ARSON INVESTIGATION

ABOUT THE AUTHOR

Thomas J. Bouquard brings over forty years of experience in law enforcement and arson investigation to the table. In 1951, Captain Bouquard became an active member of the United States Navy and he served his country in the Korean War. When he returned in 1956, he joined the New York State police force and soon transferred to the Buffalo Fire Department, becoming the Acting Battalion Chief in 1985 and an Internal Affairs officer in 1990. Although he retired in 1992, he still remains involved in the field of arson investigation through his copious writing and research. Through this book, he hopes to share some of his accumulated knowledge with the young men and women who are the future of law enforcement.

Second Edition

ARSON INVESTIGATION

The Step-by-Step Procedure

By

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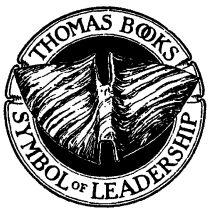
Buffalo, New York



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This book is dedicated to those who have given all
and to those who answered the last alarm.

PREFACE

We must stop and look at the thin blue line, for we the people are losing the protectors of our families. Due to the ever-changing political world, the vast influx of new ideas, and the consolidation of many firehouses in older cities, we are destroying the very basis of firefighting. New knowledge is always valuable, but even the most highly educated firefighter must learn from experience–either his own or that of the old guard that came before him.

The crime of arson is an ever-growing problem in modern society. It is a *must* to keep the investigators in the field and the teachers of the subject abreast of the ever-growing changes. It is because of the abundance of material and new scientific methods that we must update and keep everyone on the same page. It is therefore the intent of this book to bring new material and new patterns or guides into the class. I hope the instructor and the attorneys in the field will use it to augment their own procedures.

T. J. B.

INTRODUCTION

To help the user get the most out of this text, we will follow the step-by-step procedure as closely as possible. Each chapter is an update of the original chapters, which means that all the information given in the new text will follow and update the original text. My primary intention throughout, as before, is to aid the investigator, instructor, and attorney throughout their investigation, instruction, and court appearances. As the International Association of Arson Investigators states, I believe that the standardization of procedures is a necessity in this endeavor. The profession of arson investigation is a noble and multi-faceted profession. Although it is difficult to become a true expert in the field, many investigators will be required to testify in court and take the position of an "expert witness." I hope that teachers of this subject will keep this in mind.

THE STEP-BY-STEP PROCEDURE

1. As soon as an investigator is called to investigate a fire, he or she should immediately start a case numbered notebook. This notebook should have all information sources from the investigation:
   A. Case number
   B. Names of all personnel assigned to investigate
   C. Time and date of fire (and date and time called)
   D. Fire dispatch incident number
   E. Time and date the investigator reported onto the scene of the fire
   F. Name and rank of the fire officer requesting an investigation
   G. How the alarm was received
   H. Fire knowledge concerning LIVECOWWAAT
2. The investigator must determine the following items before he actually starts to probe the fire scene:
   A. What are the legal grounds? This is probably the most important question to answer. If there are any areas of concern he must check

the situation out thoroughly.

B. The investigator should never go to the scene without the tools of his trade. The common items are turn-out clothes, a flashlight, sample bottles, boxes, rakes, and even small gardening tools.
C. Has the fire been protected? How was it protected? Was any evidence found? Immediately upon his arrival on the scene, the investigator should report to the Chief Officer in charge of fire.

