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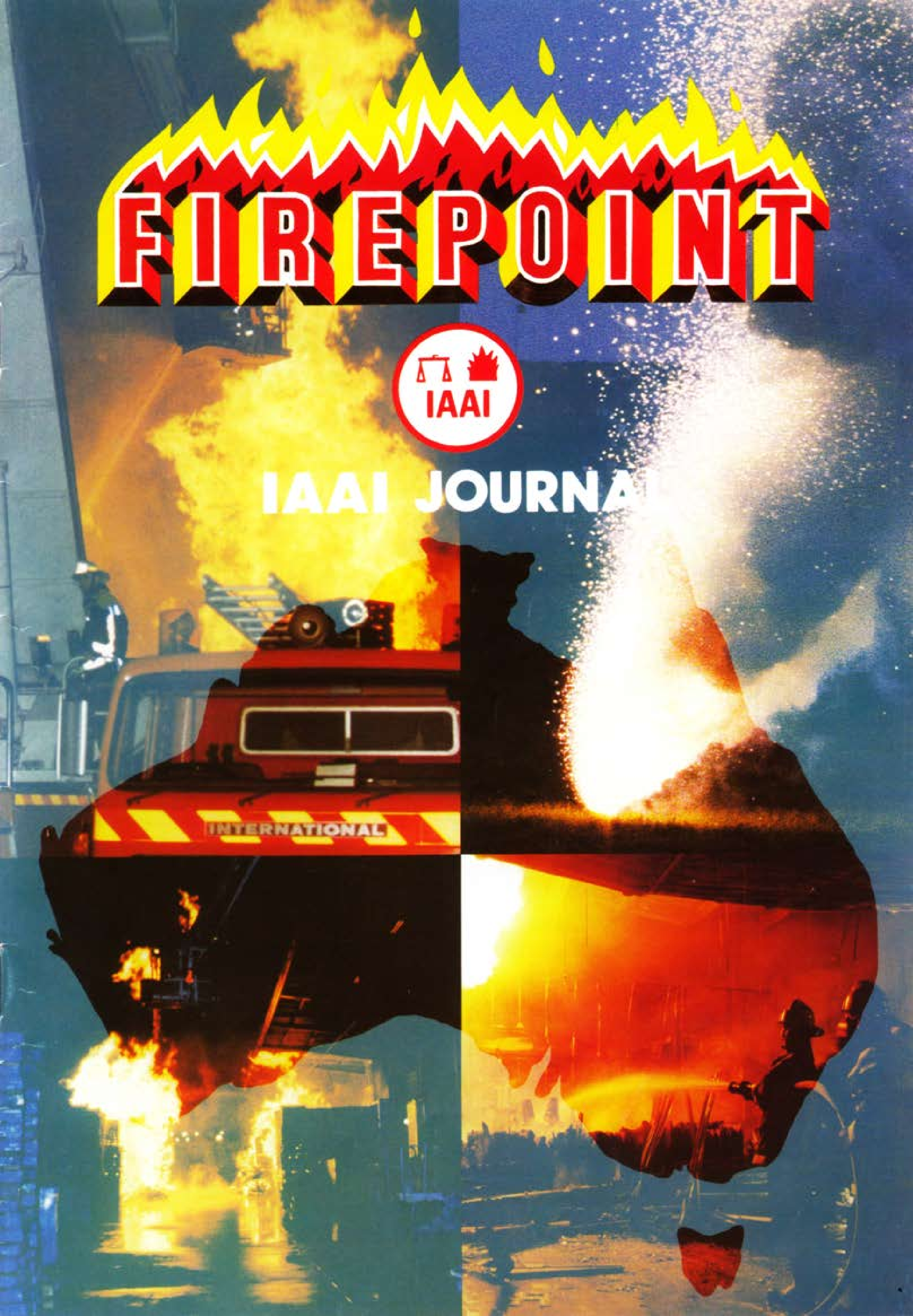

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Firepoint

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EDITORIAL

We often learn from overseas, especially the U.S. This month we have an American article on "Introduction to the Internet for Fire Investigators". It is a topic we covered ourselves last September. The next issue will have an American article on "Pyrophoric Activity". We covered it ourselves last December. Good to see we can lead, as well as learn from others. Sharing educational opportunities. That's what it's all about.

Wal Stern

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NEW SOUTH WALES NEWS

NSW PRESIDENT'S REPORT

(From NSW AFI President, Ross Blowers).

Welcome to the first edition of "Firepoint" for 1997. It is anticipated that the magazine will continue to raise and discuss issues of concern to all IAAI Chapters throughout Australia. The prime factor of course, is knowing the requirements of Chapter members. With this in mind, it is crucial that members contact either Wal Stern (Editor) or members of the NSW AFI Executive to voice their opinions.

The NSW Executive met in early February, 1997. Initial topics for discussion included responses from the Questionnaires and how we can best incorporate those issues into a conference to be planned for mid-1997.

Correspondence from the IAAI Parent Body advises that certification changes to the CFI Programme will be undertaken. This does not necessarily affect Australian Chapters at this stage. I believe the most important news out of the US IAAI at the moment is the proposed changes to the Constitution and By-Laws requiring an individual to be a member of the IAAI before they are able to vote on individual Chapter issues. This has been a strong bone of contention for the NSW Chapter for some time and has been raised at several discussion evenings and Executive meetings. Further information on this topic will be received shortly and I look forward to informing the Membership of the various propositions put forward.

On behalf of the NSW AFI Executive, I trust 1997 brings good fortune and prosperity to all Members and their families.

Ross Blowers
President
NSW AFI

NSW FIU REPORT

(Compiled by Roger Bucholtz, NSW Fire Brigade Fire Investigation Unit).

Greetings and welcome to the new year.

Despite continual media coverage of the benefits provided by the installation of smoke alarms, the message is taking a while to get through to the community.

Unfortunately 1996 did not end on a high note; during November and December we attended fires where nine persons were deceased. 1997 has started in a similar vein, three fatals in the first week. It must be remembered that a smoke alarm will provide early notification of the presence of smoke, thus allowing occupants to exit the building, though it will not extinguish the fire. This early alerting by the alarm has the advantage, from an insurer's perspective, of reducing fire damage to the property, as well as the potential to save lives.

