the number actually occurring.

In the case of fires in dwellings, one would expect nearly two-thirds of all deliberate fires and fires of unknown origins to be in dwellings. This is not the case. The reason for this is that dwellings are not common targets of arson, but they are places where accidental fires are likely to occur.

The number of deliberate fires in schools is three times more than expected, due to the fact that schools are frequently targets of

	Dwellings	Garages Sheds	Industrial premises	Schools	Shops	Hotel/Pub Places of ents.	Other
Deliberate/ poss. delib.	5654 (9122)	1906 (1066)	1786 (1722)	926 ( 293)	1124 ( 699)	1199 ( 833)	2891 (1752)
Accidental	50099 (45662)	4020 (5337)	8120 (8618)	837 (1468)	3033 (3498)	3843 (4178)	7569 (8768)
Unknown	1671 (2641)	786 ( 309)	922 ( 498)	83 ( 85)	242 ( 202)	202 ( 241)	567 ( 507)

**TABLE 2.1** Actual (expected) numbers of fires by cause and location in 1983

vandalism. Similarly, shops, hotels, pubs and places of entertainment are prone to vandalism. The relatively high level of fires of unknown origin in private garages and sheds and industrial premises may be due to a number of reasons. It may be due to the hazardous substances or processes being stored/undertaken there or, in the case of small garages and sheds, it could be a reflection of the fact that in some cases resources utilised on fire investigation cannot be justified. There could, however, be other reasons for these.

### 2.3 Reasons for Suspecting Arson

The most common targets of arson have been outlined above. However, this does not rule out arson being the cause of a fire in other locations. When investigating a fire, it is necessary to have an open mind as to the cause, and to consider all possibilities.

As has been previously stated, arson may be suspected where traces of accelerants such as petrol, paraffin or diesel have been found but none are normally present. The training material handed out by the Fire Service College also lists other cases where arson may be suspected, such as where

- a) several separate fires have occurred almost simultaneously without apparent, natural or normal causes;
- b) there is no possibility of spontaneous combustion;
- c) the fire has occurred in an improbable place;
- d) there is unusual behaviour of the fire, eg. it is particularly fierce in its early stages;
- e) substances, materials or devices are found that would not normally be used in the premises;
- f) unusual circumstances exist, such as fire doors being tied open;

- g) the same person is seen at more than one fire;
- h) a series of fires occur in the same premises in a fairly short space of time;
- i) the fire destroys records, accounts etc.;
- j) items have been removed prior to the fire.

The list outlined above is by no means exhaustive. There does not exist a exhaustive checklist of points to consider or questions to be answered when deciding whether or not a fire has been deliberately started. It is for this reason that fire investigation is such a complex task and why so many specialists are involved.

The remainder of this report examines the various approaches that have been adopted to overcome the problems of fire investigation and the detection of arson.



### 3 ORGANISATIONS INVOLVED IN FIRE INVESTIGATION

#### 3.1 The Fire Service

The Fire Service is required to protect people and property from fire. When attending an incident, the only statutory commitments of a fire officer are to rescue anyone in danger from the fire, to extinguish the fire as quickly as possible and prevent further damage, and to ensure that the fire is completely extinguished before leaving the scene. Whilst any part of the fire is still burning, the fire brigade has complete responsibility for the scene of the incident.

In addition, the officer in charge of the incident is requested by the Home Office to give certain details about the fire: the location; timings; construction of the building; extinction of the fire; damage and spread; supposed cause; life risk; and explosions and dangerous substances involved (see Appendix A).

Until recently, fire officers were taught that the best way to ensure that a fire has been completely extinguished was to remove all objects from the room(s) of the incident. This usually involved all the furniture being thrown outside or being moved around the building. Hence the task of assessing what happened prior to the fire, and the cause of the fire, was made very difficult. Nowadays, the fire officers are taught to try to leave as much as possible in the position in which it was found, or if anything needs to be moved, to note the original position. Fire officers are also encouraged to be more observant when attending a fire and to note anything that may be of interest, or of help in determining the cause of the fire.

In most cases, it is the responsibility of the officer in charge of the incident to determine the supposed cause of the fire, though some brigades have specialised fire investigation officers for this (see section 4 on Fire Investigation Teams). If the fire officer decides (or suspects) that the fire has been started deliberately, he should inform the police. Once this happens, it is the responsibility of the police to investigate the (suspected) crime.

#### 3.2 The Police Service

Once the police have been informed that the cause of the fire is deliberate or doubtful, the scenes of crime officer should be contacted to examine the scene, investigate the cause and collect samples. If the scenes of crime officer agrees that the fire has been deliberately started, he will contact the Criminal Investigation Department, who are responsible for detecting the offender. In most cases, the police scenes of crime officer will rely upon the experience of the fire officer in assessing the cause of the fire. However, in some cases, the two officers may disagree on the cause. When this happens, the police will act on the judgement of the scenes of crime officer. Some fire officers have suggested that, because arson is a difficult crime to solve, the police may not want to be involved in fires that are classified as doubtful; they may choose to interpret doubtful as meaning 'of uncertain origin', in which case no further police action is required.

Once a fire has been extinguished, it is the responsibility of the police to protect and preserve the scene if necessary. Their role in fire investigation is to investigate any crime that has been committed.

For continuity and preservation of evidence, the police scenes of crime officers are the people responsible for the collection of samples and taking of photographs and fingerprints (where possible). It is the duty of the Police Criminal Investigation Department to question witnesses, interview suspects and take statements about the incident (including comments from the fire officers present). To some extent, this is a duplication of effort, since the fire officers may already have questioned witnesses with respect to the duration of the fire, where the fire was first seen and any unusual circumstances surrounding the fire, in order to aid the fire-fighting operation and determination of the cause of the fire. Some officers (both fire and police) have commented that the public are more willing to talk to the fire brigade than to the police; and in any event, are more likely to give the truth when questioned at the scene rather than when asked about the fire after they have had time to ponder the effects of their actions.

### 3.3 The Forensic Science Service

Any samples that are taken by the scenes of crime officer are sent for analysis to the Forensic Science Service, who provide a scientific back-up service to the police. Should the scenes of crime officer decide that he is unable to determine the cause of a fire, or interpret the evidence available, he may call upon the expertise of the forensic science officer, who, depending upon the incident and resources available, may then attend the scene to offer advice and assistance. It is only in a small proportion of incidents that this is likely to occur; mainly for large fires, fires of special interest, or in particularly difficult cases.

The forensic scientists are all qualified scientists, usually with a good honours degrees in their chosen speciality. However, they tend to have very little fireground experience, and only a small proportion of their work is the analysis of fire debris, so there is little opportunity to build up the necessary expertise in the area. As a result of this, some fire officers are often sceptical about any involvement of the Forensic Science Service.

### 3.4 Liaison between the Services

The Home Office Fire and Emergency Planning Department has attempted to specify the procedures that should be followed, and the roles of the three services, in fire investigation. A circular (Fire Service Circular number 9/1985) issued in September 1985 on the investigation of fires of doubtful origin, updated and clarified advice previously given on this topic. This circular stated

"The Police Service is responsible for the prevention and detection of crime and for reporting to HM Coroner when fatality results from fire. Thus, the police are solely responsible for the direction and control of any criminal investigation into the cause of any fire whose origin is doubtful.

The Fire Service has an important role to perform at the scene of a fire, not merely because the senior fire brigade officer present has, as a consequence of section 30(3) of the Fire Services Act 1947, the sole charge for all operations for the extinction of the fire but also because fire officers will often be at the fireground before the police and thus in



a position to observe those phenomena which may be apparent in the early stages of a fire and which are characteristic of a fire which has been deliberately started.

The Forensic Science Service is the best qualified and best equipped public body for investigating suspected arson cases, for analysing fire debris, for interpreting scientific or technical findings and for giving expert evidence in court."

The circular also emphasised the need for "the closest liaison, co-operation and mutual assistance between the Police, Fire and Forensic Science Services" in order that a fire can be investigated and a successful criminal prosecution brought. It suggests that the establishment of a specialised fire investigation team within a brigade and liaison panels with the Police and Forensic Science Services would contribute greatly to identifying the cause of fires.

### **3.5 Private Investigators**

There are a number of private fire investigation firms operating in the United Kingdom. They are employed mainly by insurance companies in cases where the Fire, Police and Forensic Science Services are unable to provide sufficient resources to continue investigations and where the insurance company has reason to believe the fire may have been started deliberately. The investigators have access to fire officers, on payment of a fee, and can question them about the incident. They are also able (again for a fee) to obtain copies of reports written about the incident.

Private investigators are only involved in a small number of fires.

### **3.6 Other Organisations**

Other organisations tend not to be involved in the actual investigation of a fire and the determination of a cause. They do, however, have a role to play in the prevention of arson. As such, it may be useful to have representatives from these bodies on any liaison committees that are established. Insurance companies in particular have a large part to play in the prevention of arson. A closer scrutiny by the companies of claims with respect to fire losses might deter would-be arsonists.



## 4 CURRENT PROCEDURES

### 4.1 Fire Investigation Teams

Following the issue of Fire Service Circular No 9/1985, many brigades set up a 'fire investigation team'. In most cases, this consists of a number of officers who have taken on the responsibility for fire investigation on top of their other responsibilities. Two brigades, however, have set up teams whose sole task is fire investigation. These are London Fire Brigade and West Midlands Fire Service.

#### 4.1.1 The London Fire Brigade

The London Fire Brigade fire investigation team comprises five fire investigation units, one based in each of the divisions, although they will operate in any area of Greater London if needed. Each unit consists of a fire investigation van which is manned by pairs of officers (a station officer and a sub officer) who work the different watches. The officers are engaged wholly on fire investigation and related tasks, such as producing reports for the Brigade, or coroners reports, as well as some training of other fire officers in aspects of fire investigation.

A fire investigation unit is automatically called to any fire with 4 or more pumps; fires where there are fatalities; and fires in places of special interest. They may also be called out by the officer in charge of the incident if he feels that the unit would be of help in determining the cause of the fire. (The officer in charge of an incident is responsible for completing the form FDRI, including the probable cause.) The Brigade has a policy that fires may not be classified as of unknown cause unless the fire investigation team has been called out and they are unable to determine a cause. (This has lead to a reduction in the percentage of fires classified as unknown from almost 40% to about 6%.)

The fire investigation team has been seen as a success because of the large reduction in the proportion of fires classified as of unknown origin. The members of the team are able to concentrate entirely on fire investigation when at an incident, and can stay afterwards to continue the investigation. However, this may also lead to problems, since once a fire has been completely extinguished, the fire brigade have no legal right to be at the scene. If the fire is arson, or of doubtful origin (according to Fire Service terminology), it is the responsibility of the police to investigate the crime or suspected crime. The police may rely upon the fire investigation team to continue the investigation; alternatively, the police may ignore any work performed by the fire brigade and contact their own unit to undertake the investigation. This has reputedly led to incidents where a fire has been deliberately left alight (without causing any additional damage), to ensure that the fire brigade can complete an investigation, and it has also lead to some friction between the services.

The London Fire Brigade are fortunate in having the facilities of the London Scientific Services available to them. (This is a body, originally part of the GLC, who are available to organisations such as the Fire Service to provide scientific advice.) Only 2 other forces stated in the survey that they have scientific back-up facilities available.

The London Fire Brigade fire investigation team take samples from the scene and ensure that these are carefully collected, sealed, labelled and transported, and that a record is kept of the movement, so that court requirements are satisfied. These samples are taken to London Scientific Services for analysis. These facilities are available regardless of the supposed cause of the fire; indeed, it is often used in accidental fires to determine why, for example, a piece of equipment failed.

#### 4.1.2 The West Midlands Fire Service

The West Midlands fire investigation team consists of 5 officers who work full-time on fire investigation matters. There is also a back-up of 30 officers who are available on second call if necessary. The fire investigation team are called automatically to fires where there has been a fatality; fires of special interest; fires requiring 5 or more pumps; where the supposed cause is doubtful or unknown; and where the officer in charge requests the attendance of the team.

The reputation of the group has been growing in recent months. They have been involved in work for the Fire Research Station on fires involving aerosols, and have conducted an in-depth study into vehicle fires. The team is gradually building up expertise, but it has suffered in the past from a high turnover level.

The group believes that it works well because it is small enough to maintain the close ties with the other organisations and also with operational fire officers. This means that the officer in charge of an incident and the police dealing with the incident know the members of the team personally, which helps co-operation.

The fire investigation team does not have a scientific back-up available to them in cases other than arson or suspected arson. They have once or twice contacted the local Forensic Science Service laboratory and have asked for some work to be done. However, this must be on an unofficial basis, since the Forensic Science Service are a service to the police and can only become involved when a crime has occurred or is suspected and only upon the request of the police.

The fire investigation team has tried to encourage operational officers to call out the team if they need help in determining the cause of the fire. Although the brigade has not specified that a return of 'doubtful' should not be made unless the fire investigation team has been consulted, only 6 doubtful fires were not attended by the team in 1985. However, only the fire investigation team is allowed to classify a fire as of unknown cause.

The team has access to a computer, on which they keep records of all incidents that they attend. Only a very basic amount of information is kept on the computer - more detailed information is kept in manual records. The computer is used to perform some analysis of trends, and to link similar cases, but its full potential is not realised, due to lack of manpower and expertise.

#### 4.2 Part-time Fire Investigation Teams

Home Office circular 9/1985 encouraged brigades to establish fire investigation teams and liaison panels with the Police, Forensic Science Service and other interested organisations. In response to this, many brigades appointed a number of officers as fire investigation officers,

in addition to their other responsibilities. (Some brigades had already set-up such schemes following earlier debate, and a previous circular on the subject.) In the majority of cases, responsibility for fire investigation has fallen to fire prevention officers because of their knowledge of the behaviour of materials in fires etc.

In some cases, the additional responsibility has been allocated without it being asked for, or indeed wanted. This has meant that some officers do not have the interest or enthusiasm needed to perform the task as well as it could possibly be done. In order for fire investigation to be carried out effectively, it is vital that the officer has an interest in the work, otherwise it tends to be given secondary importance, or is ignored completely.

The team that has been set-up in Suffolk is composed entirely of volunteer officers who take on the task of fire investigation in addition to other responsibilities, often performing their fire investigation related duties in their own time. Although this has worked well in the past, it can be seen that this is unlikely to continue forever: the officers are unlikely to give up a large part of their time without getting paid for it.