3. The fire investigation team usually consists of two people, one of whom takes the outside area of the fire scene. When a fatal fire is involved, all departments necessary should be brought to bear. Firefighters should remember that all natural and accidental causes must be ruled out to claim that there was an arson fire:
   A. Check crowds and look for the person who reported the fire. Talk to anybody who thinks they have important information about the fire. The investigator should take notes or use a tape recorder if possible.
   B. Interview the first officer on the scene of the fire and the chief officer in-charge of the fire first.
   C. Take accurate drawings and photographs.
   D. The investigator should systematically search the area around the fire and secure any items that may be remotely connected to the incident. Trace evidence, which is very important, may be found here.
   E. The outside burn pattern and the placement of all lines should be noted and photographed when possible. The wind, weather, and any other climatic conditions should be noted.
   F. Tag and secure any evidence found and put into a locked trunk, following the rules of evidence set up by the courts and your prosecutor.
4. The fire investigation scene inside the building must be handled thoroughly. This means the investigators should start from the point of highest burn and work down to the area of lowest burn.
   A. Reconstruct the original scene before the fire. On-scene drawings and photographs only show the fire after the incident.
   B. Check all standard procedures and organize other information such as photography at the scene of a fire to set up a sequence or scenario where possible. For more information on this subject see Chapters one, two, and eleven in this text.
   C. Begin a systematic inspection of the entire building. This inspection should examine permits given for license, occupancy, etc. This means starting at the uppermost part of the building and ending in the lowest area or basement. The investigator must check to see where the low burn is and follow procedures set by the team.
   D. Determine the point of origin. Although this task is relatively easy at some fires, it may be impossible at others. Instead, the investigator

must narrow the possibilities down to a given area. The best results are obtained by using all other resources and departments available. Usually a firefighter can determine the intensity of fire in various areas of the building, but remember that there may be more than one point of origin.

E. The causes of fire are: accidental, negligence, or incendiary. Establish the cause of the fire beyond a reasonable doubt. Again, you must eliminate all accidental and natural causes to prove an incendiary fire set by a responsible person. Before the investigator lists the cause as electrical or undetermined, he should check both his conscience and all his reference texts.

F. Remember that the good investigator uses his street knowledge, common sense, and the scientific method.

5. Both teams of investigators (or the two investigators on the scene) must compare notes. They must go over all of the information that they have gathered and decide if their findings require further investigation. They must determine whether arson is suspected, take all physical evidence directly to the lab, and take all written notes and interviews to the District Attorney.
6. If the owner of the business or building is on the scene, interview him as soon as you and your partner have some tangible evidence. This interview should be taken right there at the scene if possible, because a guilty person will not have had time to think up any excuses. Let him or her tell you the story about how the fire started, then collect all the documents you can find.
7. Make sure you have labeled and locked up all physical evidence. Now you must start a door-to-door canvassing of the area to get information about:
   A The fire
   B Building occupants
   C Neighbors
   D Business history
   E The owner, as much as is possible
8. The investigators should never be in a hurry to leave the scene of a fire. Talk to anybody who thinks that they have something to tell you. The answers to the seven main arson questions should be starting to fall into place. Both texts and common sense will help at this point.
9. The investigator must now review all the information: interviews, physical evidence, and circumstantial evidence. Use logic and never make hasty decisions, but trust your intuition as well.
   A. Review interviews with firefighters and the crowd
   B. Check all available paperwork, books, and documents

10. When arson is the suspected cause, seek interdepartmental cooperation. Check the background of all persons involved with the building or the business and contact the District Attorney as soon as possible to secure his or her participation and guidance.
    A. Check with state insurance authorities concerning the property insurance loss register, task forces on organized crime, and national or international investigators. These sources can provide a lot of information and possible evidence.
    B. The laboratory should have all physical evidence and may be able to give you some answers. A lot of investigators do not use the lab as they should. Forensic science can make or break a case.
    C. Check all licensing departments for any types of violations such as health codes, electrical codes, and the standards of the fire prevention bureau. The District Attorney will have a warrant issued (if there is reasonable cause) for any suspect.
11. Having assembled all information and conferred with the District Attorney concerning the decision to continue the investigation, the following brief is set up:
    A. Formal interviews must be typed and signed
    B. The witness list must be drawn and approved
    C. Photographs and drawings must be reviewed
    D. Physical evidence must be lined up
    E. There must be a formal interrogation of the suspect
12. The prosecutor will interview all of the witnesses and prepare them for court. He may also interrogate the suspect if he feels it is necessary.
13. Most district attorneys have their own ways to handle an arson case. Good investigators must work closely with the attorneys and follow their guidelines. In truth, most cases are lost in the field due to a lack of cooperation between the legal and law enforcement departments. The more the legal field learns about the actual fire scene, the easier it will be for them to present and win their cases.