On a more positive note it is good to see Government authorities taking an interest in fire safety issues. I refer to the dangers associated with children playing with cigarette lighters. Following discussion and a conference with the NSW Department of Fair Trading, recommendations have been approved for a Child Resistant Lighter Standard to be introduced throughout Australia. For those investigators, firefighters and Police Officers who have witnessed the injuries suffered by young children playing with lighters, also the property damage, will view the introduction of this regulation as a very positive step in reducing such incidents.

Late news just arrived . Our (old?) mate John De Haan has updated "Kirk's" Fire Investigation book, copies of which are available from the publisher Prentice Hall. The good news concerning the book is that Inspector Ross Brogan of the NSW Fire Investigation Unit submitted several photographs and comments to John regarding vapour explosions and some of these have been used in the book. Congratulations Ross, on receiving international recognition.

KOVA: A New Resource for the NSW Fire Brigades , to assist the Fire Investigator.

Background

On 31 August 1995, the NSW Fire Brigade Commissioner granted approval to commence a Canine Flammable Liquid Detection program.

Initially, a German Shepherd dog was donated for the program to get started, however Sabre did not meet the requirements that were considered essential for a detector dog and has subsequently been placed in the care of Station Officer Ian Krimmer for work in fire safety for children.

A request was then made to the Australian Customs Service Detector Dog training centre in Canberra for the donation of a dog suitable for the Flammable Liquid Detection program.

Chief Inspector George Riley of Australian Customs contacted the NSW Fire Brigades to advise that they would be happy to donate a dog for the program and Kova was picked up on 26 June 1996.

Method of Detection

Kova is a three year old male black Labrador, trained by Australian Customs to give a "passive alert" for drugs. A passive alert is one where the dog, on detecting, sits as an indication. This method of indication is necessary at fire scenes so as to prevent the disturbing of evidence.

In the six months Kova has been with the NSW Fire Brigades, he has undergone a familiarisation program with his handler, Station Officer Graham McCarthy, both of whom have been trained by Senior Constable Paul Doney of the North Region Police Dog Squad, in the detection of flammable liquids such as petrol, kerosene, turps and thinners, at fire scenes in quantities as minute as 5 microlitres (a drop from an eye dropper amounts to approximately 30 microlitres).

Current Position

Kova and his handler took up duties with the NSW Fire Brigades' Fire Investigation Unit on 9 December 1996, to become the only dog specialising in Flammable Liquid detection in Australia. He has been called upon for his expertise by the fire investigator, to assist at numerous fire scenes since joining the unit.

THE INTERNET AS A TOOL FOR THE FIRE INVESTIGATOR

by Brenton W. MacAloney, an article from "Fire and Arson Investigator", December, 1996.

Introduction
This article is for the fire investigator who has not yet become connected to the "Information Super Highway," commonly known as the Internet. The Internet, and other related topics, including their usage, are the subjects of many books that grace the shelves of book stores. This article does not replicate what has been published by others, nor does it reference any of the materials. There are many good books available and getting one is a step forward if you plan to "get" connected. The goal of this article is to convince other fire investigators to seriously consider getting connected.

Why Connect?
Before you can "get" connected you first need to know why tying into the Internet is one of the most important things you will do as a fire investigator. We've all been taught that we must take courses to enhance our knowledge and stay current. Unfortunately, we are faced with the reality that our time and budgets are limited. Subscribing to trade journals updates us on current practices, procedures and standards. So, why would we not want to access the most current information on a specific subject immediately? Have you ever faced the situation that you needed to brush up on recent articles prior to testifying in court? Well, the Internet is an excellent way to find out timely information. Like many of you who are not full-time firefighters or full-time investigators, I am only able to take a few related courses each year, attend IAAI chapter seminars when possible and maintain a list of valuable contacts. If you've also been doing this, you've been doing all the right things, but, you need to add another avenue. The avenue, is actually a highway, and it's called the Internet and World Wide Web (WWW).

What does the WWW do for you? It gives you the ability to expand your professional contacts to thousands of people involved in fire investigation, retrieve information or products directly from companies, share valuable experiences with others and have fun doing it. For those who have experienced "telephone tag," the Internet mail allows you to leave messages and the recipient will reply in a timely manner. You can even access your mail on the road through local dial-up telephone numbers.

Technology seems to move faster and faster each year. For the fire investigator this is no exception. The good news is that progress in the area of electronic communications is being made all around us, and information is there for the taking. What also helps is, with computer prices continuing to drop, the cost of accessing this information is now affordable to most fire investigators. This great source of information is the "Information Super Highway." You have seen your local television stations e-mail addresses and Home Page links.

The President of the United States is talking about the Internet and schools everywhere are going on line. A few weeks ago nearly 1,000 schools in California were wired to meet the growing demand in public education. It's time for every fire investigator to step forward and connect to the Internet.

Once a tool for academics, the Internet has developed a life of its own, with businesses, organizations, individuals and the government joining to provide information to whoever cares to access it. Tying into the Internet through any number of service providers enables people to send and receive mail messages, as well as browse for information, with any number of Internet browsers.

The Internet as a Communication Tool

Accessing the Internet as a mail communications tool has many possibilities, from sending and receiving mail to the fire investigator in the next town, to sending and receiving mail to a fire investigator across the world. This includes local, state and federal agencies, as well as organizations like the IAAI and NFPA. Just imagine the possibilities of sharing one message with many people. In addition, computers as servers, are now set up and are being utilized for Special Interest Groups (SIG). The University of Oklahoma has one such server for fire investigators. All you need to do is send a note to the server, and anyone that has subscribed to that server will automatically get the message. In this case, you don't even need to know who has subscribed to get a question answered. The question is sent to everyone that has subscribed, and anyone can send a reply, or many may send replies. As a subscriber you don't have to send a message to see what is going on. You can see what others are discussing, and learn by just observing the communications. Another server that has been up and running for some time is the Consumer Products Safety Commission. The Commission will download (by request), announcements and product recalls through e-mail to you. Have you ever thought how great it would be if you had this information in a timely fashion and not missed or had to wait for it to come on television or in the newspaper? E-mail also has the ability to attach files along with letters. This is particularly useful for your colleagues to give their input on a file or a case before it goes to trial. However, if it is extremely confidential the US Postal Service is still the safest method.