The variety of officers nominated as fire investigation officers across the brigades reflects the different attitudes towards fire investigation. The teams range from all officers likely to be in charge of incidents to teams composed entirely of fire prevention officers. It would seem that more guidance and structure on fire investigation teams needs to be given to the Fire Service by the Home Office, in order that there is a standard level of fire investigation across the brigades.

#### **4.3 Fires attended by the Fire Investigation Team**

In the questionnaire, the brigades were asked to specify the criteria for which the fire investigation team was automatically sent to the incident. Many brigades, however, do not distinguish between operational fire officers and the team; ie. many of those officers attending a fire as part of the fire-fighting crew are also members of the fire investigation team. Comparisons cannot therefore be made between the brigades in this respect.

Where brigades have specified criteria for the attendance of the fire investigation team these are usually a subset of the following:

- when 4/5/6 (or more) pumps are used;
- when a fatality occurs;
- when the fire occurs at a place of special interest;
- when the officer in charge is unable to determine a cause;
- when the officer in charge feels that the fire is arson, but cannot prove it (ie. it is doubtful);
- when the officer in charge feels unable to perform fire investigation in addition to fire-fighting operations;
- when otherwise requested by the officer in charge.

The proportion of fires attended by the fire investigation team of each brigade varies between 0.5% in Shropshire and Somerset to 14% in South Yorkshire, 15% in Staffordshire and is as high as 40% in the Isle of Wight (though it should be noted that in this case, the fire investigation officers also have fire prevention and operational commitments). In a number of brigades, details of this sort are not recorded; the concept of an fire investigation team is so nebulous, that it would be meaningless to do so.

#### 4.4 Comments

Although most brigades would be unable to justify having a full-time fire investigation team, it would appear that there is scope for at least one full-time fire investigation officer within each brigade. This (these) officer(s) should be responsible for all major investigations within the brigade, as well as the training and co-ordination of other fire investigation officers and the training of the fire crews in fire investigation and aspects of fire-fighting related to fire investigation. Officers in charge of incidents should be encouraged not to return an unknown or doubtful cause without consulting the fire investigation team or officer.

The officer(s) should also liaise with the Police and Forensic Science Services and other interested organisations. Publicity and public education about arson are other areas in which the officer(s) could be expected to take responsibility.

In addition to having at least one full-time officer, each brigade could also have a number of officers delegated as a fire investigation team. These officers could take on the responsibility of fire investigation in addition to other tasks, such as operational duties or fire prevention. The fire investigation team would be available to the officer in charge of an incident when he felt that he was unable to determine the cause of the fire, or when he felt that he was unable to carry out a thorough investigation. In turn, the fire investigation team should be able to call upon the full-time fire investigation officer should more help be required.

## 5 TRAINING

### 5.1 Courses at the Fire Service College

#### 5.1.1 Fire Investigation Course

The Fire Service College runs a one week course on fire investigation which is open to fire officers of ADO rank and above, as well as to police officers of equivalent rank. As part of this study, the course held in March 1986 was attended. Most of the comments about this course were obtained from the officers attending that course; others were obtained from fire officers who had been on previous courses.

The course covers aspects of fire investigation ranging from the basic physics and chemistry of fire to a session on the various kinds of incendiary device. Appendix D gives the course programme as it was in March 1986. The programme is continually being amended to incorporate changes and improvements suggested by course members, and to keep the course content up-to-date.

The course begins with a review of the chemistry and physics of fire. Much of this work is covered in other courses held at the College. Although it gives a gentle introduction into fire investigation, most of the officers attending the course thought that it was an unnecessary item to fit into this course. In this and in some of the other sessions, the course members felt that they were being told about things that they already knew. Most of the officers on the course had spent at least 10 years in the service, and had gained much practical experience of fires as well as having covered the material in other courses.

By comparison, the session on electricity as a cause of fire was considered to be too short and too theoretical. This is an area which could be expanded by contacting the Electricity Board to give lectures, and if further research is undertaken in the area (see section 6.6) this should certainly be covered.

On the whole, most of the officers on the course felt that it had too high a theoretical basis and should have been much more practical. The sessions spent with the forensic science expert examining fire debris were very well received, and the officers felt that this was the part of the course from which they had gained the most. There are problems with making the course more practical, though there may be scope for extending it slightly in this area. There were some suggestions that the course should include a session of a practical 'hands-on' investigation of a fire. Although it is likely that this would be of great benefit to the course members, the practicalities of organising it may rule out the possibility. The College would have to rely heavily upon officers attending the course to bring samples of debris etc., and it might take some time before a sufficiently large collection had been obtained.

#### 5.1.2 Other Fire Service College Courses

The Fire Service College runs a number of other courses which incorporate one or more sessions on fire investigation. These include the Junior Officers' course, the Junior Officers' Advancement course, fire prevention courses, and a course on causes of fire. In general, the topic is not covered in much detail. The main aspect of fire investigation covered in the junior officers' courses is the need to preserve the scene as much as possible, and if anything needs to be

moved, to note the original position. This is a change from past Fire Service policy, which was to suggest that the best way to ensure that the fire was extinguished was to remove everything from the room.

Other aspects that are discussed are:

- the reason for fire investigation;
- preservation of the fire scene during fire-fighting;
- observation of the fire itself (colour of flames, spread of smoke etc.)
- the importance of witnesses;
- common causes of fire (including vandalism);
- the role of the police;
- location of the seat of the fire and excavation of the fire scene;
- reasons to suspect arson.

(NB. Only a subset of these are discussed on each course.)

Many of the lectures are the same as those given on the fire investigation course, though the topic is not covered in such great detail.

## 5.2 **Brigade Training**

Almost all brigades rely solely upon the Fire Service College fire investigation course to train their fire investigation team. Very few brigades give these officers any other form of training. Where this does occur, it usually takes the form of revision seminars.

For officers not specifically classified as fire investigation officers, there is usually very little training given by the brigades. In general, any that is given takes the form of a number of lectures as part of another course or as seminars. These lectures and seminars are usually given by the brigade fire investigation officers.

Most brigades have developed their own fire investigation manual. These tend to be based heavily upon the notes handed out at the Fire Service College fire investigation course, and are available to all officers who may be responsible for determining the supposed cause of a fire.

## 5.3 **Training of Scenes of Crime Officers**

Before a police officer joins the scenes of crime squad, he must have spent some time on the beat or in another department. After a short time with the squad to become familiar with the work involved, the officer is sent on a three week training course. Only a small proportion of this course deals with the investigation of scenes of fire, since this is only a comparatively minor part of the work of a scenes of crime officer. (The estimate for the amount of time spent dealing with fire investigations ranged from 1% to 10%.)



The course covers details of photography, the taking of fingerprints and the collection of samples, which are relevant to any aspect of the work. However, some aspects of scenes of crime work are much more difficult at a fire scene. Many of the scenes of crime officers spoken to felt that the course did not give enough practical preparation for fire scene investigations.

The more senior scenes of crime officers can attend the Fire Service College course on fire investigation. Once again, however, it seems that this is aimed at the wrong people, since it is usually the lower ranks that attend incidents and perform the investigations. Those scenes of crime officers visited, commented that the best way of learning about fires and their development was to work closely with the Fire Service during an investigation. This can only happen where there is good co-operation and liaison between the services. (They also commented that they had been able to help the Fire Service by adding a different outlook on the scene; police officers may have a more investigative mind than fire officers, and they would be more aware of any criminal aspects.)

#### **5.4 Training of Forensic Science Service Officers**

All of the officers in the Forensic Science Service are qualified scientists in their own particular field. However, most of them have little practical experience of fires. As with the Police Service, only a small proportion of the work of the Forensic Science Service is dealing with fire investigations, and hence it can take a long time before the scientist has built up expertise in the area. Because of this lack of practical experience, fire officers are sometimes sceptical about the usefulness of a forensic scientist at the scene of an incident. In addition, the Forensic Science Service is often constrained by lack of manpower, and a scientist is unable to attend the scene of an incident until some hours later. This means that they lose the valuable experience (and evidence) that can be obtained whilst a fire is in progress.

The forensic scientists may attend the fire investigation course at the Fire Service College, but only a small number of them do.

#### **5.5 Training of Fire Investigators in the United States**

In the United States, before a fire officer can become a fire investigator, he must spend some time with the fire investigators gaining practical experience, and must have reached a satisfactory level in the National Fire Protection Association examination on fire investigation (the pass mark is 70%). The officer is then qualified as a fire investigator, and is recognised as such. The course is nationwide to ensure the same level of competence across the various states.

The examination consists of a three and a half hour written test during which time the candidate must answer 100 questions on topics such as

- penal law;
- the chemistry of fire;
- psychology of firesetters;

- interview techniques;
- arrest procedures;
- arson investigation techniques;
- preservation and care of evidence;
- building construction and fire prevention.

Topics such as arrest procedures and court rulings are covered because in many places in the States, the fire investigators also have powers of arrest.

## 5.6 Comments

### 5.6.1 Training

The fire investigation course currently run by the Fire Service College is aimed at the more senior levels within the Fire (and Police) Service. In general, these are not the people who will be at the incident and to whom the responsibility for determining the supposed cause falls. Hence, it seems that a fire investigation course should be established for the middle ranks of the service: the officers who will be in charge of incidents and who will be completing the FDR1 forms.

If possible, the course should aim to be very practical to give the officers the 'hands-on' experience that seems to be the best way of learning about fire investigations.

The course should also be available to scenes of crime officers and to forensic scientists who will be involved in fire investigation. This may also help to improve co-operation amongst the various groups involved in fire investigation.

There also appears to be scope for a national examination as in the United States for fire officers to obtain a recognised qualification in fire investigation. This may be organised by the Fire Service College, or by the Fire Protection Association. More work would have to be done on this, and a more definite structure given to it, should the idea be adopted.

### 5.6.2 Case Studies

Although there is a session allowed for case studies during the week of the fire investigation course at the Fire Service College, it seems that much more could be gained from case studies. Where possible, they should be chosen to illustrate the problems of fire investigation; any unusual cases and 'strange' causes of fire can be highlighted to complement the work carried out in the classroom. At present, however, the case studies do not seem to be well co-ordinated. The lecturers on the course rely upon course members to bring a case study with them to talk about. These appear very often to be brief resumes of an incident, without much regard to how the investigation was structured, or to the salient points learned during the investigation.

Some of the case studies, however, have been very good, and the Fire Service College staff could utilise these by building up a library of such cases for reference and also for use as training material. (A start has been made on this, though the College does rely upon the

brigades being able to provide the information.)

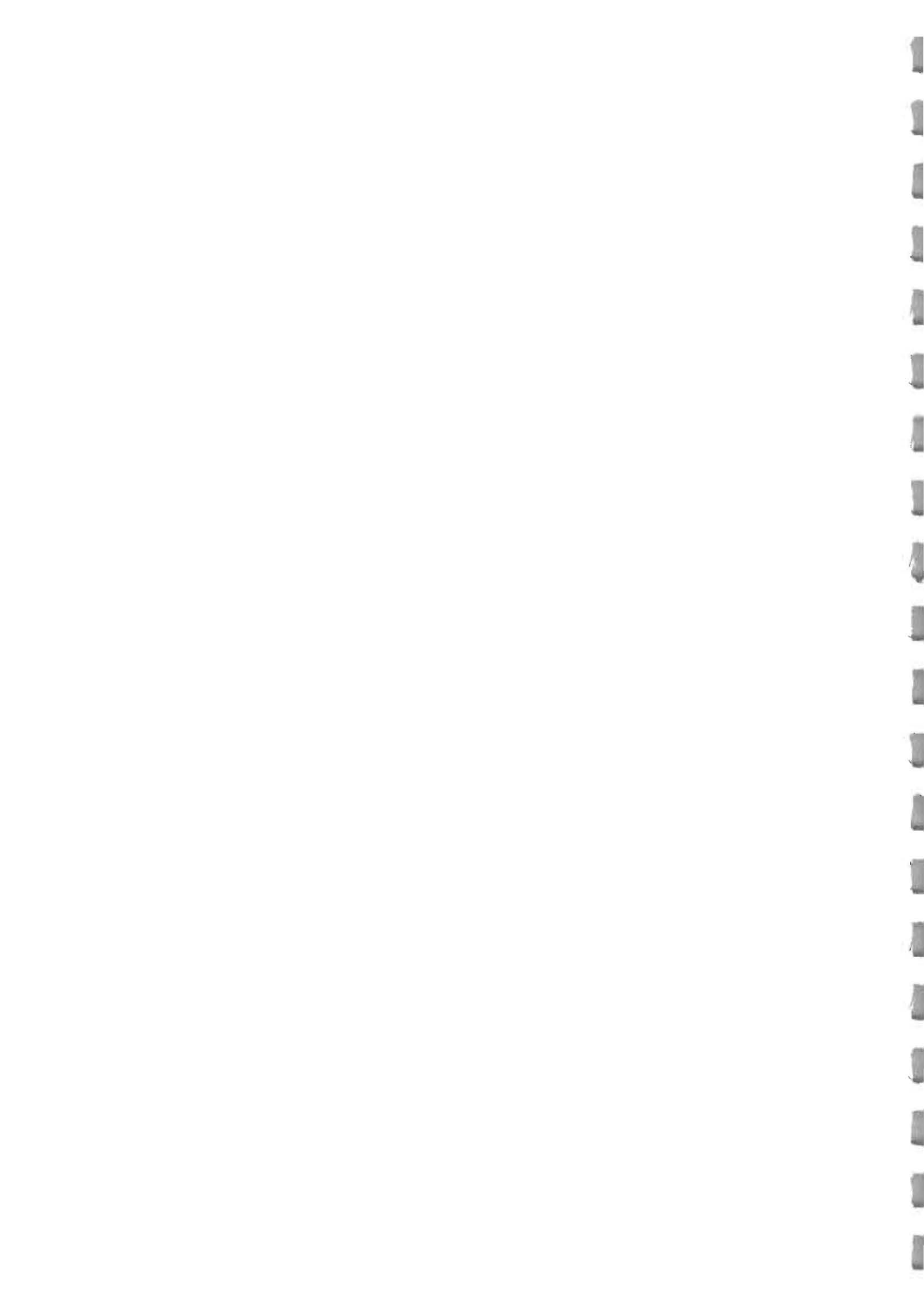
Where possible, full use should be made of photographs, slides and videos. Most brigades already use photographs to record the scene of an incident, and one or two are beginning to use videos of incidents (or reconstructions) as training aids.