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Christina Kapp–Editor

I am further indebted to the men and women in the fire services throughout this country. They are the force that motivates me to perfect the process of fire investigation.

Chief Patrick Britzalaro–Battalion Chief Safety Officer BFD

Chief Robert Stasio–Chief of Fire Prevention

F. F. Darryl Wiggins, BFD–Certified Polygraph Operator

CONTENTS

ARSON INVESTIGATION

Chapter 1

THE BEHAVIOR OF FIRE

The first chapter of this book focuses on the behavior of fire, because I believe the basic knowledge presented is vital for investigators, teachers, prosecutors and the courts. Some investigators will tell you all you need is street knowledge, yet I find this to be untrue. All knowledge is power, and I believe that an investigator must add this written knowledge to his or her street sense. The basic facts of the behavior of fire must be known to all investigators. A good investigator draws upon both scholastic and experiential knowledge in order to bring his or her knowledge up to the level of excellence needed in fire investigation.

We must remember the basic fire triangle is composed of heat, oxygen, and fuel. Adding the free radical, or separation of the triangle as given in many fire handbooks, we are able to look at the basic parts of fire. From a beginning level, we have learned that to put out a fire, it is necessary to reduce the heat by cooling. This means that the specific heat of the water applied will absorb the heat of the fire. The second way to extinguish fire is to break the triangle. Traditional wisdom states that firefighters should use foam to put out every fire, but every time that I have personally seen foam used, the crew has lost the fire. The chemical free radical of a fire is basically the interaction of chemicals, so it makes sense that we must use chemicals to fight chemicals.

In addition to a general knowledge of firefighting, the fire investigator must be familiar with the chemistry and physics of fire. Through my discussion of the fire's chemistry, I speak of the properties and interactions of matter and material. This chapter discusses the physics of the fire, including methods of measuring physical characteristics and relationships of the different types of energy. When talking about chemical combustion, oxidation, or the air itself, we must remember that Earth's atmosphere consists of approximately 21 percent oxygen and 79 percent nitrogen gases. The abundance of nitrogen slows the burning rate of oxygen. The chemistry of fire is

the chemical form or shorthand that shows the number of atoms in a molecule.

The various terms used in the chemistry of fire should be at the investigator's command, and are defined as follows:

1. *Atomic weight.* The weight of the atoms as compared with the weight of an atom of oxygen.
2. *Molecular weight.* The sum of the weights of all of the atoms in a compound as compared to air.
3. *Oxidizing agent.* A material that is capable of reacting with a combustible material in a combustion-type reaction.
4. *Reducing agent.* A material that will react with an oxidizing agent in a combustion-type reaction.
5. *Specific gravity.* Weight as compared to an equal volume of water.
6. *Vapor density.* Weight as compared to air (molecular weight plus 29, minus the vapor pressure).
7. *Boiling point of a liquid.* When the pressure of the molecules of liquid (vapor) equals air pressure (14.7 lbs.).
8. *Vapor pressure.* The pressure exerted by escaping vapor at this equilibrium (evaporated) is the vapor pressure.
9. *Flash point.* The lowest temperature at which a flammable liquid will ignite.
10. *Ignitable mixture.* A state in which the propagation of flame is located away from the source.
11. *Fire point.* The temperature of a liquid in an open container at which vapors evolve fast enough to support continuous combustion.
12. *Ignition temperature.* The minimum temperature of a substance, whether solid, liquid or gas, is the point to which a substance must be heated in order to cause it to burn and propagate combustion in a self-sustained manner.
13. *BTU (British Thermal Unit).* The quantity of heat required to raise the temperature of one pound of water by one degree.
14. *Calorie.* The amount of heat required to raise the temperature of one gram of water by one degree Celsius.
15. Chemical reactions double their rate with each increase of 18 degrees Fahrenheit.
16. One must remember that heat is a form of energy that comes from a substance that is changed from a higher state to a lower state. This is called a consummation of a union, which results in ash.
17. The various formulas such as converting centigrade to Fahrenheit, centigrade times 9/5 plus 32. When we convert Fahrenheit to centigrade, Fahrenheit minus 32 degrees, multiplied by 5/9, is equal to centigrade.

