Best Practice Manual for the Investigation of Fire Scenes

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Background

This Best Practice Manual (BPM) belongs to a series of 10 BPMs issued by the European Network of Forensic Science Institutes (ENFSI) in November 2015. The series covers the following forensic disciplines:

1. Forensic Examination of Digital Technology
2. Forensic Examination of Handwriting
3. Chemographic Methods in Gunshot Residue Analysis
4. Road Accident Reconstruction
5. Microscopic Examination and Comparison of Human and Animal Hair
6. Fingerprint Examination
7. DNA Pattern Recognition and Comparison
8. Application of Molecular Methods for the Forensic Examination of Non-Human Biological Traces
9. Forensic Recovery, Identification and Analysis of Explosives Traces
10. Forensic Investigation of Fire Scenes which have resulted in Fatalities*
11. Forensic Investigation of Fire Scenes which involve the Clandestine Manufacture of Improvised or Homemade Explosive Devices*
12. Forensic Investigation of Fire Scenes which Involve the Clandestine Manufacture of Illicit Synthetic Drugs*

* *The three specific areas on Forensic Investigation of Fire Scenes (numbers 10 -12) were combined into one BPM 'Investigation of Fire Scenes'.*

In the years 2014 and 2015, so-called Activity Teams have - in parallel - developed the 10 BPMs. The activities were performed within the project 'Towards European Forensic Standardisation through Best Practice Manuals (TEFSBPM)' and co-ordinated by the ENFSI Quality and Competence Committee. The realisation of the BPMs was supported by the Prevention of and Fight against Crime Programme of the European Commission – Directorate General Home Affairs (code: PROJECT HOME/2012/ISEC/MO/4000004278). The core project concept was that the BPMs will enhance the quality of the forensic services available to law enforcement and justice across Europe and thereby encourage forensic standardisation and cross-border cooperation between countries.

ENFSI expects that the issuing of this series will stimulate the improvement of already existing BPMs as well as the creation of new BPMs on disciplines that are not covered yet.

Official language
The text may be translated into other languages as required. The English language version remains the definitive version.

Further information
For further information about this publication, contact the ENFSI Secretariat. Please check the website of ENFSI (www.enfsi.eu) for update information.

Best Practice Manual for the investigation of fire scenes

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Acknowledgements

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1. AIMS

This Best Practice Manual (BPM) aims to provide a framework of procedures, quality principles, training processes and approaches for the examination of fire scenes[1]. In this series of ENFSI Practice Manuals the term "BPM" has been maintained for reasons of continuity and recognition.

This BPM can be used by Member laboratories of ENFSI, and other forensic science laboratories to establish and maintain working practices in the field of fire scene investigation that will deliver reliable results, maximize the quality of the information obtained and produce robust evidence. The use of consistent methodology and the production of more comparable results will facilitate interchange of data between laboratories.

This BPM provides guidance for the examination of fire scenes including a set of appendices which refer to detailed processes and specialist areas.

The term BPM does not imply that the practices laid out in this manual are the only acceptable practices used in fire scene investigation.

2. SCOPE

This BPM is an overarching document relating to the investigation of fire scenes which is underpinned by a set of subject specific appendices.

This BPM is aimed at experts in the field and assumes prior knowledge in the discipline. It is not a standard operating procedure. The BPM addresses the requirements of judicial systems in general terms only.

This document does not address laboratory examination of items, individual competence of practitioners (including training requirements), specific jurisdictional requirements, or country specific legal requirements.

3. DEFINITIONS AND TERMS

For the purposes of this Best Practice Manual (BPM), the relevant terms and definitions given in ENFSI documents, the ILAC G19 "Modules in Forensic Science Process", and in standards such as ISO 9000, ISO 17000 and 17020 apply. Other relevant and specific definitions are presented in each of the appendices.

4. RESOURCES

Management of the resources required for a fire scene investigation must take into consideration the appropriate and applicable areas of quality standards. It must also be recognised that many aspects of fire scene investigation will not be specifically addressed in such standards.

4.1 Personnel

Fire scene investigators have a wide range of experience, training and background knowledge which can be obtained through a variety of routes (academic, continuous professional development, vocational training, operational experience etc.).

[1] Fire scenes are defined as scenes involving fire damage and/or scenes involving gas phase explosions.

The classifications of fire investigators have been defined in general terms and are presented in appendices A1[2] and A2[3].

4.1.2 Competence requirements

Fire scene investigators must be competent and trained to their relevant national standards. Table 1 indicates knowledge and skills recommended for fire scene investigators.

Table 1: Knowledge and skill set

1.	Understanding the importance and relevance of health and safety at scenes and that this may vary depending on the scene.
2.	Understanding the importance of a structured, systematic methodological approach to fire scene investigation and excavation including the recording (e.g. written, photographic, video) of the scene investigation.
3.	Awareness of aspects of fire science and fire engineering which may have a relevance to fire investigation (e.g. fire dynamics, structural performance, passive and active fire protection systems, fire tests, and human behaviour in fire).
4.	Understanding the mechanisms of heat transfer.
5.	Understanding the differing types and mechanisms of ignition.
6.	Understanding the physical and chemical properties of solid, liquid and gaseous fuels and materials as they relate to their thermal decomposition including pyrolysis and combustion and how such fuels and materials will react when exposed to heat and to fire fighting activities.
7.	Understanding the mechanisms and influencing factors of fire growth and development in a wide range of circumstances.
8.	Understanding the interpretation of post fire indicators (including their limitations) and the use of such indicators in the determination of the area(s) of origin of a fire.
9.	Understanding the potential involvement of electricity as a cause of fire and awareness of the post fire indicators of electrical involvement.
10.	Awareness of the importance of the examination of fuses and electrical appliances and the appropriate means of securing electrical appliances post fire.
11.	Awareness of diffuse phase explosions and gas explosions including the pattern of damage.
12.	Understanding the factors which may contribute to fire fatalities including aspects such as toxicity of products of pyrolysis and combustion.
13.	Understanding the procedures relating to the recovery of items (including human fatalities) from fire scenes including the importance of continuity and integrity of evidence and chain of custody.
14.	Understanding the requirements for contamination control, appropriate packaging materials and the importance of control and comparison samples in the collection of fire debris suspected to contain ignitable liquids.
15.	Understanding of the general characteristics that suggest the production of either chemical substances or home made explosives (Appendix C1 and C2).

2 Practical Guide for First Responders to Fire Scenes, ENFSI Fire and Explosion Investigation Working Group.

3 Practical Guide for Level 2 Fire Investigators, ENFSI Fire and Explosion Investigation Working Group

16.	Understanding of the fire investigators role and responsibilities in relation to interviewing witnesses taking into consideration national legal requirements.
17.	Understanding that fire scene investigation is a destructive examination process that makes the original observations impossible for re-examination.
18.	Keep accurate and original records of casework. Prepare reports and/or statements appropriate for the national criminal justice systems. Give testimony and communicate their involvement in the case, their findings and conclusions, in a transparent, traceable and appropriate manner within their field of expertise.
19.	Understanding of the local working practices in relation to multi agency responses to fire and explosion scene investigation.
20.	Awareness of the wider specialisms as they relate to fire scene investigation (e.g. forensic chemist, forensic biologist, forensic anthropologist, technical specialists including electrical specialists, engineers etc.) and the requirements of such specialists within the investigative framework.
21.	Understanding the requirements of local criminal justice systems and in particular the rules of evidence and the obligations of being a witness with fire investigation expertise for the courts.

4.2 Equipment

A variety of equipment is used during a fire scene investigation some of which is detailed in the appendices to this BPM (Appendix A1 and A2). When using equipment in fire scene investigation consideration should be given to the following points:

- Equipment should be calibrated and maintained according to the operating manuals and periodic calibration and calibration checks must be recorded in a log book associated with the piece of equipment.
- All tools and non disposable personal protective equipment and clothing must be cleaned and free from contaminants or replaced between use at different scene locations or situations where potential cross contamination would be an issue.
- Equipment and tools must be regularly inspected and replaced if damaged to an extent that cleaning procedures are ineffective.
- Where possible, cleaned utensils and tools should be sampled prior to use and the samples retained for further testing if required.
- Equipment must be stored in such a way as to ensure minimal risk of biological or chemical contamination prior to use.
- Cleaning and sampling records of non disposable equipment must be kept where reasonably practicable.
- Where contamination may have occurred, this must be documented in the examiners scene notes.

4.3 Reference materials

Not Applicable

4.4 Accommodation and environmental conditions

Not Applicable

4.5 Materials and Reagents

In circumstances where the fire scene investigator is competent to carry out presumptive

testing, then only validated materials and reagents (for example for the presumptive testing for blood, or the swabbing of suspected blood) may be used.

5. METHODS

A comprehensive methodology for the investigation of fire scenes is presented in appendices A1 and A2.