E-mail is only half of the Internet story. The other half is using the Internet web sites to obtain information. Using any number of web browser tools allows you to search for information by topic or key word(s). Web information is stored on computers that are tied into the Internet which comprises the WWW. (It is called a web because it resembles a spider's web where you can come to one junction and go in any number of directions to your final destination.) The procedure is simple, all you have to do is type in key words and the browser will search the Internet for matching key word entries. A listing of the located entries will appear on the screen allowing you to move forward to any of the specific locations. The information you are searching may be located anywhere in the world. The web browser is also where you type in your special location that you heard was a great spot to get information, i.e., http//www.aurorafire.gov/iaai.htm.

Most major companies have web pages that you can link to and find product literature, company information and phone numbers. In some cases, you can actually view what the product looks like and see the specifications and suggested retail price. At these web sites you can also sign up for information to be mailed to you. There are also major newspapers and magazines that have web pages where you can locate articles on specific subjects. Colleges now make available research papers for anyone that is interesting in reading them. In addition to this you can get near realtime information such as local weather radar, accurate time and news events, including many pictures. Many, if not all states, have web pages that can link you to cities and towns that have "home pages" for you to search. More and more information is available on the WWW each day, the possibilities are constantly increasing and in the future may be endless.

Taking the Step ...

Becoming connected to the Internet is easier than you think. First, you will need to have a computer, either a Macintosh or an IBM compatible, a modem, and an Internet service provider. Friends and computer stores could help you decide what make and model is best for you. Once you have the computer hardware set-up you can connect to any of the many Internet service providers available. Many computers have service provider software already installed. Again, ask friends and check for local telephone numbers for connections so you can limit or eliminate long distance charges. Many providers have toll-free or local numbers. Each service provider has different structures. Many service providers offer free introductory hours and like any anything new, you will spend more at first, tapering off later. Most service providers offer a set monthly service charge, beyond this allocated time, addition billings may take place. The cost of the computer and the telephone charges are the two primary expenditures. The good news is, as more and more service providers become available the price hook-up will continue to decrease.

The IAAI and the Internet

It is important to note that the IAAI moved forward with developing the concept and strategy for use of the Internet in Biloxi, MS, during the 45th Annual Seminar. A white paper was developed and presented to Past President John Barracato, and he provided the support necessary to move forward. Benny King, Executive Director, provided the central focus to allow the International Office in St. Louis to set-up an Internet e-mail address. Last year, Robert Toth, Fire Investigator in Aurora Colorado, moved us quickly to the first IAAI Home Page. Today, the International has a well-designed Home Page, assisting not only current members, but also attracting new members. For members, there is also a web page where you can order Association merchandise.

Use of the Internet

Utilizing the Internet to gather information and consult with colleagues is only the beginning. It is now being used as a business tool to advertise investigation services. If you are preparing to travel, the Internet give you the opportunity to review and print maps of your destination and look up things to do while you're there.

Most of you that have been in the field of fire investigation for any length of time know that current information is a necessity in the fight against arson. Keeping current and accessing all available resources pays off. Once you've connected to the Internet you wonder why you didn't do it sooner. The "Information Highway" is here to stay, get on the "on ramp" and start cruisin'. Keep in mind, there are no speed limits, no stop signs and no one-ways, however, there is a thing called "netiquette," it is the Usenet term for etiquette.

The Annual Meeting planned for May 11-16, 1997 in Toronto, Canada has planned the first day's session around the "Information Highway and the Internet." If are able to attend, don't miss this session, it could be one of the best continuing education classes you will ever take.

Captain Brenton W. MacAloney C.F.I., is a 26 year veteran of the Westminster, Massachusetts Fire Department, where he is head of the Fire Investigation Unit.

Mr. MacAloney is also employed by Digital Equipment Corporation in Salem, NH, where he is Group Manager of New Product Introductions. He can be contacted on the Internet at macaloney@net1plus.com.

GLASS FRACTURE ANALYSIS FOR FIRE INVESTIGATORS

by Dr. David Schudel

(Reprinted from "Fire and Arson Investigator, March, 1996).

This article sets out to inform the reader on how to interpret glass fracture and what to look for at a fire scene. The article describes some of the different types of glass, how glass can break by impact, heat, frame stress or over pressure, how to interpret glass fracture at a fire scene, trace evidence, a summary and some case studies.

This article does not cover soot deposits on glass or the chemical analysis of glass. It is also confined to flat plain glass, wire glass and heat-treated (tempered) glass, which make up most of the glass we find at a typical fire scene. It does not cover other types of glass such as laminated and special composition, or curved glass such as bottles and curved mirrors.

Introduction

Fire engineers and investigators know much about the properties of materials commonly involved in a fire. Typical examples are wood, fabric, plastics and wall coverings including gypsum. The need to know how these behave in a fire, and whether they are combustible or not, is highly important in understanding fire. What we often need to know with respect to glass includes:

- How did this glass break?
- Was it broken before the fire started or during the fire?
- Was it broken externally or internally?
- Are there signs of a forced entry?
- Are there signs of a deflagration or explosion?

Glass is found at most fire scenes, often in reasonable quantity. It is non-combustible and hence is a spectator to the fire. As a spectator, it has a story to tell, but often it is overlooked. In some cases valuable, if not critical, information can be lost.

Glass

Glass is a non-crystalline material, which displays the properties of a solid and a liquid. Although solid in appearance, when heated, glass becomes soft and malleable. When left in old buildings, glass panes become thicker at the base as the glass settles with gravity. This is a liquid property but acts over such an extended time that we can consider glass as a rigid solid.

There are many compositions of glass both physical and chemical. Here are some types of glass and their uses:

Plain glass, such as that found in normal window and door glass is made by heating silicon oxide and rolling.

Heat Treated Glass, such as that found in car windows (but not the windshield), patio doors and storm doors, is also called fully tempered or toughened glass. Toughened is a misleading term as the glass is susceptible to impact and heat stress. Heat treated glass has been heated and cooled quickly. This puts the glass under a certain amount of internal stress. When it breaks, the glass releases this stress rapidly and even in an impact fracture, the whole pane of heat treated glass fractures into small pieces (called dicing). The result is a break safe pane with no long shards to cause serious harm to a person in contact with (or passing through) the frame. Heat treated glass often has an engraved marking with information about its manufacturer, conformance to Standards[1,2], and wording to the effect that it is safety tempered.

Laminated glass is found in car windshields. It is made of thin layers of glass bound by a clear adhesive and is quite strong. When impacted, often only one of the laminates will break. When broken through, the adhesive strips hold the glass together forming a break safe with no long shards.