### 5.6.3 Seminars and Discussions

At present, there is very little discussion about fire investigation between brigades or between the police forces. In general, this only occurs when officers attend the fire investigation course at the Fire Service College. Hence it may be that fire investigators are facing the same (or similar) problems in different parts of the country, and are having to spend time on problems which have been tackled elsewhere. The forensic science laboratories have regular inter-laboratory advisory committees on various topics, one of which is arson, where they discuss cases and new developments. Such a scheme could be of benefit to the fire and police officers involved in fire investigation.

The two main ways in which to achieve a better flow of information around the services are by means of seminars/conferences about particular aspects of the problem, and via a national (or regional) newsletter. These could be organised by the Home Office, the Fire Service College or by the Fire Protection Association, and would cover all aspects relating to fire investigation and arson detection.

The Swedish Fire Protection Association is currently developing a newsletter in conjunction with other Nordic countries. The United States International Association of Arson Investigators produces a regular newsletter on arson and associated topics. It would appear that something similar would be of benefit in the United Kingdom (perhaps as a section of one of the current publications?).



## 6 FIRE INVESTIGATION TECHNIQUES

### 6.1 Fire Brigade Investigations

When carrying out a fire investigation, it is necessary to have an open mind as to the cause of the fire. All the possible causes need to be considered and, where applicable, reasons for their rejection given.

In order to determine the cause of the fire, the first step the fire investigator should take is to locate the seat(s) of the fire. More than one seat of fire indicates that the fire is the result of arson. The most widely used indicators of the seat of fire are the area of greatest damage and the lowest point of burning. Since fire travels upwards, it is often the case that the lowest point of burning coincides with the seat of the fire. However, consideration should also be given to whether pieces of burning material could have fallen from above. Similarly, the area in which burning has been most sustained is not necessarily the same location as the seat of the fire as air flows and the flammability of materials etc. can affect the severity of the fire in places. However, these form good bases on which to start.

Having found the area in which the fire is thought to have originated, fire investigators should carefully remove the debris layer by layer, noting the findings at each stage. Each article should be examined and an assessment made of whether it had played any part in the outbreak of the fire. When considering equipment, the investigator should note whether the item was switched on or off, and should decide whether any damage was caused by the fire or whether it could have been the reason for the fire. In fires involving electrical equipment this is particularly important.

Apart from the excavation of the scene of the fire, there are a number of other indicators that fire officers are taught to consider which give additional information about the development of the fire and its spread. These are covered in the notes given to members on the fire investigation course at the Fire Service College and are also included in the fire investigation manuals of most brigades. They include:

- the type of deposits left on walls, ceilings, windows etc.;
- the glazing of the windows;
- the depth of char;
- the pattern of fire spread.

The notes also list a number of possible causes of ignition, together with the circumstances usually required to cause ignition. These are not strict rules, and as previously stated, each fire is different. However, they do form basic guidelines to follow.

The fire investigation techniques used appear to be consistent across the brigades and follow the stages outlined above. It is only in the amount of effort placed, and degree of care taken, in fire investigation that investigations differ.

One point that should be stressed to all officers who have to investigate fires, is that each fire is different: the materials involved; the structure of the premises; and the air circulation. There is no simple formula which can be applied to determine the origin of the

fire. The officer should consider each incident as a separate case, should consider the materials etc. present before the fire and should evaluate all possible causes before specifying the most probable cause.

## 6.2 Police Investigations

The scenes of crime officer's knowledge of fire investigation is usually limited only to basics. In most cases, the scenes of crime officer will rely upon the judgement of the fire officer in deciding the cause of the fire, and for indicating the samples and photographs to be taken.

The scenes of crime or Criminal Investigation Department officer will be more aware of the criminal aspects of the investigation, such as looking for evidence of a break-in or looking for fingerprints. The police officers are not so involved with determining the actual cause and behaviour of the fire; rather they are interested in deciding whether a crime has been committed and if so by whom. They tend to address their investigations to these areas.

## 6.3 Scientific Analyses

Only a small number of fire brigades have a scientific service to which they can refer in fire investigations. Hence, in fires that are not arson or suspected arson (doubtful), it is the responsibility of the fire brigade to perform any analysis or research into the reasons for the fire: its cause and behaviour. It would appear that the brigades could benefit greatly from having a scientific facility to which they could refer. It would probably not be possible for the Forensic Science Service to fulfil this role (or not at current manpower levels), but perhaps other organisations such as universities or could polytechnics provide such a service whenever necessary on a retainer type basis.

Most of the analyses carried out by the Forensic Science Service in fire investigations are to test the samples to see whether an accelerant has been used. The most commonly used item of equipment for this is the gas chromatograph (sometimes used in conjunction with the mass spectrometer). A small sample of the air surrounding the sample is pushed through a tube filled with an absorbent material which acts as a filter to the various components. Effectively, the different elements in the air sample pass through at different rates, and the readings taken can indicate what substance is present.

The other major area in which analysis is carried out is the testing of equipment to see whether this caused the fire or whether the damage was due to the fire itself. This usually involves electrical equipment.

Some work is also done on testing materials to see how they burn. This can often give an indication as to whether the fire spread was as could be expected given the furnishings etc., or whether an accelerant must have been used.

The Forensic Science Service also have available all the other techniques which are not specific to fire investigation. These include the analysis of blood, and the matching of fibres etc. found at the scene and on suspects. Most of these techniques are more commonly used to determine the offender; they are not often used to determine whether or not an offence has been committed.

#### 6.4 Criminal Investigations

In the past, the fire brigade have tended to concentrate on the evidence available at the scene of an incident to help them determine the supposed cause. Any sort of 'criminal investigation' was left to the police. Nowadays, however, they are encouraged to consider any other evidence available to them.

Before arriving at an incident, the fire officers are expected to note any unusual circumstances, or anything that may have delayed their arrival at the scene. These may be tactics used by an arsonist to allow more time for the fire to develop.

The fire officers are also asked to note the behaviour of the people at the scene, in particular that of the owner(s) of the premises. Fire officers are also asked to be aware of who is at the scene, and whether one person is at the scene of several incidents.

Much of this type of investigation is the work of the Police Criminal Investigation Department once a fire has been classified as (suspected) arson. However, the information gained from this activity may also be useful to fire officers in determining the supposed cause. Better liaison between the Police and the Fire Services would be of benefit here, as people may be more willing to talk to fire officers (or would be more open when talking to them). Comparisons between the statements obtained, may also help to highlight anomalies and thereby raise further points to consider.

#### 6.5 Equipment

In response to the question asking how much equipment the fire investigation team had available to them (fire investigation questionnaire - Appendix C) almost half the brigades replied that their team had no special equipment to take to an investigation. The most well equipped teams are those working full-time on fire investigations (ie. London and West Midlands). Appendix E lists the equipment that is carried by the London Fire Brigade fire investigation unit.

The amount of equipment carried by the remaining teams varied. Some only have a very basic set consisting of small trowels and spades together with notebooks, rulers, tape measures etc. for recording the scene. Other fire investigation teams carry almost a full set of equipment as listed in Appendix E. The items of equipment thought to be of most use are a trowel and a small brush for clearing away the debris.

Most fire investigation teams do not carry technical equipment to test for accelerants. Several officers commented that the most effective instrument to detect petrol or paraffin at an incident is the nose.

Many brigades have issued officers responsible for determining the cause of fires with a small aide-memoire, which lists the points to consider when carrying out an investigation. These are useful in that they ensure all the points which should be considered when conducting an investigation are not forgotten.

Police scenes of crime officers carry fingerprint lifting kits and sample collecting kits to incidents. They have no special equipment for use solely at fire incidents.

## 6.6 Areas for Research

At present very little is known about electrical fires: the causes and effects. There is scope for research to be undertaken in this area. Other topics on which further research might be undertaken is in the time of burning and in the location of the seat of the fire.

Where this research should be conducted is for consideration debate. It is unlikely that the Forensic Science Service could undertake such pure research without increasing its manpower; the Fire Research Station are currently involved in some research, and may be able to undertake further work; the Timber Research and Development Association may wish to be involved in the research on the burning characteristics (they have done some work on the depth of char and what this means in terms of length of burning); the Electricity Board may also be able to advise with electrical fires.



## 7 EXTERNAL FACTORS

There are several external factors completely separate from the actual fire investigation that can influence the attitude of the people involved in the investigation.

### 7.1 Detection Rates

Once a fire has been classified as arson, there remains the problem of finding the offender. In general, arson is a difficult crime to solve because evidence, such as fingerprints, is very likely to have been destroyed either by the fire or by the fire-fighting operations. The detection rates for arson are low; only about 25% of all fires classified as arson by the police are solved.

This may be the underlying reason for the discrepancies between Police and Fire Service statistics about arson. The Fire Service definition of 'doubtful' is that the officer in charge feels that the fire is arson, but cannot prove it. This can however, be interpreted by the police officer as meaning that the fire officer is uncertain about the cause, in which case the police officer will not classify the fire as arson. Since no offence has therefore been committed, no further work need be done by the police and the fire will not be included in their statistics.

This attitude is gradually dying out, but it has been the cause of a great deal of friction between the Fire and Police Services in the past.

The problem of low detection rates has to some extent been addressed in the United States. In many places, following arson fires, rewards are offered for information leading to the arrest of the offender. Large notices are displayed in the area surrounding the scene of the incident stating that the fire was arson, offering a sum of money for information, and giving a telephone number that people can ring in confidence.

This approach has also been tried recently in Sweden, following a spate of arson fires in the countryside around Halmstad. However, it is too early to say whether or not the experiment has been a success. It appears to work in the United States, though whether it is likely to work in Sweden (or in the United Kingdom) remains to be seen.

The fire investigators in the United States also have access to a database of details about known arsonists, and known arson fires. They are able to access this database to match details about fires, and to give clues to possible suspects. Many police forces in the United Kingdom keep similar records, and any convicted arsonists will have a Police National Computer record. However, these details are unlikely to be as extensive as those kept in the United States.

### 7.2 Convictions

Many of the fire and police officers spoken to felt that the sentences given to convicted arsonists were too lenient. It is thought that most people do not understand the severity of the crime. It appears that in cases where a number of offences have been committed in addition to arson, the stress is placed on the other offences rather than the arson offence. This may be because it is difficult to prove that the fire was

deliberately started, as opposed to it having been an accident.

Much of this problem might be overcome by better public education about arson and the severity of the crime.

### 7.3 Arson Prevention

Much of the effort of the joint European Working Group on arson is being expended on the prevention of arson. However, there seems to be relatively little work going on in this area in the United Kingdom. In 1978, a Working Party was set up to consider fires caused by vandalism. The recommendations of the group were mainly on ways of making the premises more secure to prevent a break-in, although the Working Party did also consider long term social measures designed to change the conditions which cause vandals to commit offences (not just arson).

The main thrust of any work being done on arson prevention is concerned with fire prevention. This seems to be evading the problem of arson itself, but concentrating on the effect of the problem. However, the reasons for arson are many and varied, so the best way forward appears to be to concentrate on damage reduction. This usually involves educating schools, businesses, industries and hospitals etc. about the problem.

Many officers are sceptical about the value of publicising the arson problem, feeling that it may increase rather than reduce the number of such fires. It is difficult to assess how true this actually is; literature on this aspect of the problem was not available during the study.

One of the projects in Sweden (see section 8) is on arson education. The fire department in Halmstad has cultivated links with the local newspaper, and several articles about the problem have been written, though the reaction of the public has not been assessed.

Some other work on arson prevention is being conducted in the United States. They have a much larger problem, particularly in the case of arson linked with insurance fraud. Buildings or businesses are often insured for much larger sums than they are actually worth, and are then deliberately set alight to obtain the money. A study has been made of the characteristics of such buildings/businesses, and an index of the factors which make a target prone to arson has been established. Other premises can then be judged according to these criteria, to assess how prone they may be to arson. The fire investigators then visit the owner(s) and intimate that should a fire occur, they are likely to suspect arson and will undertake a detailed investigation. They may also suggest other ways in which the owner(s) can overcome any problems (eg. government business loans or state grants, etc.).

## **8 FIRE INVESTIGATION IN SWEDEN**

### **8.1 An Overview**

Arson has been a problem in Sweden for some years. It was first perceived as such in 1978/79, but the authorities did not respond until some 1-2 years later. It is estimated that arson currently accounts for 30-35% of all fires in Sweden, though in the major cities, it is thought to be over 50%.

In 1980/81 the Swedish Fire Protection Association initiated projects to look at certain aspects of arson in 7 cities including Stockholm, Gavle, Boras, Gothenburg and Malmo. These projects cover areas such as statistics, police investigations, education, fire origin studies and technical developments.

The main difference between Sweden and the UK in fire investigation is that in Sweden the police investigate every fire. The fire brigade have a responsibility for rescue and emergency service, but they take little part in investigating the cause of the fire. They may, however, be asked their opinion on whether a fire could have developed in a certain way. (ie. they have experience in the behaviour of fires, but not in determining the cause.)

At the time the fire brigade is called to a fire, the police are also notified and a patrol car is sent to the scene. Once the fire has been extinguished, the police officer will seal off the area until officers from the 'technical squad' (approximately equivalent to scenes of crime officers) are able to attend to investigate the cause of the fire. This may be the next day, depending upon workload and the severity of the fire. The technical squad carry out an examination of the scene; the 'violent crimes squad' are responsible for interviewing witnesses and collating information (thus they are equivalent to CID officers).

The reason why the police investigate fires is partly tradition (they have always done so) but mainly because causing fire, even by accident or through carelessness (such as leaving an iron unattended), is a crime in Sweden. Thus in all cases except 'natural cause' fires, there is the possibility that someone will be prosecuted, and hence the police must be involved.

For each fire, the officer in charge of the incident is asked to assess the possible risk and spread of the fire, had the fire brigade not arrived. This assessment is used in court to give an indication of the seriousness of the crime.

### **8.2 The Work of the Swedish Fire Protection Association**

The Swedish Fire Protection Association is centred in Stockholm, but has 24 regional organisations. In the regions, the fire officers working for the Swedish Fire Protection Association do so as volunteers, although they are paid a small annual fee. The Swedish Fire Protection Association liaises with the fire brigades, police, prosecutors, and insurance companies, as well as with the social welfare organisations, with the aim of reducing the number and cost of fires.

The Swedish Fire Protection Association intends to produce a binder of all information on fire investigation, such as legislative acts, addresses of relevant organisations, etc. This is to be continuously

updated with the aid of the regional officers. They are also trying to start a newsletter about arson and fire investigation in conjunction with other Nordic countries, to spread information, facts and articles on fire investigation.