Further appendices present the methodology for the investigation of specific types of fire scenes.

6. VALIDATION AND ESTIMATION OF UNCERTAINTY OF MEASUREMENT

6.1 Validation

The validation of the fire scene investigation process is heavily dependent on the (1) investigating organisation, (2) the skills and competency of its staff and (3) the techniques and equipment used.

(1). The investigating organisation must provide the appropriate resources to facilitate the fire investigation process to be undertaken

(2). The fire scene investigator must be appropriately qualified and competent. Their training must be documented, assessed and they must undertake both continuous professional development and maintain and demonstrate their skills and competency

(3). (a) The equipment used in fire scene investigation must be validated by testing repeatability, reproducibility, selectivity, sensitivity and robustness (including robustness at the scene using control samples where appropriate) either through reference to the professional literature or manufacturers specifications or by in-house methods.

(b) The investigative techniques (for example the recognition and interpreting of burn patterns) used in fire scene investigation can be validated using known ground truth data, literature and testing.

6.2 Estimation of uncertainty of measurement

The fire investigation process is dependent on the knowledge and skill set of the fire investigator as detailed in Section 4.1.

The identification and specification of the main sources of uncertainty relating to the decision making and hypothesis testing associated must be stated. The determination of origin, cause and, if required, subsequent fire development in a fire scene investigation must be recorded in the investigators documentation and presented in the final report.

Uncertainties in the entire fire scene investigation process arise from a number of sources which include (but may not be limited to):

- Competence of the investigator and their specific expertise and experience.
- The amount and quality of information received.
- Assumptions made during the investigation process.
- Specific environmental conditions.

- Destruction of evidence due to the fire.
- Fire fighting activities.

6.3 Peer Review

Review of reports is mandatory in some jurisdictions. It is strongly recommended that reports be critically reviewed to check that the presentation of the report is fit for purpose and to ensure that the information available at the time of the investigation and derived from the scene investigation has been interpreted appropriately. Such reviews must be recorded.

7. PROFICIENCY TESTING

There are no proficiency tests currently available for fire scene investigation. Fire investigators are advised that they should take part in a relevant collaborative exercise/test for fire scene examination periodically so that their competence can be demonstrated and assessed. This can be an internal or an external test. "Guidance on the conduct of proficiency tests and collaborative exercises within ENFSI" provides information for the ENFSI Expert Working Groups (EWGs) on how to organise effective proficiency tests (PTs) and collaborative exercises (CEs) for their members.

8. HANDLING ITEMS

8.1 At the scene

Appendices A1 and A2 provide a comprehensive methodology for the recovery of items from fire scenes including the avoidance of contamination. Further appendices provide additional information relating to specific types of fire scenes.

8.2 Sampling, preservation, packaging, labelling and documentation.

Appendices A1 and A2 provide a comprehensive methodology for the recovery of items from fire scenes including the avoidance of contamination. Further appendices provide additional information relating to specific types of fire scenes.

8.3 Transportation

The transfer of recovered items must be carried out according to local operating procedures and legislated responsibilities used by the investigating authority or the fire investigator.

During this process the fire investigator must ensure that they witness the handover of recovered items to another person or organisation and ensure that there is a written record within their notes or items list.

Items must be transported and stored in a manner which prevents contamination, degradation or damage while maintaining the security and integrity of the exhibits.

8.4 In the Laboratory

Not applicable

9. INITIAL ASSESSMENT

Within a given case, an initial scene assessment strategy must be established with all investigators involved in the process. This must be based on the information provided to them at the time and continually reviewed in light of new circumstances and information. The scene

investigation strategy must also take into account other information and evidence relevant to the specific case. This is expanded upon within the appendices.

10. PRIORITISATION AND SEQUENCE OF EXAMINATIONS

Prioritisation and the sequence of scene investigation must normally be agreed between the fire investigator and investigating authority and in accordance with local agreements (for example a memorandum of understanding or other formal agreement between agencies).
Prioritisation and the sequence of scene investigation must be documented so that decisions are recorded and reviewed and must involve an assessment of (but is not limited to) the following:

- Initial information received.
- Initial observations of the external/internal examination of the scene.
- Potential value of the examination and/or recovery of specific items within a scene to the overall investigation.
- Order of requirements of other specialists if they are required (for example, forensic chemist, forensic biologist, forensic pathologist, forensic anthropologist, technical specialists including electrical specialists, engineers etc.)
- Time constraints (which may lead to loss of potential evidential materials such as volatile compounds).
- Health and safety implications.
- Environmental conditions.

This is expanded upon within the appendices.

11. RECONSTRUCTION OF EVENTS

Reconstruction of events can be particularly relevant in fire scene investigation and can be undertaken in a number of different ways. The assumptions and limitations of reconstructions should be noted.

- *Physical reconstruction* is a process where items are replaced (as far as possible) in their original positions prior to the fire. This can assist in the fire investigator's interpretation of the area of origin, cause and subsequent fire development.
- *Ad-hoc* testing (e.g. a test burn for flammability of a material) can be carried out either at the scene or at a later stage in the investigation and must be fully recorded including any assumptions made and the value and limitations of the test.
- Use of *computer modelling* must be approached with caution and all assumptions, limitations and uncertainties associated with the models clearly recorded.
- *Full scale fire reconstructions* can be carried out in controlled conditions after the initial fire scene investigation and must use validated equipment e.g. thermocouples and other monitoring devices.

Further information is available in appendix A2.

12. EVALUATION AND INTERPRETATION

A range of hypotheses must be considered during the evaluation and interpretation of all of the information received and gathered relating to a specific scene investigation process. This is expanded upon within the appendices.

Each hypothesis must be explored systematically and, in light of this information, an overall opinion formed of the most likely origin and cause of the fire. Interpretation and an evaluative approach of the information and physical evidence presented must be used to support or reject each hypothesis. Further information is available in the ENFSI *Guideline for Evaluative Reporting in Forensic Science.*

13. PRESENTATION OF EVIDENCE

The overriding duty of those providing expert testimony is to the court. As such, evidence should be provided with honesty, integrity, objectivity and impartiality. Evidence can be provided to the court either orally or in writing.

The manner in which evidence is presented will differ depending on different legal jurisdictions. Fire investigators must comply with their legal obligations and accreditation requirements within the jurisdiction in which they are collecting and presenting their evidence.

Presentation of evidence should clearly state the results of any evaluation and interpretation of the examination.

Written reports should include all the relevant information in a clear, concise, structured and unambiguous manner as required by the relevant legal process. A checklist of the information suggested is expanded upon within the appendices.

Written reports must be peer reviewed where this is a jurisdictional requirement. Reports should clearly state the results of any evaluation and interpretation of the examination.

All viable hypotheses must be evaluated and conclusions supported by an up to date understanding of accepted methodologies and literature.

Recommendations associated with the production of written reports are expanded upon within the appendices.

14. HEALTH AND SAFETY

Health and safety, risk assessments and personal protective equipment are expanded upon within the appendices.

In addition;

- The relevant national Health and Safety Legislation must be complied with.
- Specialist equipment operated at the fire scene must be used only by those trained to do so.
- Where fire scenes contain specific risks to health and safety, for example chemical or biological hazards, special precautions and personal protection equipment (PPE) are required and are detailed in the relevant appendices.
- Counselling should be available to investigators.

15. REFERENCES

Bibliography can be found in Appendix A0

16. AMENDMENTS AGAINST PREVIOUS VERSION

Not applicable (first version)

17. TABLE OF APPENDICES

A0 - Bibliography
A1 - ENFSI Fire and Explosion Investigation practical guide for first responders to fire scenes.
A2 - ENFSI Fire and Explosion Investigation guide for level two investigators.
B1 - Investigating fire fatalities
C1 - Clandestine manufacture of controlled substances
C2 - Clandestine manufacture of home made explosives

APPENDIX A0 – BIBLIOGRAPHY

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APPENDIX A1 – FIRE AND EXPLOSION WORKING GROUP PRACTICAL GUIDE FOR FIRST RESPONDERS TO FIRE SCENES.

FIRE AND EXPLOSION INVESTIGATION WORKING GROUP

PRACTICAL GUIDE FOR FIRST RESPONDERS TO FIRE SCENES			
DOCUMENT TYPE: PRACTICALGUIDE	REF. CODE: F&EIWGBPM-001	ISSUENO: 003	ISSUE DATE: 23 March 2008

This material is part of a global educational programme for all people involved in fire investigation in Europe, including the fire investigators and forensic specialists.

This work is a harmonisation of current knowledge and material available, and is the result of a large study of the best practice used by forensic laboratories in Europe.