Wire glass is often used in fire doors. The glass is made of two panes molded around a wire mesh. When the glass breaks through thermal stress, the wire keeps the pane whole providing a barrier to fire. It should also be noted that this glass contains many flaws (due to the wire mesh) and is weaker to impact than plain glass of the same thickness. Wire glass is often mistermed wire reinforced glass, suggesting it can be used for security/ impact resistance. This is not the case.

Special Composition glass takes many forms. It is found in optics, lenses, and special environments and is made to suit the needs of the application. Chemical additives and different processes are used to give the glass different qualities.

How Glass Breaks

One of the features of glass, is that it is frequently possible to determine the manner in which it broke, and at what time during the fire the break occurred. Information takes the form of soot deposits and fracture analysis. As noted previously, we are concerned here only with fracture analysis.

Glass breaks because the stress on it exceeded a minimum the glass can withstand. The way glass breaks, and the story it tells, depends on how it was broken, namely how the stress was applied.

There are four main ways to stress glass:

- Impact stress - such as a bullet, rock, fist
- Thermal stress - overheating from a fire
- Frame stress - slamming a door, poor frame support
- Over-pressure stress - explosion and deflagration.

Impact stress

Plain glass:
When plain glass is impacted, a characteristic pattern forms. The effect is similar to a cobweb pattern. We see radial fracture lines coming from the point of impact (fracture origin), and concentric fracture lines going around the point of impact.

The method by which the glass fractures is as follows:

As the impacting object hits the glass, the glass bends. At some point the impact stress on the glass overcomes the strength of the glass. In an instant, a flaw on the face of the glass on the opposite side to the impact area starts to give, and the whole fracture pattern starts from this point. As the fractures move at high speed through the glass, the glass breaks up, relieving the stress on the glass.

The area around the impact origin (the center of the web), is where the most information can be found. In this area, as the impact occurs, the glass bends away from the impacting object, and the break initially occurs on the side of the glass that is under the highest stress. This is the side *opposite* to the impacting object. The glass breaks with the most stressed edge moving ahead of the least stressed edge so that we get a fracture not only moving along the glass, but also across the width of the glass. Sonic "echoes" start to affect the fracture as it moves forward. The echoes cause jumps in the level of the fracture creating small lines called Wallner lines and rib marks[3]. Then as the fracture reaches the edge and the fracture starts to split up, hackle[3] is formed. Wallner lines, rib marks and hackle are used to determine from which side the glass was impacted.

Wallner lines are similar to ripples in a pool. They are fine curved lines which curve away from the fracture origin. The origin is the side of the glass under higher stress. Unlike water, the lines are frozen in place after the fracture has passed over.

Rib marks are fine parallel lines found at the opposite edge of the fracture to the fracture origin. The fracture origin is in higher stress, whereas the rib marks are found on the edge of the fracture surface in lower stress. Note that the low stress edge is on the side that the impact came from.

Hackle has the appearance of a mountain-valley effect, with lines/valleys joining together to form one line at the edge of the glass. It is similar to streams making one river. It occurs at the edge of the fracture surface opposite to where the fracture originated, namely the low stress edge.

If we look at where the Wallner lines, rib marks and hackle are, we can tell where the fracture has originated on a particular shard. If the glass shard has been taken from near the origin, the Wallner lines will ripple out from the face of the glass which was in higher stress; the rib marks and hackle will be on the face which was in lower stress. The impact will have been from the side of lower stress, the same side where the rib marks and hackle are. This is *opposite* to the side which is in higher stress. Care must be taken to examine the radial fractures and not the concentric fractures, which have rib marks and hackle on the opposite side to the radial fracture.

Heat Treated:
When heat treated glass is broken by *any* kind of stress it "dices"; the whole pane breaks into small chunks. The fracture surfaces show the same fracture detail no matter how the pane was broken. This presents a problem when looking at the remains of this glass after a fire. It is very difficult to determine how a pane of heat treated glass was broken, unless there are some obvious pointers. In some cases the remains of the glass in the frame will have an obvious hole in it showing that an impact occurred. In others, there may be only the frame with pieces jutting out of the edge, but the glass remains are inside an area where there is little or no heat damage. In these cases, a word with the fire fighters usually reveals they made a forced entry (and if they didn't, then illegal entry may be the cause of the breakage).

At a first glance, the diced pieces of heat treated glass look like that of over-pressured plain glass. It can be distinguished by its fracture surfaces. When the fracture of a diced fragment are viewed, heat treated glass has the appearance of broken within, with rib marks and hackle near both surfaces of the glass and Wallner lines running down the middle showing that the fracture origin is in the center. This is caused by the internal stress introduced during manufacture. The center region is called the mist region' or frost line'.

As we will see later, plain glass fragments from an over-pressure show rib marks, hackle and Wallner lines on one side of the fracture surface only, and also glass pieces will be found some distance from the frame. Impacted heat treated glass will be found in the area below its frame, mostly on the opposite side from the impact.

Wire glass:
Impact stressed wire glass breaks easily and forms a cobweb pattern. The direction of impact as determined from Wallner lines, rib marks and hackle on the fracture surfaces may be difficult to establish as the wire causes a muddling of this detail. If the impact direction becomes an issue, then a glass expert should be contacted, although the remains of glass below the frame should make impact direction obvious.

Thermal stress

Plain glass:
The thermal fracture of glass is much different from impact fracture. When glass is heated, it expands. In a rapid heating environment, glass can be heated more quickly on one area of the glass than another causing it to break. A familiar example is pouring hot water into a glass. A value of about 70^0 C differential between the center of a pane of glass and its protected edge is reported to cause it to fracture[5]. A theoretical value of 60^0 C has also been reported[6] based on mathematical modeling.

Thermal stress puts stress on the pane over a larger area, unlike an impact. The fracture occurs at a weak spot or flaw at the edge of the glass. It will first travel in a straight line, then the fracture starts to spread across the glass until the stress is relieved or the edge of the pane is reached. The pane is often broken into only a few pieces which is enough to relieve the stress.

The fracture surfaces are also different. In a low stress break, there are few or no Wallner lines, rib marks or hackle and the surfaces have a smooth mirror-like appearance for most of their length. In a higher stress break, Wallner lines, rib marks and hackle will be seen although the origin area may still be smooth.