18. *Heat capacity.* A property of a material for absorbing heat with a consequent temperature rise per unit of weight.
19. *Specific heat.* The ratio of the heat capacity of a substance to the heat capacity of water.
20. *Latent heat.* The quantity of heat absorbed or given off by a substance when passing between a liquid and the gaseous phase, or between the solid and the liquid phase. The first phase is called vaporization. The second phase is called fusion. The latent heat of water at the boiling point is 212 degrees Fahrenheit, which uses 970.3 BTU's per pound to attain.
21. *Linear expansion, superficial expansion and cubical expansion.* These are the three kinds of thermal expansion. Linear expansion equals length–superficial equals area and cubical equals volume.
22. *Conduction, radiation and convection.* These are the three basic methods of heat transfer. Conduction is heat traveling from one body to another by direct contact or through a solid, liquid, or gas. Radiation is heat traveling through a vacuum or through gases. Convection is heat moving by the circulating method.
23. The sources of heat and energy are chemical oxidation, electrical heat energy and mechanical heat energy. We also have energy which is formed by radical free elements.
24. The various ways heat can be measured or detected are metallic strip, thermal meter, or thermal coupling. You have the modern resistant thermal meter, which uses temperature probes. There are three types of probes, surface temperature probe, immersion probe, and gas defusion probe. Another method of measuring temperature is by the use of temperature indicating crayons which range from 113 degrees Fahrenheit to 2500 degrees Fahrenheit.

Spontaneous Heating

When the temperature reaches an ignition temperature, it is called spontaneous ignition.

1. Spontaneous ignition occurs when the primary source of heat is chemical action due to combustion itself, or between the combustible and a substance that will support combustion.
2. There are four groups to be considered when talking about spontaneous ignition.
   A. Those substances which are not in themselves combustible but which may cause ignition. Example: calcium oxide
   B. Those substances that have ignition points below ordinary tem-

perature or when combined with another compound that is capable of oxidation.
   C. Those substances (combustibles) which may undergo sufficient oxidation and ordinary temperatures to reach ignition point.
   D. Organic combustible substances which are subject to Microbic Thermogenesis.
3. Spontaneous ignition and heating occurs when a combustible material comes in contact with another substance and a chemical action is initiated.
4. Spontaneous heating and ignition sources:
   A. Pressure created in the material when it is placed in stacks.
   B. Friction between organic members due to vibration or wind motion.
   C. Bacterial activity–slow heating due to pressure or germination. Example: hay
   D. Chemical reactions due to improper storage.
5. Spontaneous ignition caused by a chemical process includes the following categories, all of which involve one or more of the four acids most commonly found in industry. These acids are sulfuric acid, muriatic acid, hydrochloric acid, and nitric acid.
   A. Sulfuration occurs when oleum of fuming sulfuric acid is added to a substance being treated.
   B. Nitration occurs when treating a substance, such as cotton, with nitric or sulfuric acid.
   C. Reduction occurs when treating substances with metallic linings in the presence of hydrochloric acid.
   D. Alkylation occurs when treating the substance with both methyl or ethyl alcohol and hydrochloric acid.
6. Spontaneous heating is the process by which a material increases in temperature without drawing heat from its surroundings.
   A. Fermentation is the most common type of spontaneous ignition, basically called oxidation. At a temperature of 160 degrees Fahrenheit, the rate of oxidation will be approximately 32 times the rate it would be at 70 degrees Fahrenheit. At 109 degrees Fahrenheit, the rate is 128 times that of 70 degrees Fahrenheit.
   B. Chemical reactions double in their speed, or rate, with each 18-degree rise in temperature.
   C. A Friedel-Craft reaction is one which evolves from heat of sufficient intensity to thermally decompose the mixture and increase the internal pressure of gases and vapors.