This guide is the result of a unique collaboration and would not have been possible without the efficient and consistent participation of the following ENFSI laboratories and guest members:

National Bureau of Investigation - Finland
Institut de Recherche Criminelle de la Gendarmerie Nationale - France
Netherlands Forensic Institute - Netherlands
National Criminal Investigation Services - Norway
National Laboratory of Forensic Science - Sweden
Ecole des Sciences Criminelles, Lausanne - Switzerland
Police Cantonale Neuchateloise–Service d'identification judiciaire - Switzerland
Forensic Science Service - UK
Centre for Forensic Science, Strathclyde University - UK
M-Scan Ltd - UK
Police Forensic Science Laboratory Dundee - UK

This guide is intended for your use and is your own property. If you have any comments, additions, suggestions or remarks, you can contact the authors at: wg-training@unil.ch

CONTENTS

1. SUMMARY

This guide is aimed at first responders attending fire and explosion[4] scenes and those individuals involved in fire and explosion scene investigation with the aim to improve their efficiency and awareness and to improve the quality of scene investigation.

Many years of experience has shown that in order to carry out fire investigation efficiently and with maximum return it is necessary to carry out the investigation in a specific order from the arrival of the first responders to any subsequent laboratory analyses. This guide indicates the key steps required of the first responder in order to ensure that subsequent examinations can be carried out effectively. An overview of the basic knowledge required to perform the first responder role is detailed as well as the information needed to facilitate the work of specialists and forensic experts acting later in the process.

Correct and contemporaneous documentation and photography is essential. This means photographing with the time and date recorded, writing notes of your activities with the time, date and your signature on every page. The importance of taking accurate and sufficient notes at the time of the examination cannot be over stated. These are your record of your actions.

<u>How to use this guide?</u>
We have decided to separate responders into three categories:

1. First responders to the scene are classed as level one
2. Level two are fire and explosion investigators with some specific training
3. Level three are fire and explosion investigators (specialists) with specific experience and expertise

This guide provides specific information for first responders (fire brigade and police personnel) in order to ensure that specific initial information and evidence is not lost. There are 5 areas of broad activity covered and the role of the first responder is explained for each stage. A checklist is provided in order to help with the collection of information.
This document is a guidance document and should be used in conjunction with other reporting and documentation required by your specific authorities including health and safety and quality system policies and procedures.

If you want to search on a specific topic, please refer to the contents and go directly to the chapter concerned. Overall investigation process at a fire scene - Look first at the summary to have an overview. Follow the advice chronologically and note relevant information using the data collection sheet. Technical terminology - See the glossary.
Use the data collection sheet to ensure that the complete information is recorded at each stage.

[4] In this practical guide when mentioning fire (scene) investigation it also includes all aspects of the investigation of dispersed phase and mechanical explosions.

2. INTRODUCTION

2.1. Preliminary comments

Remember having always the same systematic approach to each scene is essential in order to perform your role correctly and safely.

Preparation is key before attending fire scenes. You should have the following basic equipment:

- Personal Protective Equipment (PPE) (overalls, safety boots, gloves, hard hat, face mask. etc. as appropriate)
- Video and camera
- Other equipment (tools, cordon, markers, pens, sampling containers etc.)

It is advised that you prepare your own checklist of PPE and other equipment in order that you are fully prepared before attending the scene. This PPE equipment should be put on prior to entering the scene.

2.2 Safety

At the incident site safety is key.
It is necessary to carry out a risk assessment of the scene both outside and if possible inside. This is obviously of major importance and if serious risks or hazards are noted, consideration must be given as to whether or not it is possible to enter the scene. Think about your environmental conditions at any time and **don't take any risks.**

Risk assessments should be updated regularly during attendance at the incident.

Hazards include structural damage to walls and roofing making them insecure, electrical hazards, gas supply, partially damaged fuel tanks, hot or cutting metallic parts, the presence of flammable and/or toxic vapours and fumes for example pressurised gas bottles that can explode several hours after the fire has been extinguished (acetylene: up to 24 hours), etc. Consideration should also be given to the possibility that there may be incendiary devices present which have not operated.

Briefing meetings to pass on this information should be held.

3. EXTINGUISHING THE FIRE

All information should be recorded on a data collection sheet. The data collection sheet in this document may be adapted for you / your own organisations specific needs.

3.1 Record activities/details on approach/arrival, during rescue, during fire fighting and post fire period

3.1.1. En route, and near the site

Record information such as:

- The time of call and any information initially given
- People who are present (witnesses, bystanders, reporters, others)
- Cars which are present
- Anyone leaving the scene as you approach.
- Strange or specific activities of any individuals present

The prevailing weather conditions: general wind; velocity and direction should be recorded. Any changes in weather should also be recorded, this information can help in some cases to explain the spread of fire.

3.1.2. At the scene

Assess safety, evacuate/rescue personnel and stop/extinguish the fire. Make sure public safety is ensured. Record your activities as soon as is practical.

The number of fire appliances in attendance and the activities of fire fighters should also be recorded.

Observe those who are present as bystanders, if they seem to be especially interested or if they show unusual behaviour. Photographing bystanders can also be useful. Ensure that photographs are correctly dated and time is included.

Record when the owner arrives at the fire scene and their reactions to receiving the information relating to the incident.

3.2. Recording the scene (video, photographs and notes)

It is important to undertake photography and documentation as early as possible in order to record the scene fully. This should include all angles and aspects of the scene including parts which may not be on fire at the time.

Take photographs of the fire fighting activities paying particular attention to the positions of smoke and flame at the time of arrival. Recording the incident using video is also useful. Ensure that the video is dated and includes the time.

3.3 General data recording: first part of the data collection sheet

At this stage it is also possible to start collecting information from the rescue service commander (or equivalent) and the fire fighters. You can also obtain valuable information from witnesses and the property owner at an early stage. Complete the relevant parts of the data collection sheet.

3.4. Minimise damage to scene/alteration of the scene

It is important to any subsequent investigation that nothing within or outside of the scene is moved unnecessarily. While it is recognised that fire fighting activities will result in the movement of some objects and damage (e.g. to gain entry) the removal of such objects from the scene must be minimised, photographed (with time and date) and written down (with time and date). First responders should be aware that trace evidence (not always visible to the naked eye) can be added to or removed from the scene by them. Such evidence includes footwear impressions, DNA and fingerprints etc. Potential for contamination and disturbance must be carefully considered. Ways to avoid this may be by ensuring the use of items such as

disposable gloves, overshoes and scene suits together with restricting access.

First responders should be aware that any modification to the scene before arrival of the fire investigator (level 2 and/or level 3) must be recorded and well documented.

4. SECURE AND GUARD THE AREA

Strict surveillance and security measures must be put in place and maintained before and during the fire investigation.

4.1 Place a sufficiently large cordon around the area and related areas to restrict access
Cordon off a sufficiently large area around the scene of the fire in order to protect evidence and avoid damage to the scene. Ensure that as few people as possible have access to the area. You may use an inner and outer cordon if that is best practice. Ensure that the outer cordon is sufficiently large as to encompass all areas of possible evidence.

4.2. Maintain a physical presence at the cordon until informed otherwise
Cordoning off with cordon tape alone is not an efficient means of preserving a site; it is enough to keep the general public away, but it will not stop or prevent entry into the site. For this to be effective a human presence (police officer or fire fighter) at the cordon is vital. This presence should ideally be maintained at the scene until the fire investigation is complete.

4.3. Record the identity of all individuals entering and leaving the cordon.
The identity and contact details of all individuals entering the scene needs to be recorded and logged. If the scene is declared a crime scene then normal crime scene practices of maintaining a cordon log should be used. Bear in mind that the property owner or workers at the incident may become suspects at a later date and their entry to and from the premised must be monitored.

4.4. Carry out risk assessment
The outside area should be assessed for risks and hazards. These include structural safety of the building (mechanical, electrical, roof, walls, the presence of sharps such as glass or other debris etc). If necessary specialist advice may be required.

Other information about the contents and possible hazards within the site should also be noted (eg. electrical gases, asbestos, chemical hazards, other hazardous contents, aerosols and potential danger of secondary explosions).

This information needs to be communicated to the all personnel on site and in particular to the level 2 and level 3 investigators on their arrival.

5. PRESERVATION OF EVIDENCE

Fire investigation is a field of forensic science where preserving evidence is of major importance

5.1. First responder activities which may result in alteration to the scene.
It is important for any subsequent investigation that the activities of the first responder are recorded and the information given to subsequent investigators. Such information should include:

- Breaking of doors or windows
- General and specific fire fighting activities
- Subsequent damping down activities

In particular if items are moved from their original positions this must be recorded.

5.2. Do not remove any items from the scene if it can be avoided

The technical investigation of the fire is completely dependent on the preservation of evidence in and around the scene of the fire. Make sure that objects are not taken from the area and if possible discuss with fire service, health and safety and insurance company personnel how much of the scene needs to be demolished and what must be preserved.