Heat treated glass:
As noted above, heat treated glass dices whether it is broken by impact, heat or whatever stress is placed on the glass. If the pane is still whole in its frame, the lack of an impact hole and the presence of a star burst effect from an edge of the pane is an indicator of a thermal stress break. More often, most of the glass is lost from the frame, and it is difficult to determine the mode of failure from the pieces.

Wire glass:
When wire glass is heat stressed, flaws from the wire mesh causes a break at an edge to travel to another edge in straighter lines. The wire makes the fracture surfaces difficult to read and it may be difficult to distinguish between wire glass broken by heat stress or frame stress. Soot deposits and fire spread patterns should help in this regard. If a pane of wired glass is broken, but there is no sign of heat exposure in the surrounding area, then the pane did not break due to heat stress (unless it was from a previous incident).

Cooling stress:
Cooling thermal breaks occur for example when water is sprayed on hot glass. The water can cause a spalling pattern on the face of the glass exposed to the water. Spalling shows direction of water attack and may help in recreating fire fighter actions. Spalling is sometimes referred to as "crazing." [7] However, the use of crazing to describe glass is not limited to water cooling effects. It is a general term used to describe glass which has many small fractures or is in small pieces.[8]

Significance of thermal stress damage

The significance of thermal stress damage to glass at a fire scene must be treated with caution. It is often said heavily cracked glass is near the fire origin. This is not the case. Glass will break into smaller pieces as the stress increases. Higher stress can result from a number of things, including higher heat and construction of the glass and its frame. With that in mind, higher stress fractures in glass can help in locating an area of origin but only if other pointers are found supporting this, such as fire spread patterns. It is possible for glass to thermally break some distance from the fire origin due to fuel arrangements in the building. If a fire starts in a basement, but spreads to a polyurethane foam-filled sofa in the living room, the living room windows could break, albeit some distance from the fire origin.

Crazed glass (glass found as small pieces or glass which has many fractures) is also sometimes misinterpreted as a sign of accelerants (on the basis that there was a very rapid heat rise causing such a failure). Care should be taken when crazed glass is found to ensure that it isn't heat treated glass which "dices." Also, other factors may have caused a crazing effect including rapid water cooling of hot glass, high stress impact, overpressure or naturally fast fire.

A mixture of thermal and impact damage to glass can sometimes be seen at a fire. A pane may break thermally in the early stages but is then knocked out by, say, a fire fighter. Whether the pane was broken before the fire may not be readily obvious from soot deposits or layering, but if enough larger pieces are found, the pane can be reconstructed to see if a thermal break is present in the glass, indicating it was intact before the fire.

Frame stress [9]

Plain glass:
Another common way to break glass is by slamming a door or window. This can be important at the scene of a fire when considering peoples' movements and the possibility of unauthorized access. This author has seen a fire door which was not broken by heat or impact, but seemed to have been broken by the assailant hurriedly leaving the scene (who had spilled perhaps a little more gasoline than anticipated) and slamming the door against a metal fire escape railing.

Slam fractures seem to manifest in a number of ways. Sometimes, a fracture across a corner is seen; other times the glass forms fractures making an hour glass shape with no concentric fractures. As with a thermal fracture, the stress on the pane as it slams is low compared to impact. Wallner lines, rib marks and hackle may be absent or greatly reduced in number.

By deduction, it is reasonable to assume a pane was slammed if its fracture pattern is unlike thermal or impact fractures. If witnesses familiar with the building do not recall the pane being previously broken, it may be worth getting a glass fracture expert to determine if the pane was slammed or not.

Other frame stress can cause a pane to crack such as poor frame condition or wind load. This usually causes an edge to edge fracture with fracture surface detail similar to a slam fracture.

Heat treated glass:
Although this is not common, heat treated glass can be broken by frame stress. The glass dices, as in a thermal break, and it may be difficult to distinguish it from impact stress. As discussed earlier, if the pane is found with a hole through it and glass on one side, on the floor, then impact is more likely, but the converse is not true. A pane with no holes through it could be frame stress, thermal stress or a low stress impact which did not hole the pane.

Wire glass:
As noted above, wire glass can show a similar pattern for frame stress and thermal stress. The fracture will be seen edge to edge in either case. Fracture surface detail may be muddled due to the presence of the wire.

Over-pressure stress (including explosion and deflagration)

Glass can play a major role in explosions. In many buildings, the windows and glazed doors are the weakest part of the structure in terms of internal pressure. Windows make excellent "vent release panels," and will blow out at a very low over-pressure (0.15 - 1.0 psi[10,11]), sometimes preventing further damage to the rest of the structure. This is more common in the UK where most buildings are brick/stone construction and can withstand this low over-pressure.

Because of the venting nature of windows, the window damage may be one of the few indications that an over-pressure took place.

There are two indicators of over-pressure stressed glass (and hence indicators of deflagration or explosion);

distribution and fracture pattern.

Location and distribution of fragments (all types of glass):

Glass will travel considerable distances from a frame when the mode of fracture is by over-pressure of the glass. The distance the glass fragments will travel depends on pressure involved[12]. The higher the pressure, the further the glass fragments travel. An over-pressure of 1.5 psi can send fragments over 100 feet. Small or thick panes of glass require higher pressures to break than thinner or larger panes.

Given time, glass can travel some distance from its frame by means other than over-pressure, such as people movement and wind etc. However, if there is much of the glass some distance from the frame, then an over-pressure has likely occurred.

It is vital that on approaching a scene, we look from the outside in. Look around the site at some distance and as we spiral in towards the building look for glass underfoot. All glass found should be documented. If an explosion is suspected, the area outside any blown out windows should be divided into a grid and glass in each grid area photographed, collected, counted and weighed. This will give the distribution of glass throughout the area and will help to understand the explosion's intensity as each pane is broken. Horizontal surfaces above ground, such as gutters and tops of walls, should be checked for debris.

Plain glass:
Plain glass fractured in an explosion has no obvious pattern. The pane is split into many small pieces (crazed). Fracture surfaces show Wallner lines, rib marks and hackle like that of an impact but is distinguished from impact by the distribution of glass, the lack of a cobweb pattern and sometimes by the presence of fine fractures in pieces of glass which start in one face of the glass but do not make it all the way through the glass.

Heat treated glass:
Heat treated glass will dice when over-pressured and show internal stress just as in impact stress. The way to distinguish over-pressured heat treated glass from impact stress is by distribution.

