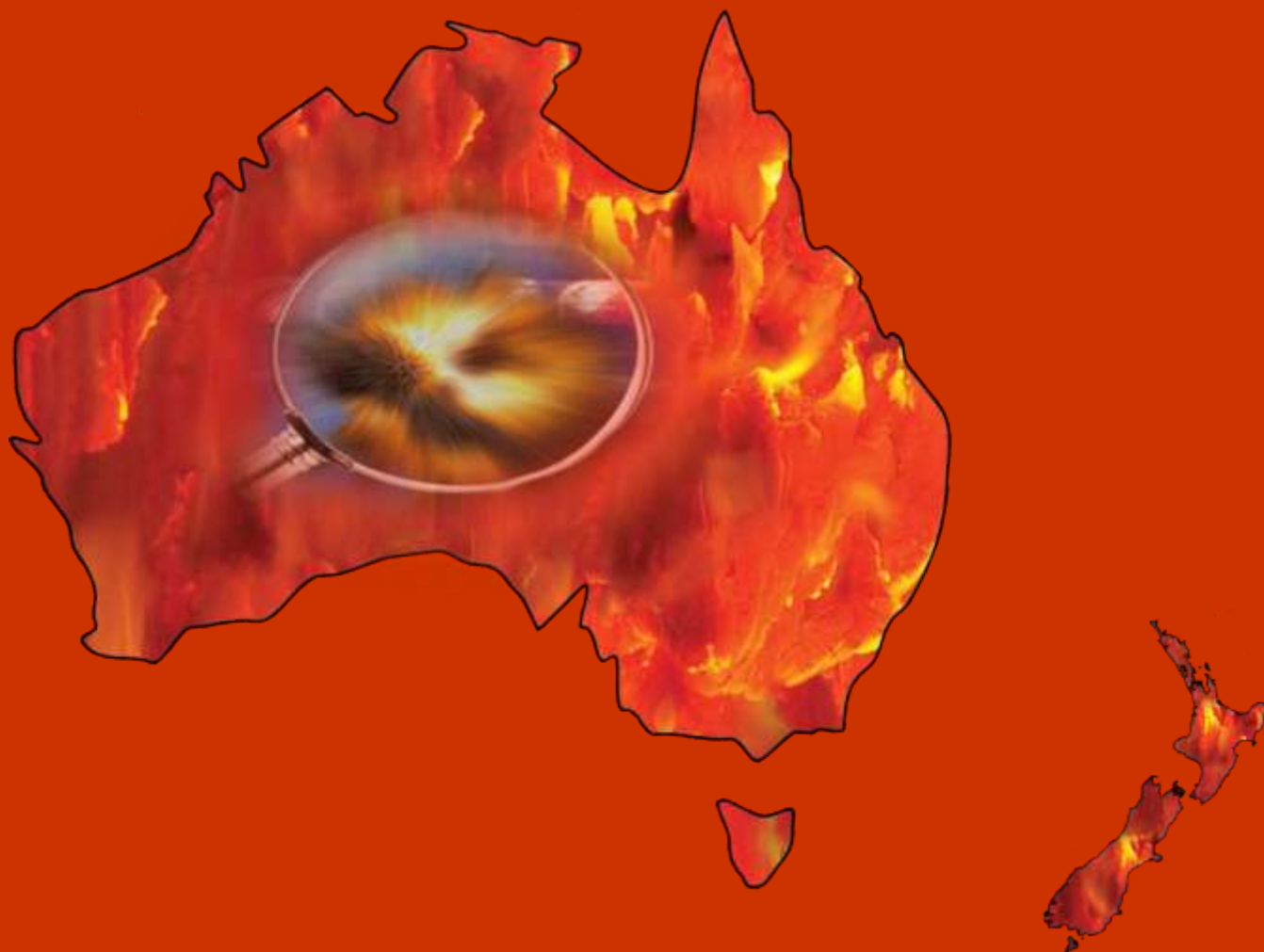


FIREPOINT

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FIREPOINT

IAAI Journal

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Editorial

Here we are at the fourth edition of the on-line FirePoint, the year is passing as fast as ever, and the Editorial Group has been working away to put together another edition.