IT IS MOST IMPORTANT THAT AS FAR AS IS POSSIBLE YOU SHOULD MOVE NOTHING WITHIN THE SCENE. It is very important that everything is kept in its original place.

5.3. If items are removed, record removal of items and where they are placed in consultation with level 2

If items must be removed from the scene, their original positions should be photographed and documented correctly. Only after this is completed should the items be removed. Items should only be removed if there is no alternative. The packaging should be in the container designated as suitable for the collection of fire samples or flammable liquids (for example metal cans, glass jars, nylon or duo bags) in accordance with relevant protocols. Items should be packaged separately to avoid cross-contamination. Particular care should be taken where packaging involves wet or damp material, sharp or heavy objects, volatile materials, potentially dangerous materials e.g. biohazards, corrosive, explosives etc both to prevent loss and avoid contamination.

All items taken should be labelled with a unique identifying mark, to allow the name of the person responsible for collecting and packaging the material to be identified, a concise and accurate description of the material, when the item was taken, location or person from where or from whom the material has been taken.

Once removed the items should be packaged and then disturbed as little as possible. Items should be stored carefully to minimise damage and contamination and signed over to the appropriate level 2 or level 3 investigator as soon as practicable.

5.4. Record/cover fragile evidence

Where there are items of potential evidence which are fragile they may require protection in situ at the scene. Their original positions should be photographed and documented correctly. The items should be covered in situ with an appropriate container and marked as fragile. Such items include footwear marks, toolmarks and other forensic evidence such as fingerprints.
If a fire or intruder alarm is present there may be only a few hours in which information can be recovered from it therefore immediate steps must be taken to secure this.

5.5. Report relevant activities to level 2 and level 3

All activities undertaken involving the gathering of information, scene preservation or the gathering of potential evidential material should be communicated to the appropriate level 2 or level 3 investigator as soon as practicable.

6. INFORMATION GATHERING TO HELP THE INVESTIGATION

After a fire, the police officer, fire fighter, fire investigator or specialist may find themselves with two extreme situations:

1. Fire propagation is limited: it is therefore quite easy to localise the origin of the fire.
2. Severe or complete destruction of a property. Extensive excavation may be required to determine the origin of the fire.

The information gathered by the first responder can help in both of these types of investigations. Some information is time dependent such as surveillance images or alarm system information and should be recovered by an appropriate person.

6.1. Complete data collection sheet
Ensure that the data collection sheet can be completed to aid in gathering the maximum amount of relevant information.

6.2. List witnesses
Make a list of possible witnesses and their contact details.

6.3 If appropriate, gather information from witnesses
Within your jurisdictional role as a first responder it may be relevant for witness interviewing to be undertaken. Ensure that such interviews comply with legislation.

Alternatively gathering information (as opposed to formal interview) from witnesses may be undertaken.

Make sure a written record is kept with the witness name and contact details. Make sure to date and sign the written record.

7. TECHNICAL INVESTIGATION

The technical investigation is carried out normally by level 2 or level 3 fire investigators. The objective is to determine the origin and cause of the fire as well as gathering information about fire spread throughout the scene.
Technical investigations may also be more specific in nature and involve the inspection of specific electrical appliances, vehicle components or chemical analyses, scene reconstructions and computer modelling amongst other activities.

7.1. Provide assistance to level 2 and level 3
Provide such assistance to the scene investigation as required by appropriate level 2 or level 3 investigators.

7.2 If appropriate, if cause is clear (or evidence will be destroyed) undertake basic investigation in consultation with level 2 and level 3
If appropriate level 2 or level 3 investigators are not available and evidence may be lost or destroyed carry out a basic examination of the scene to determine the origin and cause of the fire. Remember to take measures to avoid contamination. Also to record and document items in situ before removal, package and label any items taken appropriately, maintain

contemporaneous notes and sign and date all notes relating to the incident. On occasion it may be necessary to consult other experts e.g. Forensic Scientists. **Be careful not to overstep your area of expertise.**

8. GLOSSARY – MAIN TECHNICAL TERMS

Accelerant: an easily ignitable fuel used to speed up the rate of fire growth or facilitate fire spread; normally an ignitable liquid, but could also be a chemical mixture.
Backdraft: a deflagrative explosion of gases and smoke; occurs when air (oxygen) is introduced into a confined area where an established fire has depleted the available oxygen via the combustion process.
Combustion: a chemical reaction (oxidation) producing heat and light.
Contemporaneous: something that happens or is made/produced at the same time.
Cordon: a barrier encircling an area so as to prevent or control access into and out of it.
Deep-seated: fire occurring deep within a body of fuel as opposed to on the surface.
Deflagration: very rapid combustion producing a low energy pressure wave that travels at a speed less than the speed of sound (subsonic); for example, a gas explosion.
Detonation: extremely rapid combustion producing an intense, high energy pressure wave that travels at a speed equal to or greater than the speed of sound (supersonic); damage tends to be acute and most severe at the point of origin; possible presence of a crater.
Device: any chemical or mechanical entity used to initiate a fire or explosion.
Dropdown: collapse of burning material that causes separate, low level ignition; “curtain effect”.
Explosion: sudden conversion of energy producing a mechanical pressure wave; deflagration or detonation event.
Fire load: the total amount of fuel involved in a fire.
Flame: a cloud of burning gas that produces heat, light and often smoke.
Flameover: flaming ignition of the high-level hot gas and smoke layer in a developing compartment fire.
Flashover: the transition phase at which all combustible items within a compartment ignite; the final stage of fire growth.
Fuel: any material capable of combustion.
Ignition: to set on fire/cause an explosion; occurs when sufficient energy, normally in the form of heat, has been transferred to a fuel so that combustion results.
Ignition, spontaneous: internal chemical or biological process that produces sufficient heat to ignite the reacting fuel; occurs without any external ignition source.
Liquid, combustible: liquid that is capable of burning but which cannot be ignited at ambient temperature; requires heating for ignition to occur.
Liquid, ignitable: liquid that can be ignited at ambient temperature; combustion is self-sustaining.
Origin, point of: the exact location at which a fire or explosion was first ignited.
Oxidation: chemical reaction involving the combination of oxygen with a fuel.
Plume: the column of hot gases generated by a flame; gas movement occurs by convection.
Propagation: fire spread from one area to another.
Scene: cordoned off area that is of interest to an investigation.
Seat of fire: general area where the main body of fire damage was sustained; not always the point of origin.
Smouldering: combustion without visible flames; direct reaction between a solid fuel and atmospheric oxygen that produces heat and often light and smoke.
Soot: solid residue, produced by incomplete combustion, that is deposited on objects as a result of a fire.

Trailer: fuel that physically links more than one area of a scene, deliberately placed so as to facilitate fire propagation.
Vented: fire and/or smoke that extends outside of a structure or compartment; occurs through destruction of windows, doors and/or the roof.
Volatile: combustible substance that evaporates easily; liquid with a low boiling point.
"V" pattern: pattern produced on a vertical surface that results from the combustion of a compact area of fuel; not necessarily the point of origin.

9. DATA COLLECTION SHEET

INITIAL CALL

Date: _____ Time: _____

Location /address of incident:

Type of property:

Owner:

If the fire involved a vehicle

Manufacturer: _____ Model: _____ Colour: _____

VIN: _____ Number Plate: _____

Type of Fuel: _____

Details of the call:

Recorded call (yes / no)

Signature/initials: Date:

FIRST RESPONDER

Name/Organisation: _____

Phone number: _____

Date and time of call to the scene _____

Date and time of attendance _____

Signature/initials: Date:

FIRE BRIGADE

Date and time of call_____

Date and time of arrival at the scene _____

Date and time fire was extinguished _____

What fuel-driven equipment did the Fire Service use? Indicate the equipment and type of fuel

_____

Signature/initials: Date:

Details of access gained by Fire Service

Signature/initials: Date:

What methods of extinguishing were used by the Fire Service (where and when)

Signature/initials: Date:

What damage to the property was caused by the Fire Service? What tools were used?

Signature/initials: Date:

SAFETY

Have you carried out your risk assessment of the scene YES/ NO

Has the building been assessed for safety YES/NO

Is there electrical supply? YES/NO

Has electric supply been disconnected? YES/NO

Is there a gas supply? YES/NO

Has gas been disconnected? YES/NO

Is it worth noting down hazards identified?

Please give details including contact details of anyone involved in any of the above.

Signature/initials: Date:

Were any flames observed from the gas supply if present? YES/NO

Any other available information on safety aspects of the property (e.g. from the owner)

Signature/initials: Date:

GENERAL INFORMATION

Colour of Smoke _____ Smell of Smoke_____

Flame Colour _____ Intensity of flames _____

If appropriate – record this here for different areas of the fire.

Signature/initials: Date:

General weather conditions during fire (wind speed/direction, thunderstorms etc.)