The Swedish Fire Protection Association is also involved in other aspects of fire and fire prevention. They have produced a series of public service adverts to make the public more aware of the danger of fire and the need to be observant about, for example, the position of fire exits. They undertake an annual survey to assess public awareness of fire prevention and the use of smoke detectors. (At present, about 50% of householders have smoke detectors.)

The Swedish Fire Protection Association also have a technical department which, where necessary, can provide assistance to the police and fire brigades in fire investigation.

### 8.3 Statistics

The Swedish fire brigades are organised on a municipal basis. Each city/town has its own brigade independent of any state organisation. The brigades are responsible to a local board (of directors) who control the finances and approve major changes. As a result, there is no national standard for the organisation of the brigades, and no standard method of collecting information or statistics about fires.

The cause of a fire can be classified as natural, carelessness (no motive), suspected arson (if there is no conviction), or arson.

The aim of one of the projects set up by the Swedish Fire Protection Association is to try to obtain a national data collection and information system about all fires attended by fire brigades. The project is being undertaken in Malmo in co-operation with officers in Stockholm and Gothenburg.

In Malmo, the fire brigade has a network of personal computers used mainly for word processing. This is now being used to build up a database of details from all fires attended by the brigade. A form has been designed, similar to the FDRI (Appendix A), which is to be completed by the officer in charge of the incident. This contains details of the timings, the probable cause (a 4 figure code), and problems encountered. This information is then entered into the database. The data is categorised by cause, day of the week, time of the incident etc. and this can be used to classify the fires. Identification of trends can be done, but this requires some manual interpretation of the information. However, little analysis of the statistics is being undertaken. At present, the aim is only to improve the national statistical information; once this has been done, it may be possible to analyse the data in more detail. The information is also to be used as a basis to highlight problem areas where fire prevention techniques could be improved.

It is hoped that eventually the form will be used by all brigades in Sweden for the collection of statistics, and that a more reliable statistical basis for assessing the problem will be obtained.

#### 8.4 Work of the Police Technical Squad

The technical squad are approximately equivalent to scenes of crime officers in the UK. They attend any scenes to collect evidence and, where possible, take fingerprints.

After spending some time on the beat, police officers in Sweden have the opportunity to opt for work in one of the more specialised departments, which includes working in the technical squad. If they move into the technical squad, they spend about a year working in the group to familiarise themselves with the work and the associated problems, before attending a training course. (This also helps to weed out the officers unlikely to make a career in the department, and thereby training costs are reduced.) During this time, they attend scenes of crimes and incidents with an experienced officer to obtain on the job training.

The training course for the technical officers is a national course, which all officers who wish to continue in the technical squad must attend. The course lasts 3 months, and approximately one-third of this time is spent on aspects of fire investigation. The course aims to be very practical - what to look for and how to do so - although a basic technical introduction to fires is also given. The course relies heavily upon the use of case studies to illustrate the various points, though fires are also set (under the supervision of the fire brigade) to demonstrate the issues. A number of 'experts' are also invited to give lectures on their particular specialism. A doctor talks about the information that can be obtained from bodies; a chemist talks about flammable liquids, analysis of substances and self-combustion; and a chimney sweep talks about chimney fires.

However, the police rely on the Fire Service to provide expertise in the behaviour and spread of fire.

The equipment available to the technical squad is much the same as that available to fire and police officers in the UK. This consists of cameras, small tape recorders for noting down findings, brushes, shovels, trowels, fingerprint kits and sample collecting kits. In the office, the technical squad also have microscopes and photographic equipment for developing photographs. There is also a national laboratory near Stockholm where samples may be sent for analysis. (The result of the analysis is usually returned to the squad within 3 weeks.) The technical squad mostly rely on the laboratory for the testing of samples for flammable liquids or for the testing of electrical equipment.

It is common for the police to perform a reconstruction of the incident with everyone involved; this helps to build a picture of what actually happened, and is useful in recalling incidents that may otherwise have been forgotten.

In Borås the technical squad have placed a camera inside the appliance that arrives first at any incident. They can therefore take photographs as they arrive at the incident and in the early stages of the fire. This often helps jog the memory of officers who attended the incident and can provide valuable evidence of what actually happened. The camera has an automatic focus, light meter and wind-on for ease of use. It is fixed just inside the front windscreen (though it may be removed for use outside the vehicle) and photos are taken as the vehicle approaches the fire and at the scene.

## 8.5 Fire/Police Co-operation

All the police and fire officers spoken to during the visit emphasised the need for close liaison between the two services.

The police in Sweden have sole responsibility for fire investigation. However, as part of the work being undertaken on the arson problem by the Swedish Fire Protection Association, the Gothenburg fire brigade have a full-time fire investigation officer working closely with the police. This post has been in existence since 1965, but only recently has much emphasis been placed on the work.

The fire investigation officer does not attend all fires - only larger fires, or fires of special interest. He attends the scene and works closely with the police officers who are investigating the cause of the fire. He is one of the two fire officers in Sweden who have attended the course run for police officers in the technical squads.

Because of the way the fire brigades are organised (on a municipal basis), it is felt that it would be impossible to justify having a full time fire investigation officer in each fire brigade. However, it may be possible for neighbouring forces to combine to provide such a post on a regional basis.

The police try to keep the fire brigades informed of the outcome of the investigation. This helps to improve liaison between the two services. Also, the departments concerned are usually fairly small, so that the officers get to know each other fairly quickly.

## 8.6 Training of the Fire Officers

For many years, the fire brigades were told that their responsibility was primarily to rescue people and extinguish the fire. Nowadays, more emphasis is being placed on co-operation with the police and the need to try to preserve the scene of the incident until the police technical squad have been able to examine it to investigate the cause and find evidence.

The fire brigade in Boras, together with the police and with the help of a local journalist, produced a video outlining the work of the two services at the scene of a fire, and pointing out why the scene should be left intact. This video has been copied by the Swedish Fire Protection Association and distributed to all fire brigades to be shown as part of the general training of all officers.

In addition to the video, the fire investigation officer in Gothenburg has drawn a series of humorous slides to emphasise the points that should be noted by the fire brigade when attending a fire. These slides have also been distributed nationally.

The talks given to the fire officers are more concerned with fire-fighting procedures than on fire investigation. The officers are taught to look for signs of a break-in and to note the position of furniture etc. They are also taught to note the colour of the flames, any unusual odours and the speed with which the fire spreads, to help the police establish the cause of the fire. In addition, they are asked to be aware of the behaviour of the people at the fire as this can provide an indication as to whether a fire was deliberately started.

When visiting stations to talk about fire investigation, the police try to make a point of talking about local fires which the brigade attended. This makes the topic much more relevant, and helps to stress the importance of the help of the fire officers. Most of the police officers spoken to said that the fire officers are much more aware of the problems of fire investigation nowadays, and are making much better witnesses and preserving the scene more effectively.

## 8.7 Public Education

Arson is a complex problem in which fire prevention, crime prevention and social welfare all play a part. Improved fire prevention and a better understanding of the problem of arson, its cost and implications, may help to limit the risk. One of the projects being undertaken under the Swedish Fire Protection Association in Halmstad is to improve public awareness about arson and the work of the fire brigade and the police. Many of the ideas for this project originated in, and have been copied from, the United States, where the work has been going on for a longer period.

The police and fire brigade have tried to make the public more aware by being more open about the work they undertake. They have a contact working with the local newspaper, which has run a series of articles about the work of the two services and about the arson problem.

At present, the police have a problem with an arsonist who is setting fire to disused cowsheds in the area around Halmstad. In this case, they have offered a reward for information leading to the arrest of the person concerned. This has only recently been introduced, so it is too early to say whether or not this has been successful. However, this approach is common in the USA, where information received as a result of a reward being offered has often led to an arrest.

The reward has been publicised by notices put around the area, and by an article in the paper.

The fire brigades and police in Boras and Malmo have held seminars/discussions with schools, hospitals and businesses to explain the arson problem to them and to outline the ways in which they can combat arson.

In Malmo, they had a problem with a number of fires being set in the attics and cellars of blocks of flats. The fire brigade persuaded the local authorities and occupiers that something had to be done about this. In response, the owners have locked the areas concerned to make it more difficult to get into the area, and the cellars and attics have been segregated into smaller, fire-proof compartments so that if a fire does start, it will be contained. This has reduced the number and cost of such fires dramatically.

## 8.8 Liaison with Insurance Companies

The insurance companies work closely with the Swedish Fire Protection Association. They are regularly involved in the work and attend regional meetings. The companies also contribute to the cost of the Swedish Fire Protection Association, both centrally and regionally.

The most common arson with which the insurance companies are involved is that of vehicle fires. The Swedish Fire Protection Association, Gothenburg fire brigade and the insurance companies have subsidised a

research project on this topic, and now claim to have an excellent track record in the area. However, it was not possible to visit the officers involved in this work, or to obtain any more detailed statistics about the successes.

#### 8.9 Comments

Although the fire brigades and police have been doing a great deal on the arson problem, most of the people spoken to felt that there was still a lot to be done. The main area where work was felt to be necessary was in education of the public, the judiciary and the police and fire officers to make them more aware of the problem.

In general, although the procedures for fire investigation differ slightly between the UK and Sweden, the actual techniques and scientific facilities are broadly the same.

All the police technical officers spoken to agreed that fire scenes were the most difficult scenes of crime to investigate. On the whole they felt that the police were better able to investigate fires than the fire brigade because of the need to have experience in investigation rather than in fires and fire behaviour. However, many forces and brigades were keen on a joint approach to the problem.



## **9 RECOMMENDATIONS**

During the course of the study, many suggestions were made about the possible ways forward for fire investigation. Most of these have been discussed in previous sections. This chapter summarises the most salient issues. Not all of the points are expected to be adopted in the short term; many of the issues will require further work before they can be brought into practice.

### **9.1 Full-time Fire Investigation Officers**

Although most brigades would be unable to justify having a full-time fire investigation team, it would appear that there is scope for at least one full-time fire investigation officer within each brigade. This (these) officer(s) would be responsible for all major investigations within the brigade, as well as the training and co-ordination of other fire investigation officers (see below), and the training of the fire crews in fire investigation and aspects of fire-fighting related to fire investigation. Officers in charge of incidents should be encouraged not to return a cause of doubtful or unknown origin without consulting the fire investigation officer(s).

The full-time fire investigation officer(s) would also liaise with the Police, Forensic Science Service, and other relevant organisations. Publicity and education about arson could be another area in which the officer(s) would be expected to take responsibility.

Whether the (these) post(s) could be created without additional manpower requirements is uncertain. Further study in this area may be required.

### **9.2 Joint Fire Investigation Teams**

Fire officers have experience in dealing with fires, and they have the knowledge, gained by fire-fighting over a number of years, of the behaviour of fires. They are able to suggest, based on their experience, whether or not a fire is likely to have been the result of arson. However, they may not have the investigative approach of a police officer who is likely to notice the criminal aspects of the incident (such as broken windows, and the behaviour of witnesses). Neither the police nor the fire officers have the scientific background to be able to prove (or disprove) some of the theories as to the cause of a fire. This expertise must be obtained from the Forensic Science Service or from another scientific organisation. Hence, in order for fires to be thoroughly investigated, a number of people need to work closely together. One way forward would be for joint teams to be set-up to work on fire investigation. Where fire investigation teams have been established within brigades the wide variety of officers delegated as fire investigation officers varies considerably reflecting different attitudes to fire investigation between brigades. The composition of teams range from all officers likely to be in charge of incidents to teams composed entirely of fire prevention officers. It would seem that more guidance and structure on fire investigation teams needs to be given to the Fire Service by the Home Office, in order that a standard level of fire investigation is established across the brigades.

Liaison with organisations such as hospitals, schools and industry should be encouraged, since much can be achieved in the area of fire prevention with their aid.

Wherever possible, the fire investigation officers should volunteer for the posts. In order for fire investigation to be carried out efficiently, it is vital that the officers involved have an interest in the work and want to see it being done well.

### 9.3 Training

#### 9.3.1 Fire Service College Course

The fire investigation course at the Fire Service College is aimed at the more senior levels within the Fire and Police Services. Although fire investigation is mentioned in some of the other courses, much of the training of the people actually involved in fire investigation is left to the brigades. Most brigades provide some form of training to officers classified as fire investigation officers, but very little training is given to other fire officers who may nevertheless be required to determine the supposed cause of a fire.

There appears to be scope for a fire investigation course aimed at all officers who may be in charge of an incident; this need not necessarily be a separate course. However, the current course seems to be aimed at the wrong level, and the individual sessions on other courses seem somewhat fragmentary.

#### 9.3.2 Further Training

There may also be scope for a national scheme such as in the United States where all fire investigators must reach a sufficient level in an examination. At present there is no recognised qualification for fire officers to obtain in terms of fire investigation other than experience. Such a qualification would make the fire investigation teams a more respected group, both within their own service and by the police.

### 9.4 Scientific Services

At present, the only scientific services available to the fire officers are those of the Forensic Science Service, and these only when a fire has been classified as (suspected) arson and upon the request of the police. Fire officers can gain much experience about the behaviour of materials by attending numerous incidents. However, it would be useful for them to have access to a scientific organisation for all fires. Whether this should be the Forensic Science Service or another organisation such as the London Scientific Services is debatable. More thought should be given to this area.

### 9.5 Case Studies

The case studies discussed on the fire investigation course at the Fire Service College tend to compromise brief resumes of particular incidents; they are not usually used to highlight aspects of fire investigation or unusual causes of fire and how these were determined. There is scope for more structure to be given to case studies and for them to be used to illustrate points covered in lectures.

Where possible, use should be made of videos; these can be especially helpful when a reconstruction of the incident is made, or when showing the steps taken during an investigation.

## 9.6 Further Research

From a survey of the literature and from talking to a large number of officers, it appears that the knowledge about fires and fire investigation apparent in the United Kingdom is consistent with that in other countries, and there is no area in which expertise is lacking.

There are, however, possible areas where research could be undertaken, particularly in respect to the causes and effects of electrical fires.

## 9.7 Statistics

At present, the officer in charge of the incident completes a form FDR1 (appendix A) giving the supposed cause of the fire. This is then sent to the Home Office, where they are collated and the United Kingdom Fire Statistics are produced (usually 1-2 years later). It would be of benefit to brigades if these statistics could be made more relevant: more analysis could be performed on the statistics to highlight trends, and feedback could be given much earlier.