Still again we need more articles, case studies, editorial comments, photographs, pictures or cartoons and advertising to make this magazine the best and most informative magazine possible.

The magazine will continue to be published twice a year at this stage, we are happy to receive comments on this discussion. The next edition is planned for November/December 2017.

Again we will be awarding contribution prizes for different categories, these may include:

- **Best article.**
- **Best photograph.**

These will be judged on feedback from the readers, chapter committees and the editorial committee. Prizes will include book and hardware vouchers and will be announced in the next edition.

We cannot have enough content in the archive ready for the next editions, please forward anything you can contribute, even ideas.

The next national conference is in to the planning stages and progressing well, as you will see from the flyer at the rear of this ezine the conference will be held in regional Victoria in November 2018. Please register your interest in attending and/or presenting.

We look forward to the future discussions and contributions to FirePoint.

Don't forget to forward your feedback on the articles and magazine as a whole.

Stay safe on the Fireground.

Regards
Fire Point Team

Victorian Association of Fire Investigators

President's report

Welcome to the 4th edition!

Our website problems continued until recently, the committee has now decided to set up a new website, complete with new web address. The new site will be www.vafi.com.au, this better represents our association. Please have a look, we will be building on this platform as we progress. Our email address remain the same at this stage. We have redirected the old site to the new one, this will be in place until late next year.

Our first training session this year was well attended, with over 90 attending "Sample Collection from Fire Scene & Analysis". This event was hosted and presented by Victoria Police Forensic Services Department, and included a tour of their facility.

Our next training session will again be hosted at Victoria Police Forensic Services Department on 19 July 2017. The topic for this session is "Forensic Pathology linking with Fire Investigation" with four speakers from the Victorian Institute of Forensic Medicine. Any interstate members wishing to attend please contact me directly.

All training days will have a 15 minute session to begin with for an open forum to discuss VAFI issues and OH&S concerns that members have experienced. Please participate in this important area.

Again, please consider what you can provide to the association by your attendance or presentation at a training session. Remember, a small fire can provide good learnings, this is what

we are looking for. Some great learnings can come from a small fire with the evidence that can be viewed.

A 15 minute presentation can be fitted in to a training session if that is what you have, please step up.



We are planning the third training session for 2017, which will be held in Geelong on 11 October 2017. It is proposed to have some speakers to discuss Electricity Smart Meters – Fires, Data and Outcomes, together with some Electrical Safety and Case Studies. Put this date in your calendar.

As always, we invite members of the other Chapters to attend any of our training sessions.

Please check the website for updates on the training schedule and other important news, we will continue to also use the email system to notify members of events and news.

Planning has now started for the training schedule for 2018, there is planning for two sessions plus the Australasian Association of Fire Investigators conference in November.

Please register your interest in attending or presentation. We are also looking for sponsors and stall holders at the event which will have over 100 attendees from across Australia, New Zealand and the Asia Pacific region, the event has also been registered with the International Association of Arson Investigators.

If you or someone you know would like to sponsor or hold a trade stall at the conference, please register on the email on back page of FirePoint.

The committee has been working very hard in the background in several areas to ensure the planning and growth of VAFI, if you think you could assist in any of the tasks required please see one of the committee. We are looking for assistance so if you believe you could help, please see one of the committee.

Stay safe on the fire scene, and see you at the next training session

Michael Weekes

President – VAFI

*Your advertising
could go here!*

Articles

Ignition of combustibles due to conducted heat

Energy Safe Victoria (ESV) has over the last two years conducted an investigation that has stemmed from a number of strikingly familiar incidents that have occurred in commercial kitchens. Each of these incidents occurred within a wall space, adjacent to items of commercial catering gas equipment and there was no source of ignition within the wall space.

It was found that a sustained, relatively low temperature ($>120^{\circ}\text{C}$) was present, and was the only possible cause of ignition.