Wire glass:
Again distribution is the key with wire glass as the wire will
confuse the reading of any fracture surface detail.

Trace evidence

The reader should be aware of glass evidence found on suspects. In an impact, the stress causes the impacted face of the glass to go under compression. Tiny splinters are ejected at high speeds from this face of the glass. This is of particular importance to forensic trace evidence, as it is these glass particles that often shower the assailant who broke the glass. Chemical analysis and optical measurements are used to show or refute a match between trace evidence on a suspect and a sample source.

In an explosion where arson is suspected, the distribution of glass pieces is very important. Some of the glass may be found on the suspect so it is wise to know how far the glass was blown to then consider accidental contamination of an innocent bystander.

What you can do

Get a small piece of unwanted window glass. Tape the back with wide scotch tape or clear packing tape, and give it a gentle whack with a hammer. Remove one of the bigger shards from near the impact origin and take a look at the fracture lines with a hand held magnifying glass. Compare what you see with the direction of impact and also the figures in this article.

[Safety: Be sure to conduct fracture tests in an area which can be cleaned from glass splinters. Always wear goggles, gloves and coveralls when you break the glass.]

Examination tips

Lighting: A good oblique light from a flashlight is very useful when on the scene. Moving the light around will put the various marks on the fracture surfaces onto shadow making them visible.

Magnification:
A lens with 10x magnification is usually good enough and even the eye can pick out enough details to make an initial examination.

Cleaning:
This should be avoided, but if necessary photograph first and clean a small area in the region of interest on the shard. For example, if a piece of glass remains in a pane, then clean a section of radial impact near est the impact origin. Use water on a cotton swab and press lightly so as not to leave cotton fluff on the shard.

Recommended reading

A concise and useful section on glass fracture analysis is given *in "Principles of Fire Investigation "* by R.A. Cooke and R.H. Ide, published by The Institution of Fire Engineers, UK. ISBN 0 903 345 07 2. This book compliments *"Kirks Fire Investigation"* very well and is another excellent resource. It is available from the IFE by credit card; fax no. 011 44 1162 471231.

About the author

Dr. David Schudel received his Bachelor of Science and his Doctor of Philosophy in chemistry at the University of Hull, England, U.K. He was employed by a forensic science consultancy in England before moving to the U.S.A. He is currently employed by FIREPRO Incorporated, Burlington, MA as a technical specialist.

References

1. CFR 16, Part 1201, Safety Standard for Architectural Glazing Materials.
2. ANSI Z97.1, Glazing Material Used in Buildings, Performance Specifications and Methods of Test for Safety (includes Z97. I a).
3. J.J. Mecholsky, "Fracture Analysis of Glass Surfaces," Chapter X, A of "Strength of Inorganic Glass," edited by Charles R. Kurkjian, 1985 Plenum Press, NY.
4. Term used by Tom Mewboume to describe the mist region.
5. Michael J. Skelly, "An Experimental Investigation of Glass Breakage in Compartment Fires," NIST-GCR-90-578, 1990.
6. A. Joshi and P.J. Pagni, "Thermal Analysis of a Compartment Fire on Window Glass," NIST-GCR-90-579.
7. John J. Lentini, David M. Smith and Richard W.. Henderson, "Baseline Characteristics of Residential Structures which have Bumed to Completion: The Oakland Experience, " Fire Technology, 29(3),195, 1992.
8. NFPA 921 Fire and Explosion Investigations, 1995 Edition, section 4-13. 1.
9. Author's own term.
10. R.A. Cooke and R.H. Ide, "Principles of Fire Investigation," published by the Institution of Fire Engineers, 1985 Kirk's Fire Investigation edited by John DeHaan, Third Edition, published by Prentice Hall Inc., 199 1.
11. John DeHaan, "Kirk's Fire Investigation," Third Edition, published by Prentice-Hall Inc., 1991
12. R.J. Harris, "Gas Explosions in Buildings and Heating Plant," pages 96- 1 00, British Gas with E&FN Spon publishers

QUEENSLAND'S MULTIAGENCY APPROACH

(Greg Reynolds, Queensland Fire and Rescue Authority, reports on a "Fire Scene Examination" Course).

The Queensland Fire and Rescue Authority, as well as the Police, Private Investigations and Insurance Agencies, have a responsibility to the community to actively and accurately record and report on the cause of a fire.

It is imperative that all agencies work together in a co-ordinated and co-operative approach. It is for that purpose that I was given the task of developing the skills to enhance the skills of Fire Officers in fire cause determination while also meeting the current and future needs of the other agencies involved in fire investigation.

When establishing the cause of a fire or chemical incident, Queensland Fire Officers are in fact restricted primarily to observations established at the scene. Other agencies perform any necessary subsequent investigations. As stated in the Fire Service Act 1990, the Queensland Fire Service's role is to determine the cause of a fire or chemical incident. The emphasis is on the identification of accidental fires, faulty appliances or poor work practices. However, if the cause is believed to be deliberate, the Fire Officer adopts a supportive role and assists the Police and other agencies where necessary.

A pilot course entitled "Fire Scene Examination" was conducted in June 1996. The course explored a holistic view of the roles and responsibilities of all agencies involved in a Fire Investigation. Its aim was to narrow the learning field so as to specifically address procedures, techniques and the role the Queensland Fire Service should adopt when establishing the cause of a fire or chemical incident.

During development of this pilot course, considerable support was received from the Queensland Police Service, Forensic Services Australia, Department of Mines and Energy, electrical regulators, explosive inspectors, insurance loss adjusters, gas inspectors and insurance investigators Charles Melloy and Peter Thomas.

This course had a two week face-to-face component in which the above mentioned agencies were invited to lecture. A house was burnt to give five separate fire scenes so that the students could demonstrate and practice methods of determining the cause of a fire while interacting with other agencies. From feedback and assessment results achieved by the students, this course was very successful, and has led to the formulation of curriculum advisory committee to work on gaining accreditation under the V.E.T.E.C. system.

Biannual courses have been scheduled to commence in May 1997. They will conform with the changes of direction and policies of all agencies, yet remain within the boundaries of the Queensland Fire and Rescue Authority's procedures and responsibilities for fire scene examination. It is essential that the Fire Scene Examination Officer be aware of the impact that his/her findings may have on other agencies involved in the determination of a fire cause.

A goal of this course is to parallel the ideals of John DeHaan in ensuring that these trained fire scene examination officers are prepared to stand knee-deep in ash and fire debris with that overriding desire to establishing the cause accurately.