In addition, there are discrepancies between the Fire Service and the police statistics, due mainly to the use of the term doubtful. These differences need to be dealt with to make the statistics consistent.

## 9.8 Newsletter

There is at present a lack of communication about fire investigation between the brigades. It is only when on a course at the Fire Service College that such matters tend to be discussed. One way of addressing this problem would be to have a national newsletter or journal on fire investigation, or to devote more time to the problem in existing publications. In this way brigades could learn about the approaches adopted and problems encountered elsewhere. The organisation producing this newsletter (journal) might also act as a reference point to facilitate the exchange of information about fire investigation.

## 9.9 Arson Prevention

There is scope for a great deal to be achieved in terms of fire and arson prevention. Owners of targets prone to all types of vandalism could be encouraged to make their premises more secure; more publicity could be given to the severity of the crime; insurance companies could be encouraged to be more discriminating when dealing with claims arising from fire losses; and the problems and dangers could be explained to the judiciary, with the aim of increasing sentences which should act as a deterrent to other possible offenders.

Most of this work could be achieved through the existing liaison committees on fire investigation and arson.

## 9.10 Detection Rates

At present, detection rates for arson are very low. Some effort could be expended in this area by adopting some of the approaches used in the United States. Keeping the public informed about the work of the Fire Service and the fire investigation teams would help in this. In addition, rewards could be offered for information leading to the arrest

of an arsonist. Should this approach be adopted, it would be sensible to contact the officers involved in the trial in Sweden, and officers who have been involved in such schemes in the United States, to assess whether this approach really works, and how it could be adopted in the United Kingdom.

## 10 CONCLUSION

At present, fire investigation techniques vary between the brigades. Two brigades (London and West Midlands) have full-time fire investigation teams; some delegate fire investigation responsibility to more senior ranking officers; others delegate it to all officers who may be in charge of an incident. The proportion of incidents attended by the fire investigation officers varies likewise. It appears that some guidance is required from the Home Office to ensure a degree of standardisation across brigades. There seems to be scope for at least one full-time officer within each brigade to be responsible for all aspects of brigade work relating to fire investigation. In addition, a number of officers could be nominated as fire investigation officers in addition to their other duties. These officers would be the first line of help for officers in charge of incidents.

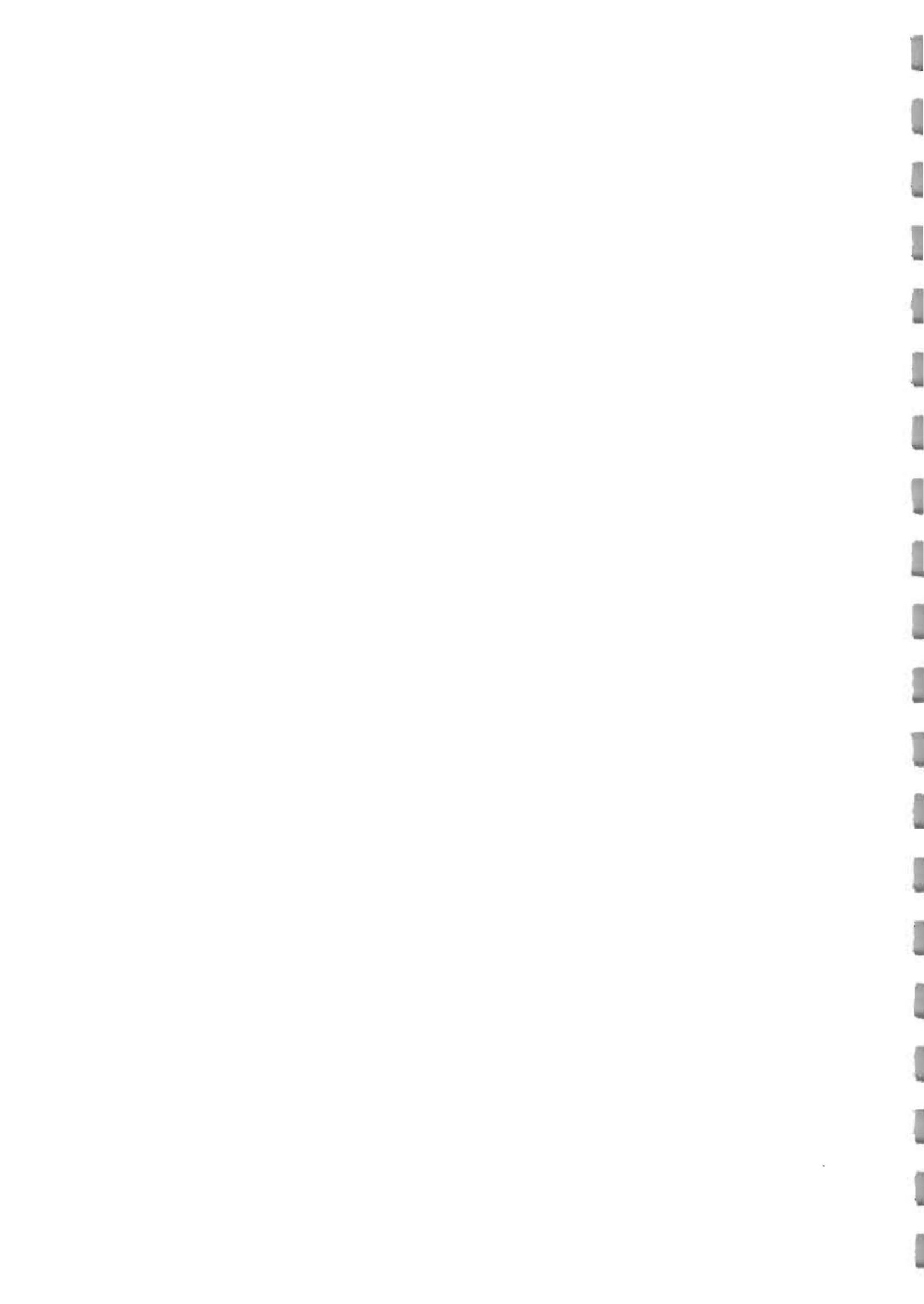
The training given to the various personnel also needs to be standardised. More training in fire investigation should be given to those officers who are required to determine the supposed cause of the fire, as well as to officers designated fire investigation officers. In particular, a national scheme to provide some form of recognised qualification for fire investigation officers would be of benefit.

Fire officers are not (usually) scientists, and are not qualified to test for an accelerant or to undertake scientific examinations of debris taken from a fire. To this end, they require a scientific organisation to provide them with such a back-up. This facility should be available for all fires, not just in cases of (suspected) arson.

Liaison between the organisations involved in fire investigation and fire prevention should be encouraged, and there should be more communication about fire investigation and the detection of arson between fire brigades, police forces and the public.

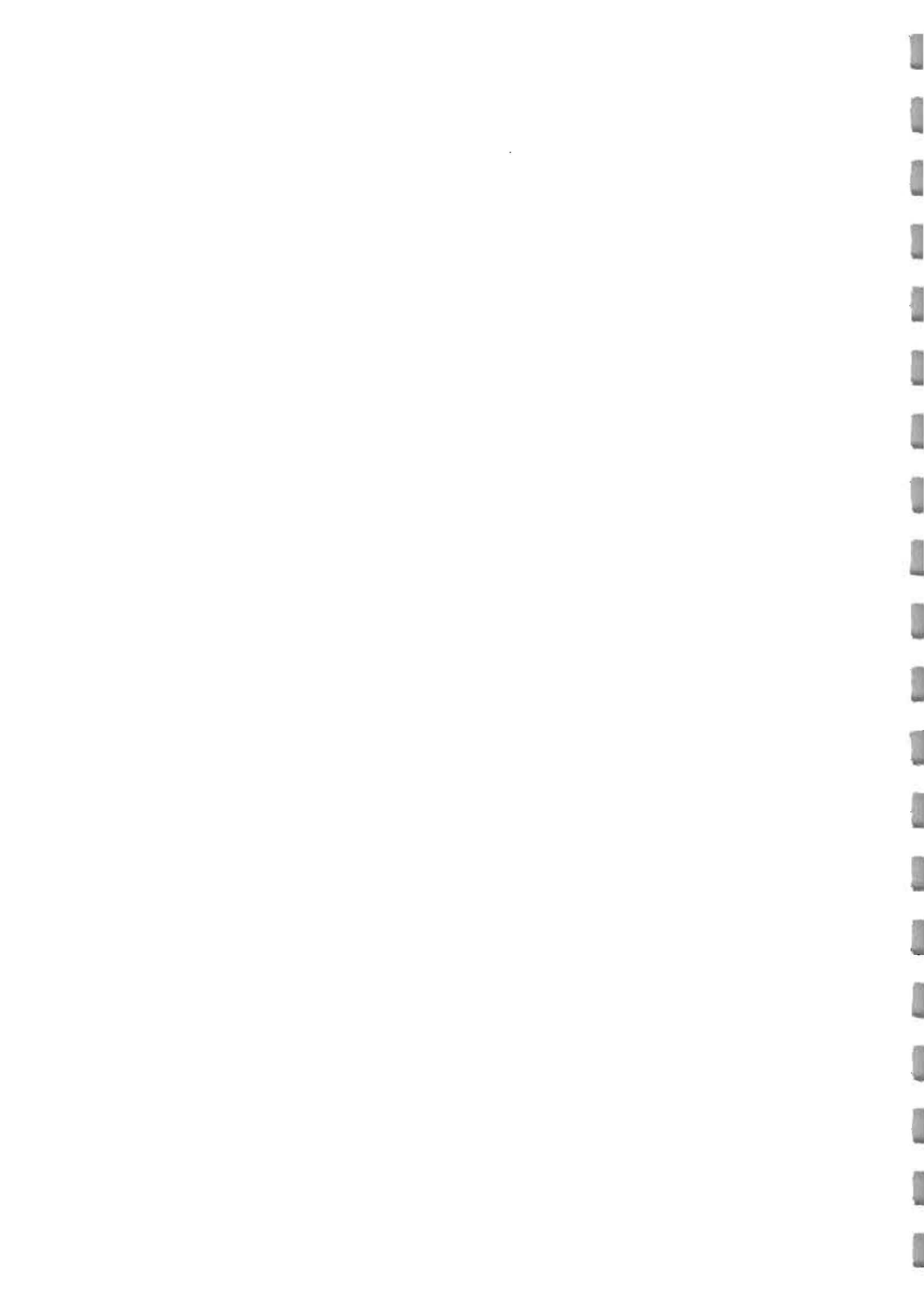
Above all, it is necessary that officers understand and believe the reasons for investigating fires thoroughly and accurately. Unless everyone concerned is interested in the work, there is unlikely to be much improvement in the identification of arson fires. The need for an open-minded approach should also be stressed.

The techniques used in fire investigation in the United Kingdom are comparable to those used in other countries. However, there are areas relating to fire investigation and the detection of arson, as outlined above and in section 9, which could be improved. It is to these areas that further work should be addressed.



**APPENDIX A**

**FIRE REPORT FORM FDRL**





# Report of Fire

Brigade Call No  Tick broken boxes if applicable

Additional particulars to follow on FDR 2

 Yes NoCriterion number(s) if fire of special interest 

## 1 General

1.1 Identification of incident:

Date Division Stn ground Address Name(s) of occupier(s) Trade or business carried on Risk category Are premises certificated? 

### 1.2 Times:

Estimated time interval from ignition to discovery  Discovered at ignition Short time i.e. under 5 mins Fairly long time i.e. 5-30 mins Very long time i.e. over 30 minsTime of discovery Time of 1st call to FB Time of arrival of FB Time under control Time last appliance returned 

### 1.3 Discovery and call:

Automatic fire detector 

Fire discovered by:

 Person Sprinkler Heat Smokeother (specify) 

Method of call:

 999 Other tel Running Call

Person via

Automatic via

 Direct line Central alarm Exchange telOther (specify) 

### 1.4 Further information

## 2 Location of fire

2.1 Type of property where fire started: 

2.2 Fires in buildings only: Description of building

i)  Detached  Semi-detached  Terraced  Otherii)  Single occupier  Multiple occ same use  Multiple occ different use  Under construction  Under demolition  Derelict  Unoccupied

2.3 Fires in buildings or ships: Details of location of fire

Floor of origin 

Place where fire started

 On Roof Other external structure External fittings Roof space Room, cabin etc.

(complete 2.6 next if necessary)

(continue)

Use of room, cabin, roof space etc. 

Openings:

Internal

External

 None All shut Some open None All shut Some open

2.4 Fires in vessels, caravans, trailers or outdoor plant only:

Dimensions in metres: Length Width Height Materials of construction 

2.5 Fires starting in road vehicles:

Make and Model Fuel Reg no 2.6 Further information

### 3 Construction of building or ship

If not applicable tick box and complete Part 4 next

not applic.

#### 3.1 General

Is there any evidence of heat damage to the structure?