Whilst the mechanism is not clearly known, historical evidence beyond the incidents investigated by ESV indicate that ignition can occur under such circumstances. Further, the time for an ignition at a low temperature decreases as the temperature rises.

The long usage patterns for commercial catering appliances has been demonstrated, via laboratory recreated scenarios by ESV, to cause temperatures of in excess of 130°C of the combustible materials.



Figure 1



Figure 2



Figure 3

This is far below the ignition temperature of wood due to external heating (Approximately 250°C), but is high enough that long-term exposure to these temperatures can result in charring or (eventual) ignition.

Clearance distance, which relates to the appliance certification and installation in accordance with AS/NZS 5601.1, are intended to prevent the temperature of combustible materials adjacent to the appliance to exceed a 65°C rise above the ambient room temperature. Where the specified clearance distance between the appliance and combustible materials cannot be achieved, the Standard makes



provision to reduce or eliminate the clearance distance if combustible materials are protected by a fire resistant material.

In practice, this has become the preferred means of compliance. However, it is a flawed allowance; in that there is effectively no limit on the temperatures experienced by the fire resistant material, and therefore conducted through to combustible materials.

Fire resistant materials must comply with a material specification, one part of which is the required thermal transmission properties.

The thermal transmission properties requirement was introduced following the removal of asbestos products from use, and was selected as being of equivalent performance to asbestos millboard products. However, the level of protection afforded by this requirement was never quantified – and no limitation was placed on the appliances to be installed this way.

For comparison, commercial catering gas appliance flue gas temperatures can be up to 575°C above ambient (Fryers). Interestingly, the incidents have not occurred on appliances such as fryers – but on lower heat input appliances (with lower flue gas temperatures) used to boil vast quantities of water such as steamers and brat pans. It is hypothesised that this is due to the differing modes of operation – a fryer operates thermostatically, while steamers and brat pans tend to operate continuously (Even when fitted with a thermostat – the thermostat is usually set above 100°C resulting in continuous operation when used for heating water).



Figure 4

Of the incidents that ESV has investigated, a surprisingly short period of time had elapsed since the installation began operation before a fire occurring. Two separate incidents show this – 4 and six days respectively. The exact temperatures experienced by combustible members is unknown from these two appliances, however the flue gas temperatures from the appliance were measured as 430°C and 380°C.

Initial work by ESV centred around products that failed to meet the required product specification and were incorrectly marketed for use as a fire resistant material in gas installations.

ESV is now consulting with Standards Australia committees AG-006 Gas Installations and AG-001 Gas Appliances in order to determine an acceptable level of protection, and set appliance requirements to limit the heat that is imparted onto the installation.

Hopefully such requirements will prevent heat being imparted to combustibles to safe levels.

Tyler Mason

Gas Engineer

Energy Safe Victoria



The case of the black widow (police article)

Editorial Anna Erbrederis

George Marcetta ate his favourite dish – pork rolls and noodles, on the night of Thursday, 9 September 2004. Mr Marcetta's partner Vasiliki 'Vicky' Efandis had cooked the meal at his Bellfield home before returning to her house in the nearby suburb of Ivanhoe. At 2am Mr Marcetta's house was set alight. Three hours later the 58 year old's body was found lying face up, semi clothed and heavily burnt in the master bedroom.

Vicky Efandis met Mr Marcetta in 2000. She was 41 and working for him as a housekeeper. He was a generous, kind-hearted man who owned a successful painting business. In a short time the pair formed a relationship and by 2004, Efandis had transferred Mr Marcetta's house and three cars into her name, including an expensive Jaguar – his pride and joy. She had become co-signatory on all of his bank accounts, co-director of his business and had even convinced Mr Marcetta to revoke his will, which left the estate to his only daughter. In November 2008, the dubbed "black widow" was sentenced to 24 years in prison for the murder of Mr. Marcetta.

Efandis was caught following intensive investigative work of the Victoria Police Arson Squad. What they discovered was a crime that had taken years of planning. Efandis had spun a web of lies. The black widow presented herself as a polite kind and pleasant woman. But as detectives untangled her deceit, they found a cold, calculating and callous killer motivated by greed.