Signature/initials: Date:

Any fire/smoke/burglar alarms? (Delete as appropriate)

If yes, have you contacted anyone to ensure the recovery of available information. YES/NO

Any obvious signs of forced entry? YES/NO

Details of windows (any breakages, caused by fire/other, order of breaking/ signs of force)

Signature/initials: Date:

Details of doors and locks (open/closed/blocked/forced etc).

Signature/initials: Date:

Were there any electrical appliances (including lights) or gas appliances still operating, if so where?

Signature/initials: Date:

Did you find any indication of ignitable liquids at or near scene? (smell,containers,etc)

Signature/initials: Date:

Any evidence of multiple seats of fire? If yes, explain.

Signature/initials: Date:

Details of victims and current location (either within the scene or elsewhere). If a fatality record the position of the body and clothing at the time of your attendance.

Signature/initials: Date:

Details of occupants (name/date of birth /sex/ contact details etc.)

Signature/initials: Date:

Details of witnesses (name, address, contact phone number).

Signature/initials: Date:

Further observations regarding witnesses (injuries, clothing etc)

Details of any other persons in the vicinity of the scene and their activities. Have these people been noticed at scenes before? Were they acting unusually?

Signature/initials: Date:

Are there any tyre tracks or footwear marks leading to/from the scene.
If yes have you ensured their protection – give details.

Signature/initials: Date:

'Could bloodstaining, fingerprints or other forensic evidence be important? If yes have you ensured their protection - give details'

Have you noticed any surveillance cameras nearby? YES/NO
(note the location on your sketch)

Have you alerted the relevant authority so the images can be seized? YES/NO

Did any member of the public make any video recording or take photographs of the fire? If so give contact details.

Signature/initials: Date:

Has any Infra Red video/photography been used? If so give contact details.

Signature/initials: Date:

Using separate sheet, sketch the property and indicate extent of damage on arrival and fire progression. Indicate on the sketch the position of any stock/furniture and electrical and gas appliances. Also indicate if any items that have been moved or modified by the fire brigade during the extinguishing process and any unusual blockages of furniture which may have been present. Also indicate the position of any bodies, tools or weapons discovered.

SKETCH of the site

Smoke traces		Indicate North on the sketch
Outline of fire as seen by the first witness		
Partial burned areas		
Heat effected areas		
Outline of burned area		
Flame progression		

Signature/initials: Date:

Signature/initials: Date:

Signature/initials: Date:

Signature/initials: Date:

10. APPENDIX – AIDE MEMOIRE

ACTIONS FOR THE FIRST RESPONDER TO FIRE SCENES

- Consider your personal safety and that of others.
- Record all activities using video, photographs and notes at all stages including the date and time.
- Secure the area to restrict access.
- Minimise damage or alteration of the scene.
- Preserve evidence in situ whenever possible.
- Gather information using the data collection sheet.
- Contact the appropriate investigator as soon as possible and pass all information including the data collection sheet on to them.

APPENDIX A2 – FIRE AND EXPLOSION WORKING GROUP GUIDE FOR LEVEL TWO INVESTIGATORS.

FIRE AND EXPLOSION INVESTIGATION WORKING GROUP

GUIDE FOR LEVEL TWO INVESTIGATORS			
DOCUMENT TYPE: PRACTICALGUIDE	REF. CODE:	ISSUENO:	ISSUE DATE: **DUE 2016**

APPENDIX B1 - INVESTIGATING FIRE FATALITIES

1.1 INTRODUCTION

When human remains are found or suspected to be within a fire scene their recovery must be undertaken by practitioners who have the competence to do so. However, all fire scene investigators must have an awareness of how such remains should be preserved and protected during the fire scene investigation process.

1.2 HEALTH AND SAFETY

There are a number of specific risks associated with the location and recovery of human remains within a fire scene. These risks vary in type and severity depending on the degree of damage to the body. Full personal protective equipment (including masks and goggles) for biological hazards must be worn based on the hazards identified. Counseling must be available for anyone who comes in contact with human remains.

1.2.1 Sharps
As a result of the fire, a body is exposed to both heat and impact damage for example due to falling debris and structural collapse. Loss of soft tissue due to heat can expose fractured bone which in turn pose a sharps risk to those handling the remains.

1.2.2 Biological hazards
Soft tissue damage can expose internal organs and bodily fluids which can contain potentially harmful bacterial and virus', these in turn pose a risk to those handling the remains both by inhalation and by direct contact.

1.2.3 Psychological risks
Observing and handling human remains carries the potential for psychological distress.

1.3 GENERAL INDICATORS OF THE PRESENCE OF HUMAN REMAINS

The physical condition of human remains will vary dependent upon the severity of the fire and/ or the length of time which the body has been exposed to the heat flux within the fire scene. Heat and fire fighting activities can cause extensive fragmentation and dispersion of the remains however the remains are still present within the scene to be recovered. The stages of damage listed below are not clearly defined but are part of a dynamic process that will vary on a scene by scene basis.

- Minimal heat damage,
- Pugilistic pose associated with some soft tissue damage
- Pugilistic pose associated with fragmentation of limb bones and exposure of the skull.
- Extensive loss of soft tissue, fragmentation of limb bones, exposure and fragmentation of skull and ribs, some loss of tissue and fragmentation of torso.
- Complete loss of soft tissue and fragmentation of bones, those left powder on touch.

1.4 SCENE EVALUATION

If human remains are suspected to be present in a scene at any stage of the scene examination, standard operating procedures for the recovery of human remains should

be initiated and re-evaluation of the risks and handling of the scene must be carried out. Consultation with the appropriate specialist/expert must be part of this process of re-evaluation, such specialists could include a forensic pathologist, forensic anthropologist etc.

In cases where the recovery of human remains is required the following procedures must be followed ;

1. The location of the body (including nearby debris on or surrounding the body and protected areas under or near the body) must be recorded and include a measured plan of the environment.
2. The position of the body must be recorded.
3. Photography of the teeth and fingerprinting should be considered prior to handling of the body depending on its condition.
4. Handling of the remains must be kept to a minimum.
5. Based on the condition of the body and the agreed scene examination strategy, samples (fingernail scrapings, biological evidence, trace evidence, clothing etc.) may be taken *in situ*. This is particularly the case if areas of the body have been protected from the effects of the fire for example by clothing or fallen debris.
6. Personal possessions and any clothing or wrapping associated with the body must be photographed and documented *in situ* prior to recovering, packaging and labelling.
7. Where applicable the body should be turned over within the scene and photographed. The area underneath the body should be recorded and carefully excavated.
8. For bodies that have become fragmented, the fragments may have spread as a result of fire suppression activities and all attempts should be made to maximise the recovery of these fragments in such cases consultation with forensic anthropologists or forensic pathologists is advisable to ensure maximum recovery. Discussing fire suppression activities with the first responders will help in this respect. The location of all fragments must be recorded.
9. For situations where bone is exposed and has become fragile through heat exposure, stabilising chemicals or wrapping materials (such as cling film) can be considered if their use prevents further fragmentation or deterioration. Chemicals must be used with extreme caution and control samples of any chemicals and wrapping materials should also be supplied.
10. Body fragments can adhere to other items of debris (melty bits) and this debris should be carefully checked prior to removal from the scene.
11. In scenes where human remains are in danger of further damage and the body cannot be recovered quickly, it is the role of the fire investigator to initiate contact with the appropriate specialists as soon as possible and act upon the advice of these specialists in relation to the protection of the remains.
12. Human remains must be placed in cold storage as soon as possible after recovery.

APPENDIX C1 – CLANDESTINE MANUFACTURE OF CONTROLLED SUBSTANCES.

1.1 INTRODUCTION

A clandestine laboratory is any laboratory or facility that illegally manufactures controlled substances, or converts precursor chemicals into controlled substances. This includes the production of stimulants, depressants, hallucinogens and narcotics, (e.g. methamphetamine, amphetamine, heroin, cannabis), as well as an ever changing number of controlled analogs and designer substances collectively known as New Psychoactive Substances (e.g. substituted cathinones, synthetic cannabinoids). It also includes chemical processes which convert pre-precursor chemicals (e.g. APAAN) into precursor chemicals.

Clandestine laboratory premises can be encountered in almost any location usually houses, garages, industrial buildings, warehouses, motor vehicles and caravans. The chemical processes use equipment and recipes of varying degree of sophistication. Many of the chemicals found at a clandestine laboratory have a wide range of legal uses from which they have been diverted.

Cannabis has traditionally been grown outdoors but there has been an increasing tendency for indoor cultivation. This can be found in domestic or commercial premises and can be located in closets, basements etc. depending on the scale and sophistication of the production. Indoor cultivation is often hydroponic where plant nutrients and water are fed into the growing medium.