Yes (continue)

No (Part 4 next)

Approximate year of construction

Number of basements

Number of floors

#### 3.2 Approximate dimensions: (in metres)

	Length	Width	Height
Of room, cabin etc of origin	<input type="text"/>	<input type="text"/>	<input type="text"/>
Of premises or ship	<input type="text"/>	<input type="text"/>	<input type="text"/>

#### 3.3 Materials of construction and linings etc. directly affected by fire: (underline or specify as appropriate)

Roof/roof lining	Walls	Wall lining	Ceiling	Ceiling lining	Floor	Floor covering
<u>asphalt/bitumen</u>	<u>asbestos</u>		<u>asbestos</u>		<u>brick/tile</u>	
<u>concrete</u>	<u>brick/stone</u>	<u>paint only</u>	<u>concrete</u>	<u>paint only</u>	<u>chipboard</u>	<u>carpet</u>
<u>felt</u>	<u>breeze block</u>	<u>paper</u>	<u>fibreboard</u>	<u>paper</u>	<u>concrete</u>	<u>linoleum</u>
<u>glass</u>	<u>chipboard</u>	<u>plaster</u>	<u>lath &amp; plaster</u>	<u>plastics</u>	<u>earth</u>	<u>paint only</u>
<u>metal</u>	<u>concrete</u>	<u>plastics</u>	<u>plaster</u>	<u>timber</u>	<u>metal</u>	<u>plastics</u>
<u>plastics</u>	<u>fibreboard</u>	<u>timber</u>	<u>plasterboard</u>		<u>timber</u>	
<u>slate/tile</u>	<u>plasterboard</u>		<u>plastics</u>			
<u>timber</u>	<u>timber</u>		<u>timber</u>			
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

3.4 Further information

### 4 Extinction of fire

#### 4.1 Sprinklers and drenchers in area involved in fire: (if none tick box and answer 4.2 next)

none

Installation:  Automatic  Manual

Number of heads actuated

Effect:  Did not operate  Operated but did not control fire  Controlled fire  Extinguished fire

give reason

#### 4.2 Methods of fighting the fire:

Before arrival of Fire Brigade

Methods used by Fire Brigade

#### 4.3 Attendance of Fire Brigade: (excluding relief attendance)

Name and rank of person in charge of 1st attendance

Name and rank of person in charge of fire

Number of persons — Station Officer and above

— below Station Officer

Number of major pumping appliances

Specify other appliances

#### 4.4 Further information

# 5 Damage and spread

## 5.1 Description of damage:

i) To item ignited first	<input type="text"/>	<input type="text"/>
ii) To room, cabin etc of origin	<input type="text"/>	<input type="text"/>
iii) Elsewhere on floor, deck etc of origin	<input type="text"/>	<input type="text"/>
iv) Elsewhere in building, ship, etc of origin	<input type="text"/>	<input type="text"/>
v) Outdoor spread; spread beyond building, ship, plant, vehicle etc.	<input type="text"/>	<input type="text"/>

## 5.2 Total horizontal area damaged: in square metres

	Area damaged by direct burning	Total area damaged
In buildings or ships	<input type="text"/>	<input type="text"/>
Not in buildings or ships	<input type="text"/>	<input type="text"/>

## 5.3 If any livestock were killed specify:

Species	Number	Species	Number	Species	Number
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

5.4 Further information

# 6 Supposed cause of fire

## 6.1 Most likely cause: (if alternative causes are worthy of note, record these in 6.2)

Source of ignition

Material or item ignited first (state composition of item)

Defect, act or omission giving rise to ignition

Material or item mainly responsible for development of fire (state composition of item)

6.2 Further information

# 7 Life risk

## 7.1 Involvement of persons: (as known to Fire Engineer)

Approximate number of persons at discovery of fire in:

i) Room or cabin etc of origin

ii) Other parts of building, vehicle etc

Approximate total number who left the affected property because of the fire

Approximate numbers of those who escaped by unusual routes

Fixed fire escape

Ladder

Through window

Drainpipe, sheet rope, etc

Climbing over roof, ledge etc

Other unusual routes (specify numbers and routes)

## 7.2 Fatalities, other casualties and rescues: (complete one line for each person. Always refer to Guidance Notes for the codes to be entered in cols. 1-6)

Name	Age	1 Status	2 Location	3 Circs	4 Fatality/Casualty	5 Rescued by	6 Rescue Method
A							
B							
C							
D							
E							
F							
G							
H							

7.3 Further information

# 8 Explosions and dangerous substances

## 8.1 Explosions:

*Explosion caused fire*

*Fire caused explosion*

Specify materials involved

Specify containers involved

## 8.2 Dangerous substances affecting fire fighting or development of fire:

Substance	Amount	Circs*	Effect on fire or firefighting

\*M = being made

S = in storage

T = in transit

U = being used

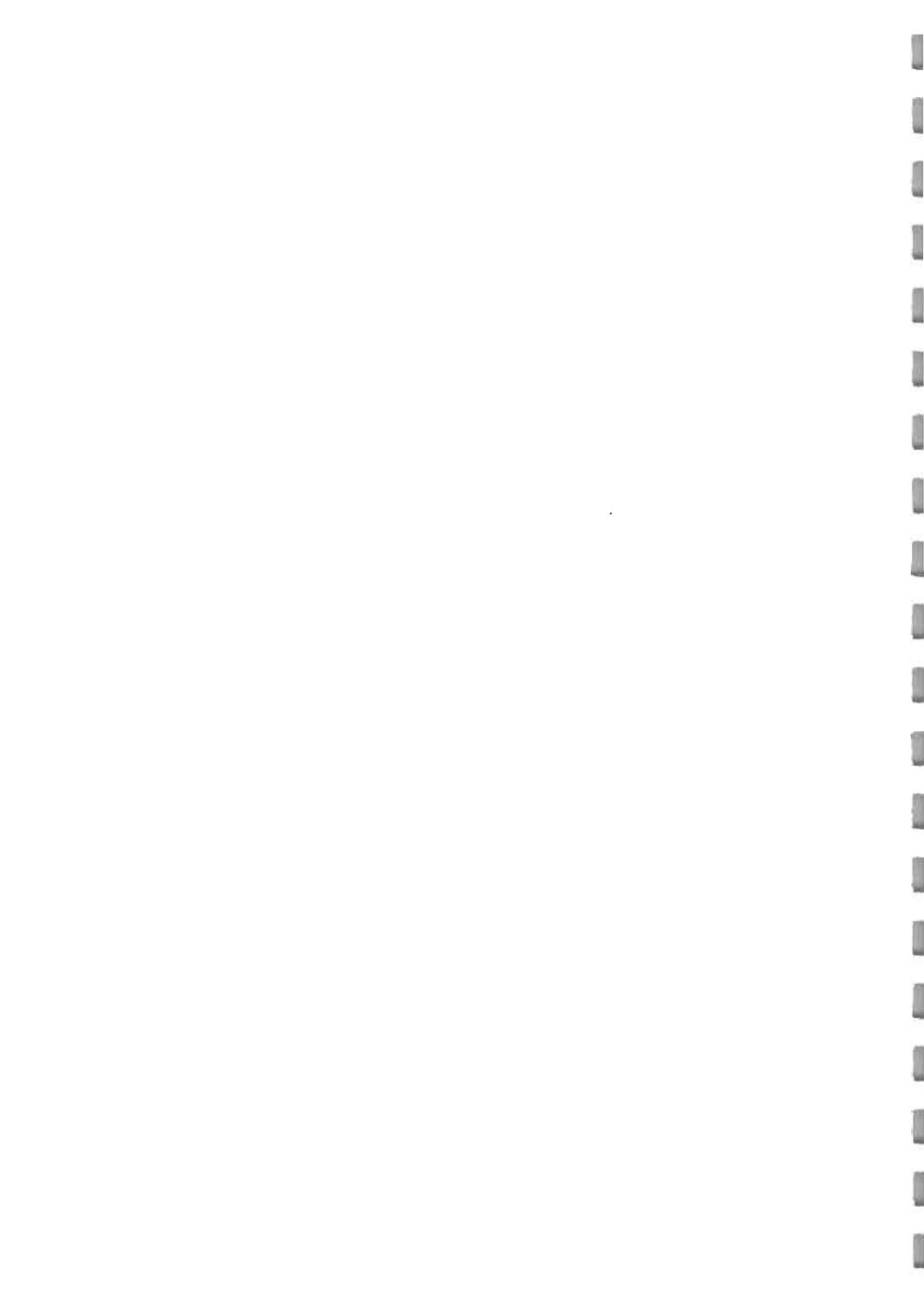
8.3 Further information

Signature ..... Rank ..... Date .....

G. Jackaman

**APPENDIX B**

**SUMMARY OF SURVEY RESPONSES**



Analysis of FI survey, Appendix C question 5.

BRIGADE	FIRES (1983)	ARSON (%)	UNKNOWN (%)	F.I. TEAM (Y/N)	No (RANK) OF FI OFFICERS
Avon	1370	12.6	6.5	N	FPO, 9ADOs
Bedfordshire	703	13.5	8.1	N	9DO/ADO
Berkshire	909	10.7	8.6	N	FPO, 2ADO(FP), 5StnO
Buckinghamshire	782	13.7	4.5	N	27 all ranks StnO up
Cambridgeshire	851	13.6	1.8	N	All ranks StnO up
Cheshire	1538	12.4	4.2	N	8 officers
Cleveland	994	15	2.8	N	
Cornwall	558	6.1	5.7	N	OiC, FP
Cumbria	862	8.4	7.5	N	OiC
Derbyshire	1146	12.8	5.6	N	15ADO, 7FPO, 6Ops
Devon	1471	10.1	6.8	N	OiC, SFPO
Dorset	744	7.7	7.7	N	SFPO, ADO
Durham	972	13.2	6.1	N	OiC, FPO
East Sussex	1091	11.2	3.9	N	OiC, 3ADO(FP), 1SO(FP)
Essex	1916	15.2	3.3	N	All ADOS
Gloucestershire	777	7.1	5.9	N	5
Hampshire	1682	12.2	6		
Here & Worcester	943	10.5	4.1	N	7
Hertfordshire	1174	12.7	4.9	N	OiC
Humberside	1622	16.3	3.1	N	50 Officers StnO up
Isle of Wight	183	20.8	5.5	N	FPOs
Kent	1801	15.3	6.7	N	SFPO, 10others
Lancashire	2930	11.3	2.8	N	OiC, higher ranks
Leicestershire	1905	14.1	1.8	N	OiC, FIO(SO), SFIO(ADO)
Lincolnshire	725	9.1	3.6	N	OiC, Volunteers
Norfolk	923	8.5	5.3	N	12 StnO-DO
North Yorkshire	974	9.8	2.8	N	FPOs
Northamptonshire	769	21.1	5.3	N	6ADO-DO
Northumberland	551	10.2	7.6	N	5DO, 6ADO, 4StnO(FPO)
Nottinghamshire	1517	19.1	4.4	N	ADO(FP), volunteers
Oxford	668	9.1	6.4	N	OiC, FPOs
Shropshire	593	11.6	5.2	N	FPOs
Somerset	605	6.3	7.6	N	9FPOs
Staffshire	1265	13.9	2.4	Y	5ADOS
Suffolk	814	9.1	4.7	N	14 volunteers
Surrey	1331	15.7	3.3	N	OiC, FPOs
Warwickshire	575	13.2	5	N	9
West Sussex	901	8.5	5.3	N	OiC, seniors
Wiltshire	687	8.4	5.4	N	12 StnO-DO
Gtr Manchester	5804	17.5	1.5	N	50 FIOs
Merseyside	4138	26.9	2.6	N	OiC
South Yorkshire	1958	10.7	2.7	N	OiC, FPO
Tyne and Wear	2748	22.2	2	N	DO
West Midlands	5294	16.3	8.2	Y	5StnO
West Yorkshire	3731	19.1	0.8	N	OiC
Greater London	13141	18.1	7	Y	5 FITs of 2
Clwyd	695	10.4	4.2	N	OiC
Dyfed	491	5.9	2.6	N	FPO
Gwent	670	11.5	2.8	N	StnO up
Mid Glamorgan	857	20.5	2	N	14StnO up
Powys	153	5.9	6.5	N	All
South Glamorgan	475	16.5	4.6	N	All
West Glamorgan	566	12.7	11	N	OiC, FPO
Stathclyde	6049	22.6	2.3	N	OiC, FPO
High and Isles	433	6.9	11.5	N	
Grampian	1004	7.7	0.9	N	FPO
Tayside	1170	12.6	1.3	N	OiC, FPO
Lothian and Bdrs	2737	22.9	1.7	N	ADOS
Fife	726	10.9	13.5	N	ADO up
Central	586	15.4	0.7	N	All
Dumf and Galloway	254	5.9	5.5	N	FPOs, DOS

Analysis of FI survey, Appendix C question 6,7,8.

BRIGADE	% FIRES ATTENDED	CALL-OUT CRITERIA	SCIENCE BACKUP	EQUIPMENT
Avon		OiC	Y	None
Bedfordshire	2.5	OiC	N	None
Berkshire	1.7	OiC		Full
Buckinghamshire	3.3	OiC, F, A, S	N	Full
Cambridgeshire	5	U,D,F,OiC,S	N	None
Cheshire	1.5	OiC	N	Full
Cleveland		F,OiC	N	Full
Cornwall	4	OiC	N	Basic
Cumbria		D	N	None
Derbyshire	5	F,I,A,D,S,OiC	N	None
Devon	2	D,F,S	N	None
Dorset	1	OiC,S	N	Basic
Durham	1	F,S	N	None
East Sussex	1	5P,F,OiC,D,A	N	Full
Essex	10	OiC, D	N	None
Gloucestershire		D F S U 4P	N	Full
Hampshire				
Hereford & Worcester	5	S F OiC D	N	Full
Hertfordshire	3	U F D A S	N	None
Humberside	10	OiC S F U D	N	Basic
Isle of Wight	40	F A D OiC	N	None
Kent	5	F D S U pol req	N	Full
Lancashire	12.5	OiC, A, D	N	None
Leicestershire		OiC,F,S,6P	N	Full
Lincolnshire	3.2	OiC,5P,D,F,S	N	Full
Norfolk	6	F,OiC	N	Basic
North Yorkshire		D,U,A,	N	None
Northamptonshire	2	D,A,U,f,S	N	None
Northumberland	2.5	F,S,D,U	N	Full, Aide Mem
Nottinghamshire	2	F,S,D,OiC	N	Some
Oxford		OiC	N	None
Shropshire	0.3	D,S,F,	N	None
Somerset	0.5	5P,F,OiC	N	Full
Staffordshire	15	F,A,D,5P,OiC,S	N	Full
Suffolk		OiC	N	Basic
Surrey			N	None
Warwickshire	4.6	F,D,S,5P	N	Full
West Sussex	1.3	A,D,F,OiC	N	None
Wiltshire	7	4P,F,A,D,S,OiC	N	Full
Greater Manchester	1	OiC,F,6P,D,	N	Full
Merseyside		OiC	N	Basic
South Yorkshire	14	S,F,D,	N	Some
Tyne and Wear	1	F,5P,D	N	Some
West Midlands	6.8	F,D,A,OiC,S,5P	N	Full
West Yorkshire		D,4P	N	None
Greater London	10	4P,F,D,OiC,U	Y	Full
Clwyd		OiC	N	None
Dyfed	4	F,5P,OiC,D	N	Some
Gwent	4	OiC	N	Some
Mid Glamorgan	4	F,OiC	N	Small
Powys		All	N	None
S Glamorgan	1.1	F,5P,OiC	N	Full
W Glamorgan		S,A	N	None
Stathclyde		F	N	None
High and Isles	0.5	F,D,S	N	None
Grampian	5	S,F,U	N	Very Full
Tayside	2	F,S,A,D	Y	Full
Lothian and Borders	1.4	S,F,4P,	N	Full
Fife		A,F,S,	N	None
Central			N	None
Dumfries & Galloway		OiC	N	



Analysis of FI survey, Appendix C question 9.