Former Arson Squad detective, Sergeant Matthew Height, became involved in the case on the night of the fire. He said police first met Efandis that

evening, but it was not until later that she became a suspect.

"Police were on the scene at about 3am, the same time as Efandis," Sgt Height said.

"She immediately told us that George Marcetta was murdered by Ivan Bassett, a business associate. Efandis did not even know at this stage that there was a body in the house.

"She left the fire and went home that night without even knowing if Mr Marcetta was dead or alive."

The seven kerosene bottles found littered around the burnt out house told a

disturbing story.

"We could prove that the kerosene was purchased at least several months before the murder." Sgt height said.

"Sparko Kerosene had changed its labels some time ago and the bottles found in the house were branded with the out dated design. The very last of these labels was taken off the shelves in about December 2003."

This told investigators George Marcetta's murder was planned at length for some time. The kerosene evidence was a major factor in the large sentence Efandis received.

From the exterior Vicky Efandis appeared to be a polite and helpful woman living in the quiet well to do suburb of Ivanhoe. On the inside she was planning one of Victoria's most cold and calculating murders.

Ivan Bassett was Efandis' fall-out boy. She told police there was bad blood between Mr Marcetta and Mr Bassett over a business debt. Three months prior to the murder, Efandis reported a burglary at the Bellfield address, alleging she had seen Mr Bassett drive off with \$23,000 worth of tools from a shed at the property. She also alleged Mr Bassett had threatened her lover with physical violence.

"Efandis went about setting up Ivan Bassett for the murder of George Marcetta." Sgt Height said.

"What we found was Mr Bassett's car had been written off and sold to a wrecker in Bundoora two days before the reported burglary.

"When we searched Efandis' Ivanhoe property we found a large quantity of goods that had been allegedly stolen."

A common theme of cars continued to unravel Efandis' lies.

"Efandis had hired a late model Ford Falcon from 6 to 9 September despite the fact that she had access to three other vehicles." Sgt Height said.

"She concealed possession of the hire car from everyone, even her daughter."

She did not park the car near her house."

Witnesses confirmed seeing the Ford at Mr Marcetta's address on the night of the murder.

Another interesting piece of circumstantial evidence against Efandis involved SMS text messages.

"Efandis told us she and Mr Marcetta text messaged each other every morning and night." Sgt Height said.

Efandis' text messages were sent via the mobile phone tower in Ivanhoe. Mr Marcetta's messages were sent via the Preston tower.

On the night of the murder Efandis claimed she was at her house and Mr Marcetta was at his.

"She sent him a text message at 11.08pm. He sent one back 20 minutes later."

"Phone records showed us that both messages were sent via the Preston tower and that Efandis also received her message via that tower."

The mobile phone evidence placed Efandis in the area of the crime.

A key part of the case against Efandis was Mr

Marcetta's last meal, his favourite pork rolls and noodles. An autopsy revealed high quantities of Oxazepam, a sedative and hypnotic drug in Mr Marcetta's body.

"Mr Marcetta did not have access to this drug. But Efandis had a prescription for Serepax,

which is a form of the drug." Sgt Height said.

Police found that Efandis laced her victim's last meal with Oxazepam, rendering him unconscious while she set about burning down the house.

The case against Efandis was built on numerous pieces of circumstantial evidence. Each piece of the evidence was totally independent of the next," Sgt Height said.

"This made our case extremely strong."

The Supreme Court judge who sentenced Efandis labelled the murder as 'chilling'. He described the black widow as 'cunning, ruthless and evil'. Efandis was sentenced to a non-parole period of 20 years' imprisonment. This is the largest sentence ever handed down to a female murderer in Victoria.

"She left the fire and went home that night without even knowing if Mr Marcetta was dead or alive."

Queensland Association of Fire Investigators



QAFI Chapter Report Jan - July 2017

The QAFI started the year with our first Forum /Seminar for the year conducted in March, to support and develop a national consistency of preparedness and direction across the Fire Investigation Community we decided to expand on the ideals set during the AAFI conference.