1.2 HEALTH AND SAFETY

It is critical for all responders to the scene to be able to identify the levels of risk as well as types of protection needed for the particular incident under investigation. Full personal protective equipment (including breathing apparatus) for chemical hazards must be worn based on the scale of the production process and the nature of the chemical or biological hazards identified. Based on the hazards identified, appropriate decontamination procedures must be deployed.

Clandestine laboratories pose specific and serious health threats due to;

1.2.1 Chemicals

There are many hazardous highly flammable chemicals (e.g. large amounts of solvents), explosive and corrosive chemicals (e.g. strong acids, bases), as well as toxic and carcinogenic substances. These pose immediate and long term risks to human health and the environment. Dangers also arise where mixtures of chemical waste are present and chemical spills can further result in inhalation of toxic levels of solvents, acids, cyanide etc. Additional dangers arise from a lack of control measures, unlabeled or mislabeled chemicals and inappropriate ventilation within the ‘laboratory’ that can increase the risk to responders.

1.2.2 Structural modifications

Premises are often modified in order to facilitate the laboratory function. This may cause increased risk to building integrity and reduced ventilation by removal or alteration of supporting structures. Poor ventilation can cause risk of inhalation of chemicals as well as high humidity levels which can result in elevated airborne levels of mould spores posing potential health hazards e.g. respiratory diseases.

Gas and electricity supplies may be altered causing an increased risk of fire, explosion and electrocution. Modification to water supplies may pose a risk due to reduction in water flow or contamination of water by chemicals.

1.2.3 Equipment

Home made and/or modified equipment can result in their catastrophic failure leading to an increased risk of explosion and fire.

The presence of gas cylinders cause an increased risk of explosion and fire.

Carbon dioxide generators are utilised in cannabis cultivation and pose a risk of suffocation.

1.2.4 Booby-traps

All responders should be aware of the possible presence of booby traps such as (but not limited to) electrified metal plates at door thresholds, wiring door and window handles to mains electricity supplies and the use of sharp objects strategically placed at entry points.

1.3 GENERAL INDICATORS OF CLANDESTINE MANUFACTURE OF CONTROLLED SUBSTANCES

Indicators which may alert fire investigators to the possible presence of a clandestine laboratory during the initial assessment may include the following:

- Unusual odors such as solvents, ammonia etc.
- Covered or painted over windows.
- Unusual or excessive security measures for the type of premises e.g. cameras, high fences, locked/chained gates, bars on windows, guard dogs, booby traps.
- Laboratory glassware /equipment.
- Chemicals, marked and unmarked chemical containers, unusual amounts of cold remedies.
- Unusual use or location of heating, cooling or pressurized equipment.
- Unusual ventilation equipment (pipes, fans etc.).
- Large amounts of full and/or empty chemical containers kept inside or in the vicinity of the premises.
- Observation by neighbours of odours, smoke, dumping of waste.
- Evidence of cooking rings and burnt utensils.
- Chemical and/or oil spillages and stains on surfaces.
- Unusual stained coffee filters.
- Discarded cling film and foil.
- Drug recipe books and notes (hand written and printed).
- Internet references for drug production.

1.3.1 Cannabis cultivation

Some specific equipment associated with the cultivation of cannabis include;

- Growing medium eg clay pebbles, perlite, coco shell, rockwool.
- Seeds.
- Germinating discs.
- Nutrients, fertilizer, vitamins, minerals and/or pesticides.
- pH meters.

- Electrical conductivity meters.
- Thermometers.
- Carbon dioxide cylinders/generators.
- Extractor fans.
- Ventilation ducting.
- Carbon filters.
- Light bulbs eg neon, LED, silver halide, high pressure sodium.
- Light reflectors.
- Electrical timers.
- Extensive wiring.
- Aluminium foil sheeting for lining walls and ceilings.
- Watering system eg drip feed system with associated piping, capillary mats, misters, water pump.
- Written instructions on cultivation process including watering/ lighting/ feeding.
- Various pots and trays.
- Plant and growing medium waste.

1.4 SCENE EVALUATION

If a clandestine manufacturing process is suspected at any stage of the scene examination, standard operating procedures for the handling of hazardous materials must be initiated and re-evaluation of the risks and handling of the scene must be carried out. Consultation with the appropriate specialist/expert must be part of this process of re-evaluation.

In addition to the fire investigation a separate scene investigation may be carried out to investigate the chemical manufacturing process. This will involve appropriate specialists which may include, forensic chemists, safety officers, environmental officers and decontamination/ clean up personnel etc.

An overall strategy should be discussed and agreed to prior to any activities commencing in relation to both the fire scene investigation and the investigation of the chemical manufacturing process. This must include (but is not limited to);

- scene preservation including restriction of access to the scene.
- health and safety including the chemical or biological hazards present.
- evacuation of the immediate area or extension of a ‘safe zone’.
- safe shut down of any chemical processes in operation.
- identification of the chemical process involved where possible.
- prioritisation of the scene examination in order to maximize the recovery of relevant evidence for both the fire scene investigation and the investigation of the clandestine laboratory.

FLOW CHART A :
CHEMICALS USED IN THE SYNTHESIS OF CONTROLLED DRUG SUBSTANCES.

Controlled Substances

Amphetamine, Methamphetamine

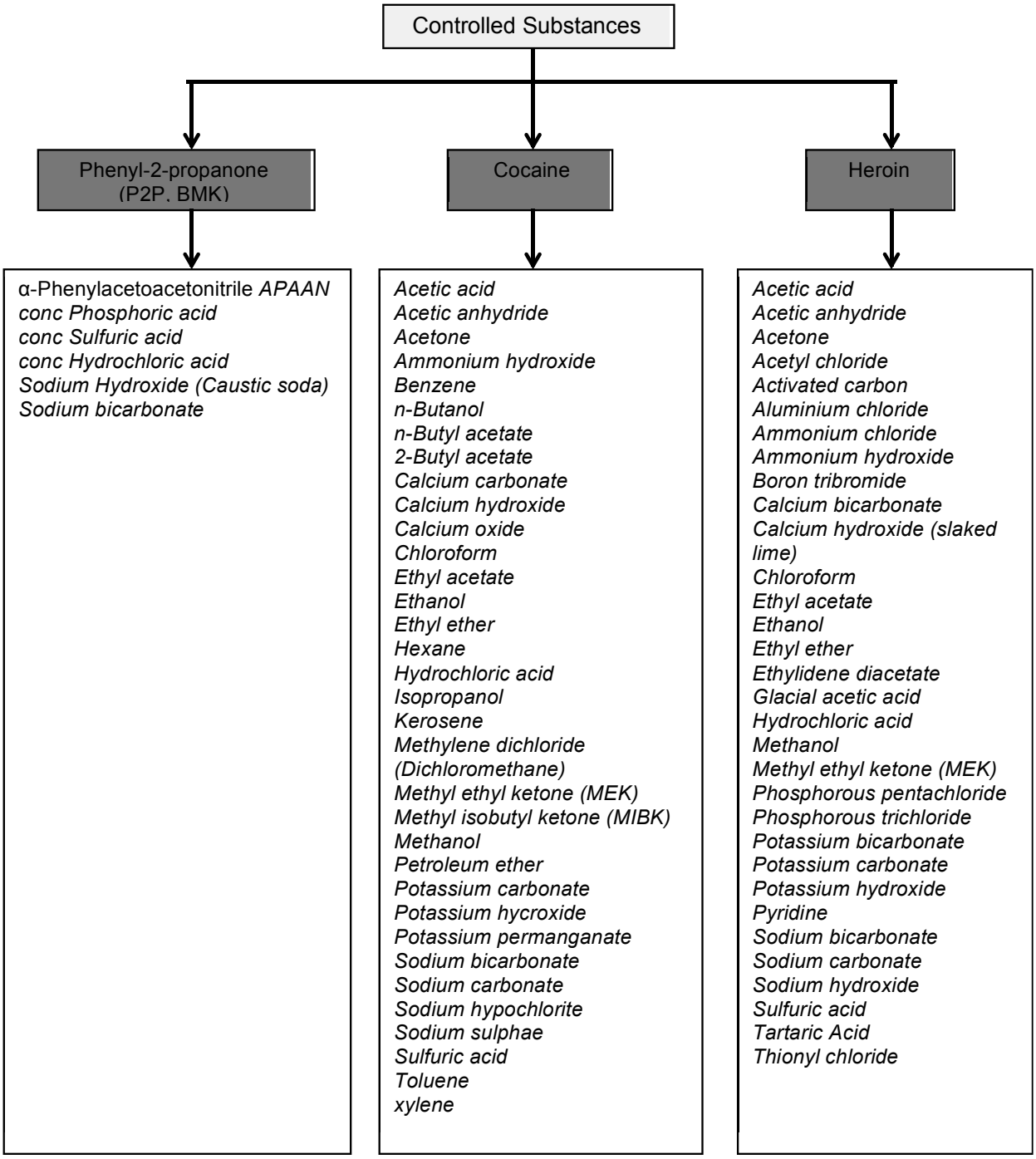
Acetic acid
Acetic anhydride
Acetone
Acetaldehyde
Acetonitrile
Aluminium chloride
Ammonia (gas)
Ammonium acetate
Ammonium carbonate
Ammonium chloride
Ammonium formate
Ammonium hydroxide
Benzaldehyde
Benzene
Benzyl chloride
Bromobenzene
Butylamine
Calcium hydroxide
Copper (metal)
Chloroform
Ephedrine
Ethyl acetate
Ethanol
Ethyl ether
n-Ethyl ephedrine
n Ethyl pseudoephedrine
Ferric chloride
Formamide
Formic acid
Hexane
Hydriodic Acid
Hydrochloric acid
Hydrogen peroxide
Iodine
Isopropanol
Lithium Aluminium Chloride
Magnesium (metal)
Mercury (metal)
Mercuric chloride
Methanol
Methylamine
Methylene chloride
N Methyl ephedrine