BRIGADE	TRAINING
Avon	(a)FSC;(b)None; 2 days for SOCO
Bedfordshire	(a)FSC;(b)None
Berkshire	(a)Brigade manual + course; (b)None
Buckinghamshire	(a)FSC+brigade; (b)lectures
Cambridgeshire	(a), (b) 1 day + continuation
Cheshire	(a)FSC, FI seminars;(b)some.
Cleveland	(a)FSC;(b)some lectures
Cornwall	None
Cumbria	FPO to FSC; Lancs FI course
Derbyshire	(a)FSC + seminars; (b)none
Devon	SFPO to FSC; others none
Dorset	(a)FSC;(b)by supervisors
Durham	(a)FSC;(b)some lectures
East Sussex	(a)FSC;(b)Lectures on JO course
Essex	Basic
Gloucestershire	(a)FSC;(b)Training given by FIT
Hampshire	
Hereford & Worcester	(a)FSC;(b)None
Hertfordshire	Courses in FI (Manual enc)
Humberside	(a)FSC, 3day course;(b)FB Note
Isle of Wight	FSC
Kent	(a)FSC;(b)Lectures
Lancashire	(a)FSC;(b)internal(see manual)
Leicestershire	(a)FSC;(b)FI Note
Lincolnshire	(a)FSC;(b)Short course
Norfolk	Seminars
North Yorkshire	(a)FSC;(b)Seminars
Northamptonshire	(a)FSC;(b)Seminars
Northumberland	(a)FSC;(b)brigade training
Nottinghamshire	(a)FSC;(b)Seminars
Oxford	
Shropshire	(a)FSC;(b)Minimal
Somerset	(a)FSC, 2days;(b)lectures
Staffordshire	(a)FSC;(b)1day course
Suffolk	(a)Seminars
Surrey	(b)1wk internal course
Warwickshire	(a)seminars,FSC;(b)some
West Sussex	(a)FSC;(b)Some
Wiltshire	(a)FSC, meetings
Greater Manchester	(a)video;(b)basic, aide memoire
Merseyside	(a)FSC;(b)1 wk course to sub off up
South Yorkshire	(a)+(b)brigade course based on FSC
Tyne and Wear	(a)FSC;(b)some
West Midlands	(a)FSC;(b)some
West Yorkshire	(a)FSC;(b)brigade courses
Greater London	(a)FSC;(b)full
Clwyd	(a)FSC;(b)none
Dyfed	(a)FSC;(b)None
Gwent	(a)+(b)FSC/some
Mid Glamorgan	(a)FSC;(b)1day
Powys	(a)FSC;(b)none
S Glamorgan	(a)FSC;(b)some
W Glamorgan	(a)FSC;(b)1 day
Stathclyde	(a)FSC;(b)brigade course
High and Isles	(a)FSC;(b)None
Grampian	(a)FSC;(b)basic
Tayside	(a)FSC;(b)brigade course
Lothian and Borders	(a)FSC;(b)1 week
Fife	(a)FSC;(b)1 day
Central	FSC
Dumfries & Galloway	None

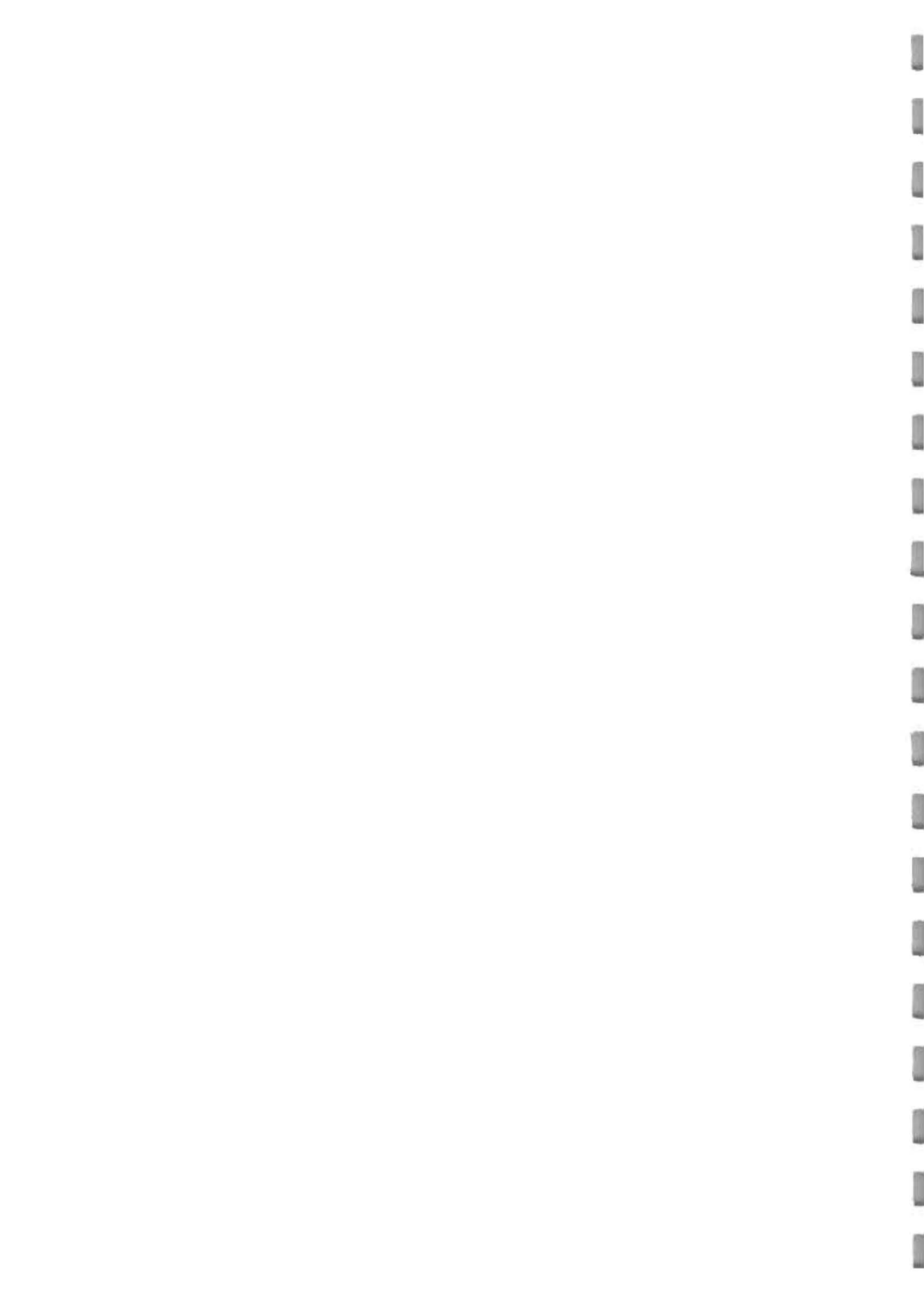
a - training for Fire Investigation Officers  
 b - training for other officers

Analysis of FI survey, Appendix C question 10.

BRIGADE	LIAISON
Avon	Good
Bedfordshire	SOCO accompany FIT. Good; annual meetings
Berkshire	FIT may call SOCO
Buckinghamshire	Frequent meets with SOCO + FSS
Cambridgeshire	Good
Cheshire	Close
Cleveland	Ad-hoc
Cornwall	Draft policy formulated
Cumbria	Good. County Analysts spoken to re backup
Derbyshire	Generally good
Devon	Good; Avon FB gives courses on FI
Dorset	
Durham	
East Sussex	Nothing formal
Essex	Good
Gloucestershire	Excellent. Regular visits, discussions
Hampshire	
Hereford & Worceste	Good at incidents
Hertfordshire	Nothing formal
Humberside	Liaison panel. Relations good and practical
Isle of Wight	Good, though lack of information re results
Kent	Very good
Lancashire	Good formal and informal. Some local problems
Leicestershire	V Good
Lincolnshire	Good. Regular meetings. Also crime prevention
Norfolk	Very good
North Yorkshire	Excellent. Meet when necessary
Northamptonshire	Excellent
Northumberland	Some problems (personalities).
Nottinghamshire	Excellent. Good relations with HM Coroners
Oxford	Good
Shropshire	Good, but should have direct contact with FSS
Somerset	Good local liaison
Staffordshire	Good informal relations
Suffolk	Good. Committee on vandalism and arson
Surrey	Quarterly meetings; discuss cases + problems
Warwickshire	Good
West Sussex	Close
Wiltshire	Not too good
Greater Manchester	Close links
Merseyside	Good
South Yorkshire	Good, though nothing specific
Tyne and Wear	Extremely good
West Midlands	Liaison committee set up
West Yorkshire	Local contacts
Greater London	Not too good
Clwyd	Good
Dyfed	Good with police, FSS not so good
Gwent	Generally good
Mid Glamorgan	Good
Powys	OK
S Glamorgan	None
W Glamorgan	
Stathclyde	Some
High and Isles	Excellent
Grampian	Very good
Tayside	Adhoc
Lothian and Borders	Excellent
Fife	None
Central	Excellent
Dumfries & Galloway	

**APPENDIX C**

**FIRE INVESTIGATION QUESTIONNAIRE**



## E.R.

### FIRE INVESTIGATION SURVEY

#### DETECTION OF ARSON

1. Name

2. Rank

3. Brigade

4. Tel No

5. Does your Brigade have a specialist fire investigation team (ie officers whose sole responsibility is fire investigation)?

5a. If so, how many officers are involved and how are they dispersed throughout the Brigade?

-

-

5b. If not, who is usually responsible for fire investigation and what other responsibilities do these officers have?

6. Approximately what proportion of fires are attended by the fire investigation team/officers?

7. What are the criteria for the attendance of the fire investigation team/officers at an incident?

E.R.

FIRE INVESTIGATION SURVEY

8. What equipment does the fire investigation officer have available at the scene of the fire?

9. Please give details below of any training in fire investigation that your Brigade provides to:

- (a) fire investigation officers;
- (b) other fire officers.

(If possible please send a copy of any training material that is given to the officers).

10. Are there any comments you would like to make regarding your relationship and/or liaison with the police or forensic science services in the area of fire investigation? Please include details of any committees that have been set up to cover this area.

**E.R.**

FIRE INVESTIGATION SURVEY

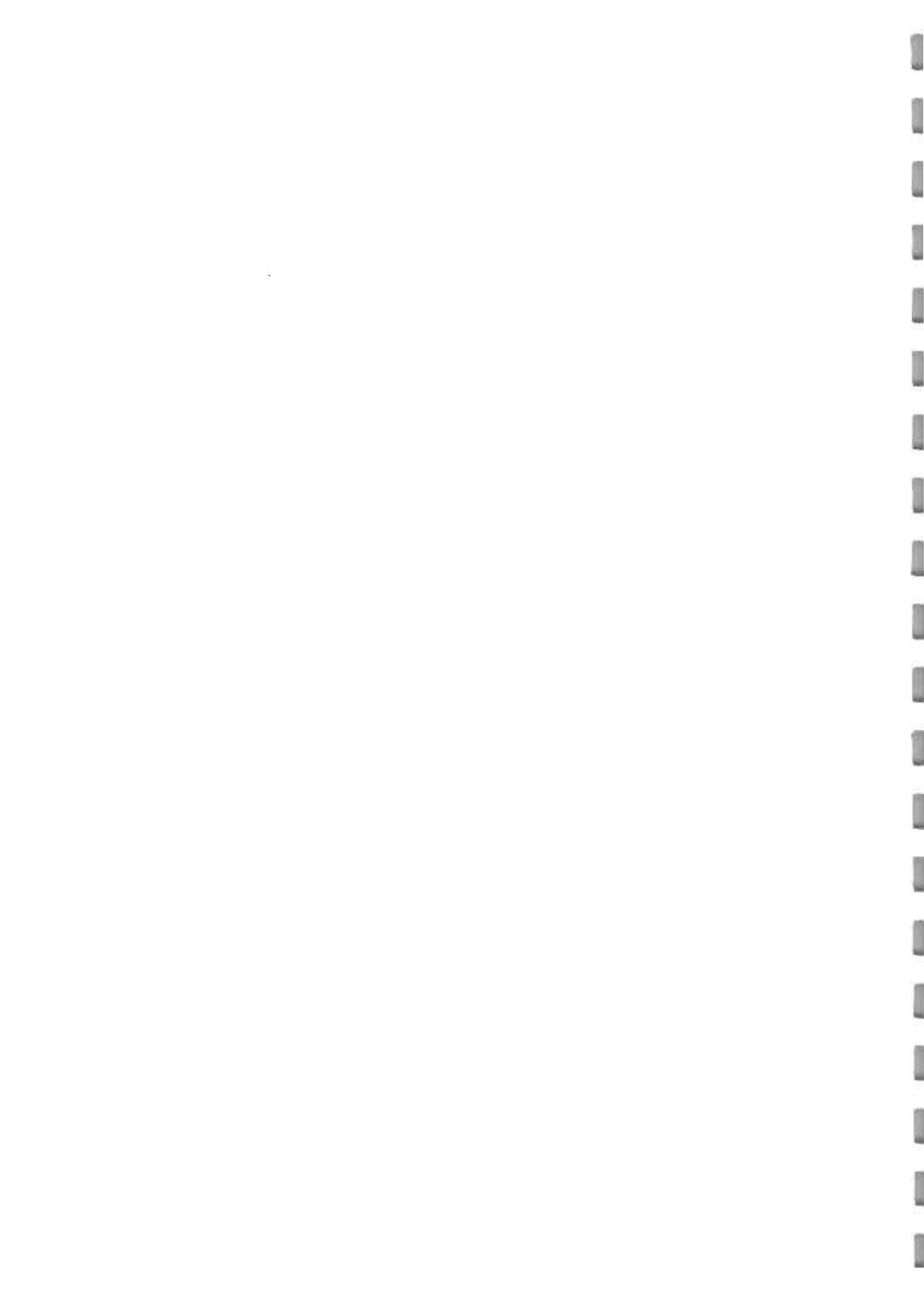
11. Please add any further comments, including future plans for changes in fire investigation or changes in procedures/resources that might assist in the improved detection of arson.