Any Fire Investigator irrespective of their agency representation must always be prepared and have a demonstrated capability to defend and define the manner in which they have processed a fire scene, conducted their investigation analysis activities and developed their final hypothesis on the origin and cause outcomes.

Are you prepared?

To promote best practice methodology in all agencies involved in Fire Scene Investigation - Origin and Cause Determination throughout Queensland.

Aim 1

We decided to run a session that posed the question to each agency involved in Fire Investigation whether they were a government based agency (e.g.: Fire or Police Service) or a private agency representative (eg: Insurance Assessors or Private FI) "Are You Prepared".

We took the approach that we could apply the Scientific Methodology to review the individual agency capability to withstand external scrutiny of your agency practices and preparation.

Without revisiting the entire session in this forum, I will include a small snippet of how we progressed this as an example for other agencies to consider.

Are you prepared?

- With appropriate equipment, training and qualifications.
- With recognised work practices and protocols.
- To defend and validate your investigative actions under scrutiny in a court of law.
- To defend your evidence collection and preservation methodology under scrutiny in a court of law.

Can you demonstrate reliability and validity of your investigative processes and protocols?

We used the framework of the Scientific Methodology to progress the concept. There were many points raised in each section and the following is a concise example of the topics raised and the questions posed.

Investigation Procedures and Protocols

Recognise the need

- Do YOU have a defined response protocol for recording notifications to conduct investigations?
- How is an investigator allocated to any specific investigation, what is the basis for their attendance.
- Do YOU have a defined Operational Protocol to follow for conducting the Investigation?

Define the Problem

- How would your agency demonstrate to the courts your notification/response protocols?
- Is there a review of the required qualifications to conduct the investigation?
- Can YOU demonstrate to an external party the basis of YOUR sequential process?

Collect Data

- Review YOUR Organisational Policies and Directives
- Review existing National and International standards for similar agencies
- Investigative Sequence and WHS Requirements for site investigations

Analyse the data

- Do YOUR policies provide guidance and direction for the investigator?
- What justification can you provide for the choice of organisational standards?
- How do YOUR standards compare against recognised industry accepted standards?

Develop a Hypothesis

- Standards set are satisfactory for organisational requirements
- Standards set may not meet recognised best practice
- Standards may require review to increase capability

Test the Hypothesis

- Evaluate how effectively those standards address the requirements of the investigation
- Evaluate how effectively those standards protect the investigator
- Submit your organisational standards to an external party for peer review

Select the Final Hypothesis

- Existing organisational standards are appropriate
- Existing organisational standards require review and modification

We carried the theme right through on a range of agency preparedness topics including.

- Analysis and Review actions
- Cause Hypothesis
- Evidence Collection processes
- Reporting Procedures

The seminar was well received by a small but enthusiastic group of agency representatives.

At the close of the forum QAFI management were approached by a leading Insurance Agency Manager requesting further information of how he could best prepare his agency representatives to improve their training and avoid and exposure during any post investigation analysis in the courts.

So we considered the session a success in that we achieved the objective to promote awareness of the

importance of pre investigation preparation by Investigative Agencies.

Stay tuned to future editions of Firepoint and the QAFI website for further news on this Seminar/Workshop.

Regards

Chris Markwell
QAFI President

*Your advertising
could go here!*

NSW Association of Fire Investigators

Presidents report

Greetings and welcome to another edition of Firepoint

Well the year is powering along and there has been plenty going on in the world of fire investigation. The IAAI ITC was conducted in April with two of our NSWAFI members attending this international conference. One of our members, Mark Pellegrino, was actually interviewed at the conference for the Speaking of Fire, which is a radio show that discusses all things fire investigation.

(<http://speakingoffire.com/>) You can view the interview at.

(<http://www.voiceamerica.tv/media/304477>)

The 2018 ITC will be held in Frisco, Texas May 20-24.