To maintain the skills acquired during this course, future refresher programs will reassess competency and augment existing skills and knowledge by exposure to new technology and procedure.

The continuation of this multi-agency approach can only enhance the efficiency and accuracy of fire scene investigations in Queensland.

VICTORIAN NEWS

Hopefully all members had a relaxing and enjoyable Christmas break and returned fresh and ready to start a new year. You will be aware of the fires of the 20th and 21st January 1997 in and around Melbourne. Many of our members were involved in the firefight and the continuing investigations into the fires. This has put extra work load on some of the Committee and we apologize for any inconvenience it may cause our members.

MEMBERSHIP

The committee welcomes the following new members to the Victorian Chapter:

Michael Burns
Brett Collis
Dominic DeVincentis
Gary Egan
Greg French
Gavin Pomeroy
Philip Pyke
Paul Reynolds
Ronald Schultz
Glen Sutton
Michael Sutton
CFA Resource Centre

We still require your services, as members, to be spokespersons to recruit members for the Chapter.

NEW ADDRESS

The Admin. Officer is now at:
180 Fernbank-Lindenow Road
LINDENOW SOUTH
VIC 3875
Phone/Fax (03) 5157 1647

PROGRAM OF EVENTS 1997

Due to the Christmas break and the January fires the committee have not fully completed arrangements for the Golf Day or Meetings, so as the information comes available it will be forwarded to each member. If your intention is to attend any of the events please contact the organiser to secure your place.

Editor's Note:

Members throughout Australia witnessed with horror the tragic bushfires in Victoria in January, and shared the anguish of those involved. Evidence that they appeared to be deliberately lit was disturbing. They highlighted the need for full and acurate fire determination investigation.

PYROLYSIS

(Views of Dr. David Schudel, from the December 1996 copy of "Fire and Arson Investigator").

In recent years there has been some confusion and misuse of terms in the fire investigation field. Although on the whole the "intent" of the usage is clear, an investigator must be comfortable in the precise definition of terms before using them.

One of the problem terms is "pyrolysis". A common misuse is found in a recent example where pyrolysis is described as "a chemical reaction or oxidation of material that lowers the ignition point of wood".

In fact, pyrolysis is the degradation of a material into one or more different materials by *heat alone*. The term is the counterpart of photolysis, which is degradation by *light*. Pyrolysis can occur in many materials, not just wood. For example, in the events leading to flashover, combustible materials in a room are heated by the hot layer in the room until they start to pyrolyse and release gases. It is these pyrolysis products (gases) which subsequently ignite.

California Association of Criminalists CODE OF ETHICS

The Code of Ethics adopted by the IAAI has created some interest and criticism. A more detailed code has been spelt out in California by their Association of Criminalists. It could be used as a basis for an Australian standard. Do we need to define our own code?

This Code is intended as a guide to the ethical conduct of individual workers in the field of criminalistics. It is not to be construed that these principles are immutable laws nor that they are all-inclusive. Instead, they represent general standards which each worker should strive to meet. It is to be realized that each individual case may vary, just as does the evidence with which the criminalist is concerned, and no set of guides or rules will precisely fit every occasion.

At the same time, the fundamentals set forth in this Code are to be regarded as indicating, to a considerable extent, the conduct requirements expected of members of the profession and of this Association. A failure to meet or maintain certain of these standards will justifiably cast doubt upon an individual's fitness for this type of work. Serious or repeated infractions of these principles may be regarded as inconsistent with membership in the Association.

Criminalistics is that professional occupation concerned with the scientific analysis and examination of physical evidence, its interpretation, and its presentation in court. It involves the application of principles, techniques and methods of the physical sciences, and has as its primary objective a determination of physical facts which may be significant in legal cases.

It is the duty of any person practicing the profession of criminalistics to serve the interests of justice to the best of his ability at all times. In fulfilling this duty, he will use all of the scientific means at his command to ascertain all of the significant physical facts relative to matters under investigation.

Having made factual determinations, the criminalist must then interpret and evaluate his finding. In this he will be guided by experience and knowledge which, coupled with a serious consideration of his analytical findings and the application of sound judgment, may enable him to arrive at opinions and conclusions pertaining to the matters under study. These findings of fact and his conclusions and opinions should then be reported, with all the accuracy and skill of which the criminalist is capable, to the end that all may fully understand and be able to place the findings in their proper relationship to the problem at issue.

In carrying out these functions, the criminalist will be guided by those practices and procedures which are generally recognized within the profession to be consistent with a high level of professional ethics. The motives, methods, and actions of the criminalist shall at all times be above reproach, in good taste, and consistent with proper moral conduct.

1. ETHICS RELATING TO SCIENTIFIC METHOD:

A. The criminalist has a truly scientific spirit and should be inquiring, progressive, logical and unbiased.

B. The true scientist will make adequate examination of his materials, applying those tests essential to proof. He will not, merely for the sake of bolstering his conclusions, utilize unwarranted and superfluous tests in an attempt to give apparent greater weight to his results.

C. The modern scientific mind is an open one incompatible with secrecy of method. Scientific analyses will not be conducted by "secret processes," nor will conclusions in case work be based upon such tests and experiments as will not be revealed to the profession.

D. A proper scientific method demands reliability of validity in the materials analyzed. Conclusions will not be drawn from materials which themselves appear unrepresentative, atypical, or unreliable.

E. A truly scientific method requires that no generally discredited or unreliable procedure be utilized in the analysis.

F. The progressive worker will keep abreast of new developments in scientific methods and in all cases view them with an open mind. This is not to say that he need not be critical of untried or unproved methods, but he will recognize superior methods if and when they are introduced.

2. ETHICS RELATING TO OPINIONS AND CONCLUSIONS:

A. Valid conclusions call for the application of proven methods. Where it is practical to do so, the competent criminalist will apply such methods throughout. This does not demand the application of "standard testing procedures," but, where practical, use should be made of those methods developed and recognized by this or other professional societies.

B. Tests are designed to disclose true facts and all interpretations shall be consistent with that purpose and will not be knowingly distorted.

C. Where appropriate to the correct interpretation of a test, experimental controls shall be made for verification.

D. Where possible, the conclusions reached as a result of analytical tests are properly verified by re-testing or the application of additional techniques.