Methyl formamide
N Methyl pseudoephedrine
Nitric acid
Nitroethane
Norpseudoephedrine
Oxalic acid
Palladium black
Perchloric acid
Petroleum ether
Phenylacetic acid
1-Phenyl-2-propanone (P2P,BMK)
Phenyl propanolamine
Red phosphorus
Phosphorous pentachloride
Platinum (metal)
Platinum (IV) dioxide
Potassium
Potassium hydroxide
Pseudoephedrine
Pyridine
Raney Nickel
Sodium (metal)
Sodium acetate
Sodium bicarbonate
Sodium borohydrate
Sodium hydroxide
Sodium sulphate
Sulfuric acid
Tartaric acid
Tetrahydrofuran
Thionyl chloride
Toluene

Methylenedioxymethamphetamine (MDMA)

Acetic acid
Acetone
Aluminium (metal)
Aluminium chloride
Ammonia (gas)
Ammonium acetate
Ammonium chloride
Ammonium hydroxide
Benzene
Chloroform
Cuprous oxide
Dibromethane
Diethylamine
Dimethylformamide
Ethylamine
Ethanol
Ethyl ether
Formic acid
Hydrochloric acid
Isopropanol
Isosafrole
Mercuric bromide
Mercuric chloride
Methanol
Methylamine
Methylenedichloride (Dichloromethane)
3,4Methylenedioxyphenyl-2-propanone (PMK)
PMK Glycidate
Oxalic acid
Palladium black
Piperonal
Piperonyl alcohol
Platinum metal
Platinum dioxide
Potassium hydroxide
Raney Nickel
Safrole
Sodium bicarbonate
Sodium carbonate
Sodium dichromate
Sodium hydroxide
Sulfuric acid
Toluene

FLOW CHART A (CONTINUED) : CHEMICALS USED IN THE SYNTHESIS OF CONTROLLED DRUG SUBSTANCES .



FLOW CHART B : EQUIPMENT COMMONLY USED FOR THE SYNTHESIS OF CONTROLLED DRUG SUBSTANCES.

Common equipment : Balances, thermometers, freezers, buckets, barrels, tubs; mixing devices; pH meter or paper; separation funnels, centrifuge, glass jars or modified soft drink bottles, packaging equipment, tableting press, heat sealing equipment, cling film, polythene bags, drying cupboard or drying rack.

Equipment used for the synthesis of specific controlled substances

Methamphetamine	Amphetamine	Methylenedioxy-methamphetamine (MDMA)
Heat source e.g. heating mantles, hot plates, Bunsen burners, camping stoves *Cans of camping fuel* *Match boxes or striking surfaces from match boxes* *Flares (pyrotechnic)* *Filtration equipment e.g. vacuum filtration, coffee filters, filter papers, funnels, cotton wool balls, adapted petrol can/gas canisters* *Hair dryer, fan* *Freezer*	*Heat source e.g. electric heating mantles, Gas burners* *Glass reaction vessels, Custom made glassware* *Reflux condenser* *Separation funnels,* *Steam distillation equipment,* *Tubing* *Vacuum pump* *Large scale industrial equipment e.g. stainless steel reaction vessels, condenser tubes, refluxers, distillation and separation apparatus*	*Heat source e.g. electric heating mantles* *Reaction vessel (jerry can, plastic container or stainless steel vessel);* *Condenser tube;* *Glassware.* *Distillation equipment (industrial and/or custom-made);* *Vacuum flask;* *Buchner funnel with filtration paper;* *Vacuum pump;* *Gas bottles;*

FLOW CHART C : HOUSEHOLD PRODUCTS COMMONLY USED FOR THE SYNTHESIS OF METHAMPHETAMINE.

Household products	Chemical
Precursor source	***Precursor chemicals***
Weight loss products, Cold medication e.g.Sudafed,	*Ephedrine/Pseudoephedrine*
Plant material	*Ephedra*
Vasoconstrictor	*Phenylpropanolamine*
Source of Essential chemical	***Essential chemicals***
Aluminum foil	*Aluminum foil*
Photographic development solvent	*Methylamine*
Lithium batteries	*Lithium*
Matchbooks and matchbook striker surface	*Red phosphorous*
Iodine tinctures	*Iodine*
Etching solvent, wood preserver	*Mercuric chloride*
Hair bleach	*Hydrogen peroxide*
Food preservative	*Phosphinic acid*
Precious metals, jewellery, dentistry	*Platinum*
Table salt	*Sodium chloride*
Epsom salt, fertilizer	*Magnesium sulfate*
Source of Solvents	***Solvents***
Mineral spirits	*Mineral spirits*
Charcoal lighter fluid	*Charcoal lighter fluid*
Camping fuel	*Camping fuel*
Denatured alcohol	*Ethanol*
Nail varnish remover	*Acetone*
Paint remover	*Dichloromethane*
Methylated spirit	*Methylated spirit*
Air conditioning refrigerant, crop fertilizer	*Anhydrous ammonia*
Antifreeze	*Ethylene glycol, propylene glycol*
Dyes, lacquers ,varnish	*Benzene*
Engine starter fluid	*Ethyl ether*
Gas line, antifreeze, brake cleaner fluid	*Methanol*
Lye, drain cleaner, caustic soda	*Sodium hydroxide*
Paint thinner, brake cleaner	*Toluene*
Concrete cleaner	*Hydrochloric acid*
Concrete cleaner, disinfectant	*Hydriodic acid*
Battery acid	*Sulfuric acid*
Dry cleaning fluid	*Trichloroethylene*
Vinegar	*Acetic acid*

APPENDIX C2 – CLANDESTINE MANUFACTURE OF HOME MADE EXPLOSIVES

1.1 INTRODUCTION

Explosive materials include conventional high explosives, quantities of small arms propellant, fireworks, other pyrotechnic materials, incendiary mixtures and home made explosive mixtures. Explosives are sensitive to heat, shock, friction and electrostatic discharge; sensitivity will vary based on the type of explosive. However, all can explode violently if mishandled. Some home made explosives may be manufactured in a cold water bath or be stored in a refrigerator or packed in ice to ensure that they remain inert.

Home made explosives can be made from commonly available chemicals. They can be more or less sensitive than commercial explosives depending on the formulation, starting materials, purity and the methods of manufacture.

Many chemicals can be obtained from chemical companies in pure form or from readily available household or industrial products. Flowchart D provides some examples of the commonly encountered chemicals used in the manufacture of home made explosives, together with their physical appearance.

1.1.1 Appearance

Some home made explosives may be found as crystalline solids that have settled to the bottom of a liquid filled container. Some may float on the top of a liquid. Other home made explosives may appear as non-crystalline solids. Residues of explosives may be left in mixing or storage containers; these can be extremely hazardous.

Colour and smell is not always a good indicator of the presence of explosives as this will vary depending on several factors, including starting products and purity.

1.2 HEALTH AND SAFETY

It is important to look at the circumstances of a scene in their entirety. These types of scenes are not always clean and tidy environments, and time should be taken to assess the scene carefully.

DO NOT HANDLE any items believed to be involved in the manufacture of home made explosives; contact an expert immediately.

1.3 GENERAL INDICATORS OF HOME MADE MANUFACTURE OF EXPLOSIVE SUBSTANCES

The manufacture of home made explosives does not require specialist scientific equipment include but are not limited to:

- food mixers,
- coffee grinders and blenders;
- beakers, glass jars, glass containers,
- buckets and bowls;
- saucepans
- conventional kitchen hob or electric hot plate;
- cold water bath or ice bath.

Specialist tools are also not required. Many tools used in household DIY are suitable and include but are not limited to:

- pliers,
- screwdrivers,
- soldering iron and solder,
- hammers,
- batteries,
- bulbs,
- wires,
- circuit boards,
- commercial electronic items such as switches, timers and clocks
- Home made detonators.
- Modified mobile phones.