Please return this form to:

Jennie Milward  
Scientific Research and Development Branch  
Home Office  
Room 303 Horseferry House  
Dean Ryle Street  
London SW1P 2AW

In case of any queries, telephone 01 211 4260

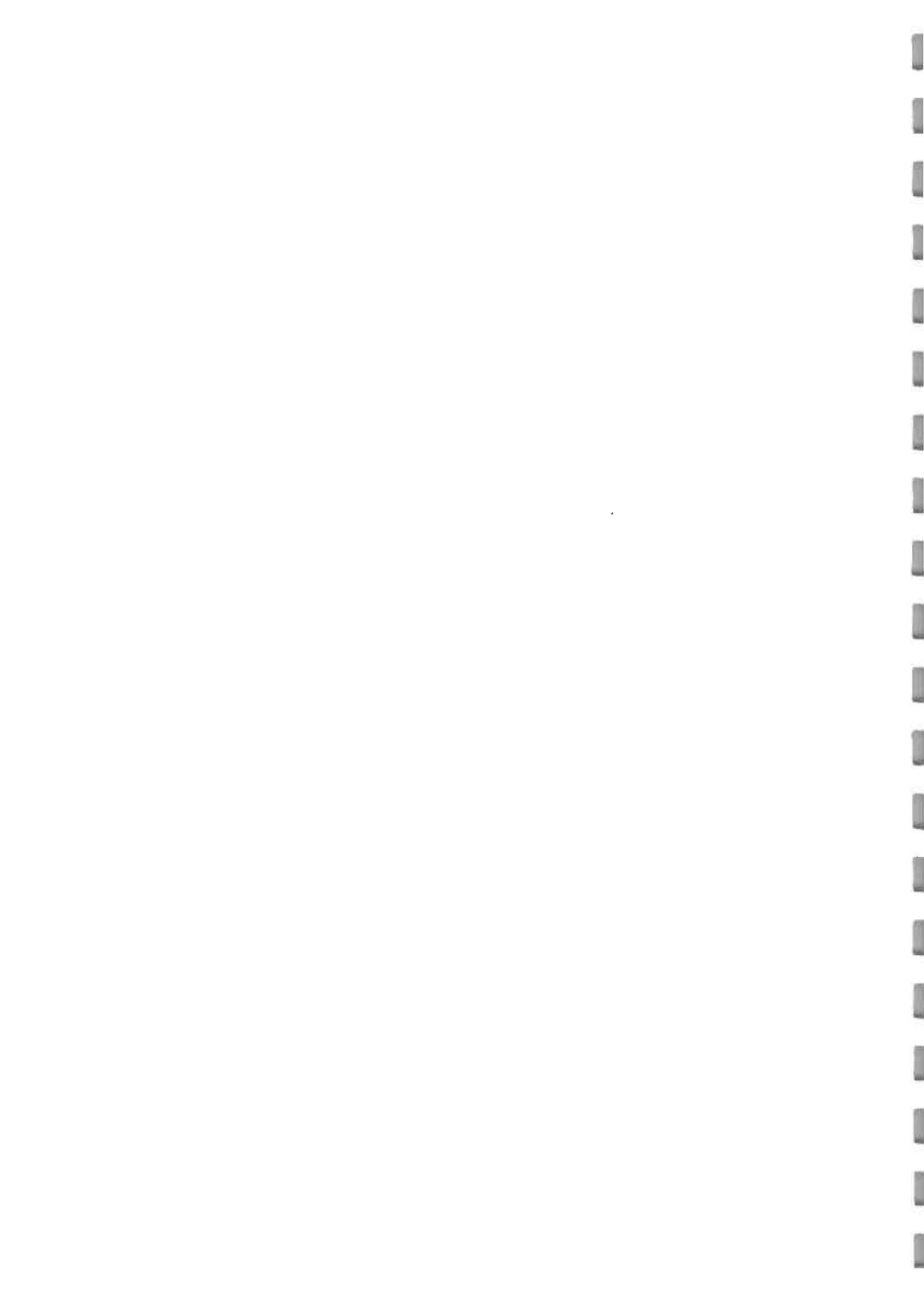
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**APPENDIX D**

**FIRE INVESTIGATION COURSE PROGRAM**



FIRE SERVICE COLLEGE

FIRE INVESTIGATION COURSE - NO FI 06/85

COURSE DIRECTOR : DIVISIONAL OFFICER A REID

COURSE STAFF : ASSISTANT DIVISIONAL OFFICER L REDGATE

TIME	SUBJECT	PLACE	INSTRUCTOR
<u>MONDAY 3 MARCH 1986</u>			
0830-0925	Introduction to Course/Personal Introductions	No 5 LR	DO Reid & ADO Redgate
0930-1030	Review of the Chemistry and Physics of Fire (1)	CL 1	Dr Cooke
1030-1100	TEA		
1100-1130	Review of the Chemistry and Physics of Fire (2)	CL 1	Dr Cooke
1135-1235	Electricity as a Cause of Fire	PL	Mr Whitton
1235-1400	LUNCH		
1400-1530	The Role of the Analytical Chemist in Fire Investigation; Sample Collection and Analytical Techniques	CL 1	Dr Cooke
1530-1600	TEA		
1600-1655	The Role of the Police in Fire Investigation	No 4 LR	VL Det Chief Insp. Stanley & ADO Redgate
1700-1730	Discussion	No 4 LR	- DITTO -
<u>TUESDAY 4 MARCH 1986</u>			
0830-0930	Fires in Furniture and Furnishings	CL 1	Mr Wood
0935-1035	Vandalism as a Cause of Fire	No 5 LR	DO Howcroft
1100-1235	Burning Characteristics of Timber	No 5 LR	VL Mrs L Parry & ADO Redgate
1400-1445	Fires in Buildings The Effect of Ventilation - Buildings, Materials and Linings on Fire Growth and Spread Film "Anatomy of Fire"	No 5 LR	VL Mr A Morris, Fire Research Station & ADO Redgate
1500-1530	Discussion	No 5 LR	- DITTO -
1600-1655	Spontaneous and Smouldering Combustion	No 5 LR	VL Mrs Beever, Fire Research Station & DO Reid
1700-1730	Discussion	No 5 LR	- DITTO -

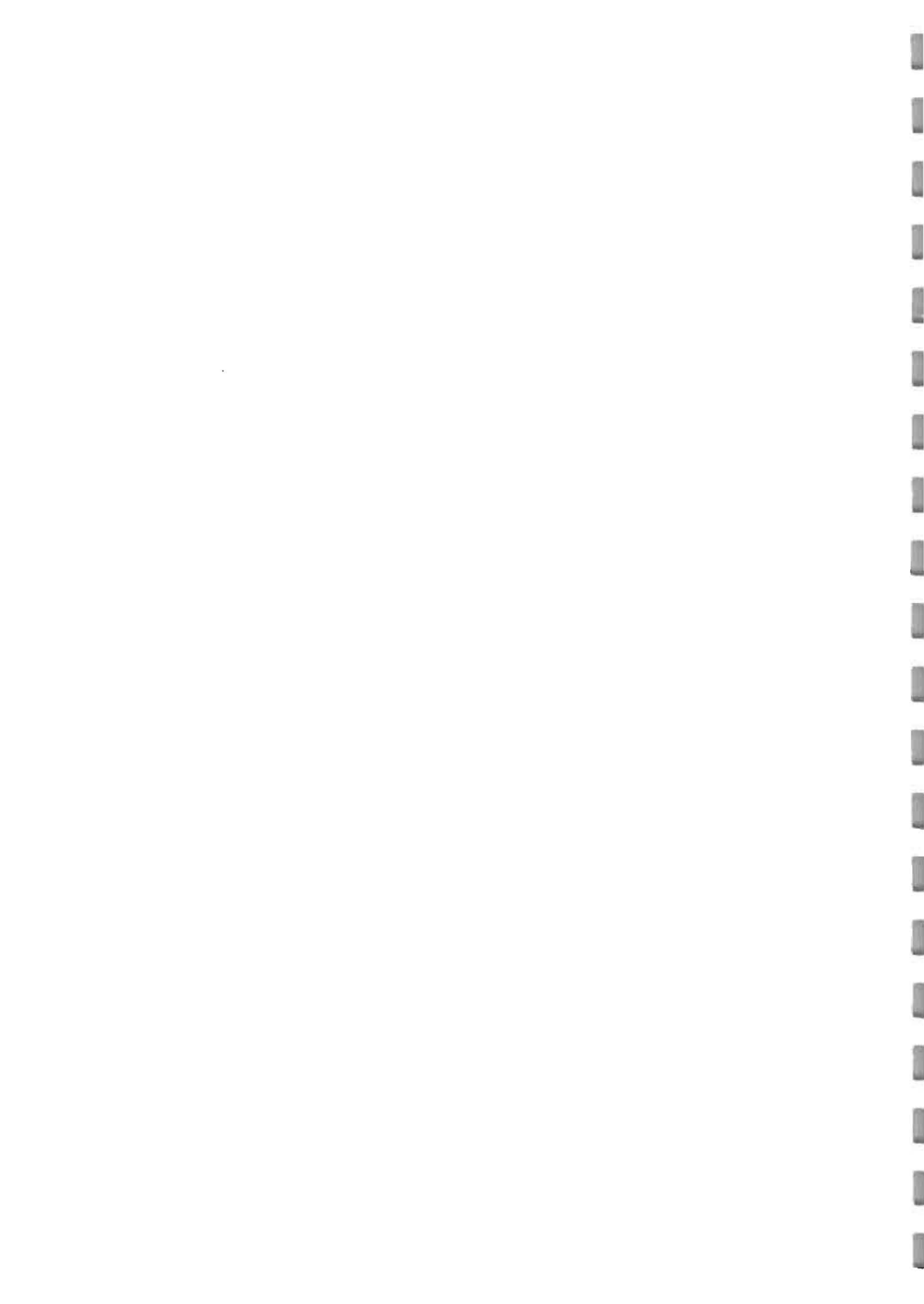
WEDNESDAY, THURSDAY AND FRIDAY CONTINUED OVERLEAF/.....

TIME	SUBJECT	PLACE	INSTRUCTOR
<u>WEDNESDAY 5 MARCH 1986</u>			
0830-1030	Location of Seat of Fire	No 5 LR PD 1	VL Mr Ide, DO Reid & ADO Redgate
1100-1145	Excavation Techniques	- DITTO -	- DITTO -
1150-1235	Examination of Fire Debris	PD 1	- DITTO -
1400-1530	Discussion of Conclusions Arrived at as a Result of the Examination of Fire Debris	PD 1	- DITTO -
1600-1730	Case Histories	CL 2	DO Reid & ADO Redgate
<u>THURSDAY 6 MARCH 1986</u>			
0830-1000	Arson Identification	No 5 LR	DO Howcroft
1005-1030	Fire Investigation in USA	No 5 LR	DO Howcroft
1100-1230	The Formation of Fire Investigation Teams	No 5 LR	DO Howcroft
1400-1530	Role of the "Loss Adjuster" in Fire Investigation	No 5 LR	VL Mr I Wharam, DO Reid & ADO Redgate
1600-1730	Case Histories	CL 2 No 5 LR	DO Reid & ADO Redgate
<u>FRIDAY 7 MARCH 1986</u>			
0830-1000	Infernal and Terrorist Devices	No 5 LR	VL Capt D Hewitt & DO Reid
1005-1035	Evidential Requirements and the Role of the Expert Witness	No 5 LR	VL Mr Jones, & DO Reid
1100-1215	Evidential Requirements and the Role of the Expert Witness	No 5 LR	- DITTO -
1215-1230	End of Course Discussion	No 5 LR	ACO Robinson, DO Reid, ADO Redgate & Dr Cooke
1230	Room Check		ADO Redgate

SH/MP  
21 February 1986

**APPENDIX E**

**LIST OF EQUIPMENT CARRIED BY THE LONDON FIRE BRIGADE  
FIRE INVESTIGATION TEAM**



FIRE INVESTIGATION UNIT - EQUIPMENT

Aspirator Bulb & Smoke Tubes	1
Martindale Masks	12
Rubber Bands	Asst
Portable Tape Recorder, 'ASSAM' Type	1
Spare Battery	1
Spare Tape Cassette	1
Metal Tweezers	1 Pair
Metal Tongs	1 Pair
Pen Knife	1
Electrical Screwdriver	1
Labels (Gummed)	-
Labels (Tie on)	-
Litmus Paper	All types
Sellotape	1
Ruller	1
Rubber Stamp	1
In Pad	1
Security Tags	
Chalk	-
Sealing Wax	-
Magnifying Glass Illuminated	1
Calipers in Pouch	1
Box disposable gloves	1 Box
Tape Measure	1
Dymo Tape	1
Draegar Hydrocarbon Detector No. 31	1
Draegar Tubes (Boxes of Ten) 5"	Assorted
blow Lamp	1
Dymo Printer	1
Gas Alarm	1
3 Piece Alloy Extention Ladder	1
Pick Axe	1
Bass Broom	2
Glass Sample Jars 500, 250ml	10
Pencils	-
Chinagraph Pencils	-
Small Notebooks	-
Sketch Pad	1
Rule	1
Sample Tins	3
Hearth Set Tools without Toolchest	
Electical Powered Jig-Saw	1
Evac Radio	1
Compass	1
Aide-Memoire Pad	1
Holdall	1

FIRE INVESTIGATION UNIT - EQUIPMENT

Atlas	1
Nominal Roll Boards	2
Appliance Jack	1
Jack Handle	1
Wheelbrace	1
BCF Refill	1
BCF Extinguisher	1
F.I.T. Tabard	2
C.A. Set	2
TSR Folder	1
Gas Tec	1
Clip Board	2
Shovel	2
Airport Map in Case	1
First Aid Kit	1
Safety Goggles	3
C.A. Cylinder	2
BA Log Book	2
Traffi Tape	Rolls
Safety Helmet with Visor	1
Boiler Suit	1
Yellow Safety Coat	1
Rubber Boots	1 Pair
Rubber Gloves	1 Pair
Sieve	1
Paper Kitchen Towell Roll	1
Cotton Wool	1
Plastic Box (Lge) 10 x 3 x 3½	2
Plastic Box (Sml) 4½ x 2 x 4	2
Salvage Scoop	1
Hand Brush	1
Soap	2
Safety Helmet	1
Bucket	1
Case for Samples 18 x 16 x 24	1
Nylon Bags (Ass.) 18 x 24	30
Heavy Gauge Bags 24 x 48	30
Axes	2
Torches	2
Handlamps - Brightstar	4
Polaroid Camera and Case	1
Spare Film	1
Hand Rake	1
Hand Towel	1
Camera and Flash Equipment (Negative Producing)	1
Film Developing Tray - (Wallet for Photos)	1
Pen for Marking Photos	1
Flood Lights	2
Extension Cables	2
Tripods	2



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