E. Where test results are inconclusive or indefinite, any conclusions drawn shall be fully explained.

F. The scientific mind is unbiased and refuse to be swayed by evidence or matters outside the specific materials under consideration. It is immune to suggestion, pressures, and coercions inconsistent with the evidence at hand, being interested only in ascertaining facts.

G. The criminalist will be alert to recognize the significance of a test result as it may relate to the investigative aspects of a case. In this respect he will, however, scrupulously avoid confusing scientific fact with investigative theory in his interpretations.

H. Scientific method demands that the individual be aware of his own limitations and refuse to extend himself beyond them. It is both proper and advisable that the scientific worker seek knowledge in new fields; he will not, however, be hasty to apply such knowledge before he has had adequate training and experience.

I. Where test results are capable of being interpreted to the advantage of either side of a case, the criminalist will not choose that interpretation favoring the side by which he is employed merely as a means of justifying his employment.

J. It is both wise and proper that the criminalist be aware of the various possible implications of his opinions and conclusions and be prepared to weigh them, if called upon to do so. In any such case, however, he will clearly distinguish between that which may be regarded as scientifically demonstrated fact and that which is speculative.

3. ETHICAL ASPECTS OF COURT PRESENTATION:

A. The expert witness is one who has substantially greater knowledge of a given subject or science than has the average person. An expert opinion is properly defined as "the formal opinion of an expert." Ordinary opinion consists of one's thoughts or beliefs on matters, generally unsupported by detailed analysis of the subject under consideration. Expert opinion is also definded as the considered opinion of an expert, or a formal judgement. It is to be understood that an "expert opinion" is an opinion derived only from a formal consideration of a subject within the expert's knowledge and experience.

B. The ethical expert does not take advantage of his privilege to express opinions by offering opinions on matters within his field of qualification to which he has not given formal consideration.

C. Regardless of legal definitions, the criminalist will realize that there are degrees of certainty represented under the single term of "expert opinion." He will not take advantage of the general privilege to assign greater significance to an interpretation than is justified by the available data.

D. Where circumstances indicate it to be proper, the expert will not hesitate to indicate that while he has an opinion, derived of study and judgment within his field, the opinion may lack the certainty of other opinions he might offer. By this or other means, he takes care to leave no false impressions in the minds of the jurors or the court.

E. In all respects, the criminalist will avoid the use of terms and opinions which will be assigned greater weight than are due them. Where an opinion requires qualification or explanation, it is not only proper but incumbent upon the witness to offer such qualification.

F. The expert witness should keep in mind that the lay juror is apt to assign greater significance to ordinary words of a scientist than to the same words when used by a lay witness. The criminalist, therefore, will avoid such terms as may be misconstrued or misunderstood.

G. It is not the object of the criminalist's appearance in court to present only that evidence which supports the view of the side which employs him. He has a moral obligation to see to it that the court understands the evidence as it exists and to present it in an impartial manner.

H. The criminalist will not by implication, knowingly or intentionally, assist the contestants in a case through such tactics as will implant a false impression in the minds of the jury.

I. The criminalist, testifying as an expert witness, will make every effort to use understandable language in his explanations and demonstrations in order that the jury will obtain a true and valid concept of the testimony. The use of unclear, misleading, circuitous or ambiguous language with a view of confusing an issue in the minds of the court or jury is unethical.

J. The criminalist will answer all questions put to him in a clear, straightforward manner and refuse to extend himself beyond his field of competence.

K. Where the expert must prepare photographs or offer oral "background information" to the jury in respect to a specific type of analytic method, this information shall be reliable and valid, typifying the usual or normal basis for the method. The instructional material shall be of that level which will provide the jury with a proper basis for evaluating the subsequent evidence presentations, and not such as would provide them with a lower standard than the science demands.

L. Any and all photographic displays shall be made according to acceptable practice, and shall not be intentionally altered or distorted with a view to misleading court or jury.

M. By way of conveying information to the court, it is appropriate that any of a variety of demonstrative materials and methods
be utilized by the expert witness. Such methods and materials shall not however, be unduly sensational.

4. ETHICS RELATING TO THE GENERAL PRACTICE OF CRIMINALISTICS:

A. Where the criminalist engages in private practice, it is appropriate that he set a reasonable fee for his services.

B. No services shall ever be rendered on a contingency fee basis.

C. It shall be regarded as ethical for one criminalist to re-examine evidence materials previously submitted to or examined by
another. Where a difference of opinion arises, however, as to the significance of the evidence or to test results, it is in the interest of the profession that every effort be made by both analysts to resolve their conflict before the case goes to trial.

D. Generally, the principle of "attorney-client" relationship is considered to apply to the work of a physical evidence consultant, except in a situation where a miscarriage of justice might occur. Justice should be the guiding principle.

E. It shall be ethical for one of this profession to serve an attorney in an advisory capacity regarding the interrogation of another expert who may be presenting testimony. This service must be performed in good faith and not maliciously. Its purpose is to prevent incompetent testimony but not to thwart justice.

F. It shall be ethical and proper for one criminalist to bring to the attention of the Association a violation of any of these ethical principles; indeed, it shall be mandatory where it appears that a serious infraction or repeated violations have been committed.

G. This Code may be used by any criminalist in justification of his conduct in a given case with the understanding that he will
have the full support of this Association.

Letters to the Editor

I read with interest your article on hydrocarbon propellants.

We investigated an explosion in a kitchen located at the back of a second floor apartment in Montreal, Canada. The origin of the explosion was inside an electrical clothes dryer installed in a closet in one corner of the kitchen. The explosion caused almost no heat damage. However, the enclosure of the dryer opened like a firecracker and intense damage was caused to the building's structures around the kitchen, No one was injured as the occupants were at the front of the apartment at the time of the explosion.

The cause of the explosion was an aerosol air freshner can misplaced in the clothes dryer while the dryer was in use. Similar cans were stored on the shelf above and one of them may have fallen in the clothes on top of the dryer before they were placed in the dryer.

Our discussions with the air freshner manufacturer indicated that the can contained by weight 30% of a mixture of hydrocarbons (propane, isobutane and butane)) used as a propellant. The can itself did not explode and was found in the debris in front of the dryer. Its cap was beside it, cracked but in one piece, partially melted along the cracks.

We believe the heat in the dryer and/or shocks against the drum allowed a small amount of the propellant to be expelled from the can. The explosive mixture was then ignited by one of the many potential ignition sources inside the dryer.

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