1.4. SCENE EVALUATION

If the manufacture of home made explosives is suspected, procedures for the handling of hazardous materials must be initiated and re-evaluation of the risks and handling of the scene must be carried out. Consultation with the appropriate specialist in explosives ordnance disposal (EOD, Bomb disposal) must be part of this process of re-evaluation.

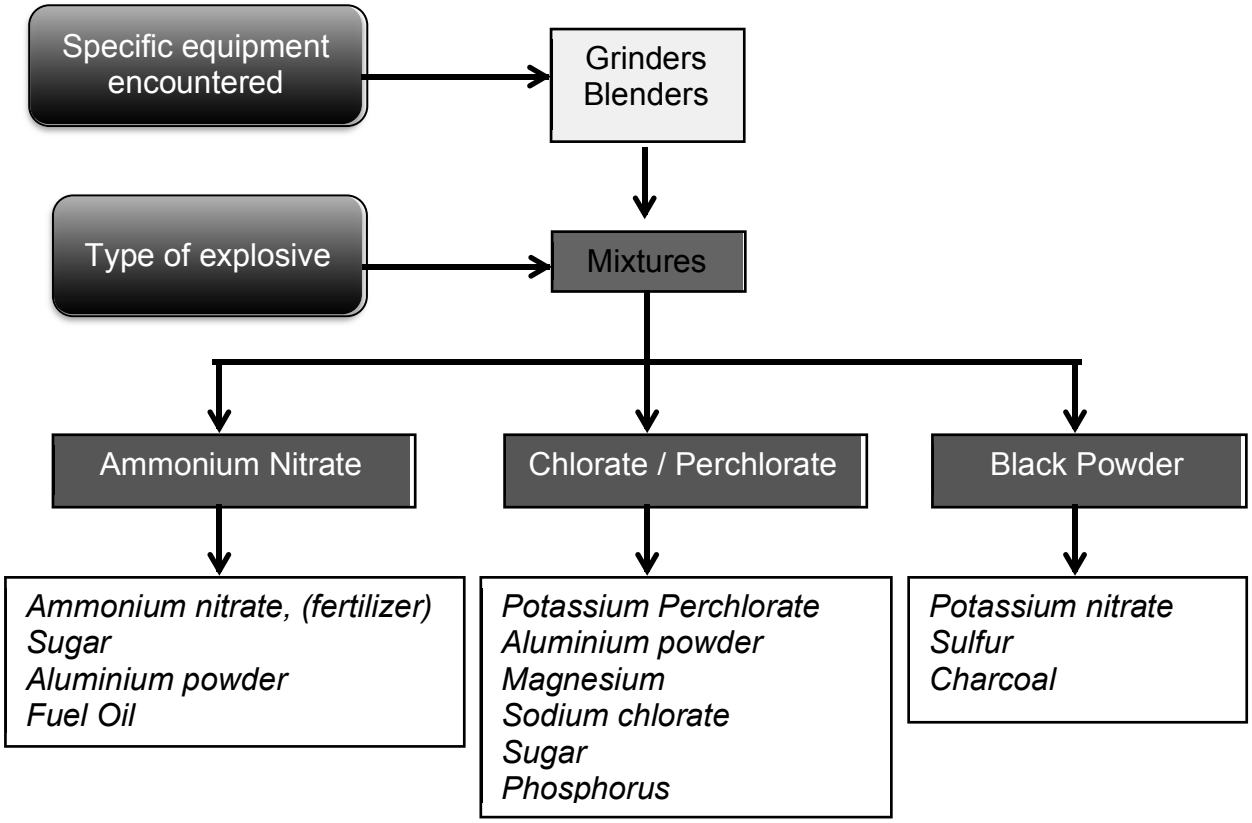
In addition to the fire investigation, a separate scene investigation may be carried out to investigate the home made explosive manufacturing process. This will involve appropriate specialists which may include explosive experts, safety officers and decontamination/clean up personnel etc.

An overall multi agency strategy should be discussed and agreed prior to any activities commencing. The strategy should include both the fire scene investigation and the home made explosive manufacturing process. It should be borne in mind that further destruction may be required if the home made explosive material needs to be made safe by EOD or bomb disposal specialists.

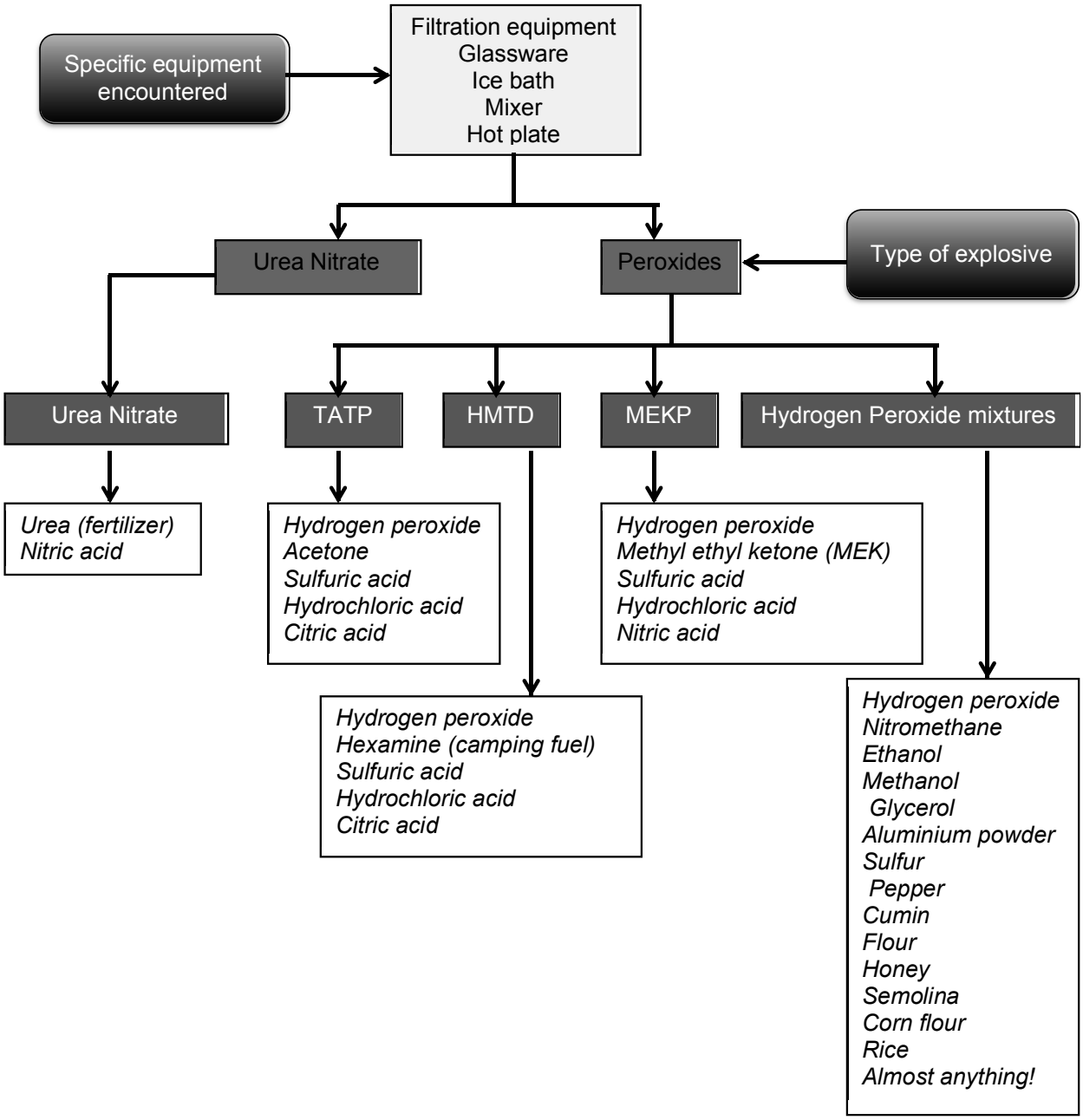
The strategy must include (but is not limited to);

- evacuation plan of the immediate area.
- scene preservation including restriction of access to the scene, creation of different zones within the scene etc.
- health and safety including the chemical and explosive hazards present.
- identification of the home made explosive manufacturing process involved where possible.
- safe shut down of any chemical processes in operation.
- prioritisation of the scene examination in order to maximize the recovery of relevant evidence for both the fire scene investigation and the investigation of the preparation of the home made explosive material(s).

FLOW CHART D1 : MATERIALS COMMONLY USED FOR THE SYNTHESIS OF HOMEMADE EXPLOSIVES



FLOW CHART D2 : MATERIALS COMMONLY USED FOR THE SYNTHESIS OF HOMEMADE EXPLOSIVES



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