One of our most important (if not the most important) documents, NFPA 921, has its 2017 edition released in March. If you are fulfilling the requirements of NFPA 1033, Standard for Professional Qualifications for Fire Investigators, then you should already know this. If you did not know this then you should acquaint yourself with the changes to this document ASAP. NSWAFI conducted an education night in June which went through all of the major changes to the guide. A copy of that presentation can be found at (<https://www.nswafi.com.au/single-post/2017/06/08/1617-Education-Night-Summary>) I cannot stress enough the importance of this guide in doing the job as a fire investigator. Not only will it assist you in doing that job but it will also show your competence to a court when quoting this document. You can purchase the new edition for the FPAA website:



<http://www.fpaa.com.au/sales/guide-for-fire-explosion-investigations.aspx>

In IAAI news the organisation continues to be the global leader in fire investigation with membership now exceeding 9000 worldwide. There are now 2,181 IAAI-CFI's and 1,718 IAAI-FIT's. . If you have been in the fire investigation industry for a few years you may be able to apply for the FIT and/or CFI certifications. Please contact me if you are interested.

More information about

these programs can be found at:

<https://www.firearson.com/Training-Certifications/Certified-Fire-Investigator-IAAICFI/Default.aspx>

<https://www.firearson.com/Training-Certifications/Fire-Investigation-Technician-IAAIFIT.aspx>

CFITrainer.net has had new programs added to its large list of educational modules. As I have said in the past this is a valuable resource for the fire investigator. And best of all it is FREE!!! They also have regular podcast you can listen to which update you on different topics in the fire investigation world. If you have not registered for this website please give it your consideration.

Recently NSWAFI has created an Expert Referral Service as part of our website. From time to time, we get approached to provide a referral for an expert in the fire investigation field. Each time this has occurred, we have had to write

back and state that we are an education association, not a referral association. The Committee has thought about this approach and decided that, as an Association, we have many members that are experts in the field of fire investigation and if people choose to look for such a person then we should be able to provide a list of people who can be contacted for expert referral. As a result, the Committee has decided to create a page on our website for this purpose - the Expert Referral Service. We are now seeking details from members who wish to be on this list. There will be two requirements to be considered for inclusion on the list:

1. You must be a financial member of the NSWAFI;
2. You must be in good standing within the NSWAFI.

If you wish to contribute your details to the Expert Referral Service of the NSWAFI website, please contact the Secretary with your name, company affiliation, contact number, email address, and specific area of expertise.

- The NSWAFI AGM was conducted on 3/8/17. Thanks to all those who attended, here is a summary of the meeting:
- We have had a good year with a successful AAFI 2016. A profit from this conference of just over \$10,000 has put the association in good financial position. The committee has decided to put \$2500 towards an increase of the seed funding for future conferences.
- We have 138 financial members.
- We are approaching 500 likes on our Facebook page.

- We had 5 education nights in the previous year with 6 planned for the coming year.
- President Michael Forbes announced the Ross Brogan Training Scholarship. This will enable at least 2 NSWAFI members to attend each AAFI Conference into the future. The scholarship will pay for the winners' registration fees. More info on this will be announced soon.
- The Treasurer reported that the association has over \$24000 in the bank.
- The new Committee was appointed for the next 12 months:
President: Michael Forbes
Senior Vice President: Alex Visotin
Junior Vice President: Barry Sutherland
Secretary: Bob McKay
Treasurer: Taylor Pallaton
Education: Steve Apps
Merchandise: Jason Taylor
Committee: Mark Pelligrino, Mark Hamilton, Sonia Scott and Wayne Schweickle.

NSWAFI has two remaining education nights for the year. Thursday 5/10 and Thursday 7/12; both will be held at RFS HQ at Homebush. Some of our recent education nights have been put onto our YouTube site.

Congratulation to VAFI for producing another edition of Firepoint. I thank you for the time spent reading this message and being part of the AAFI.

Michael Forbes IAAI-CFI CFEI GFireE
President
IAAI Liaison Officer

Articles

QGIS

In the digital age people expect communication to be visually attractive and to clearly and succinctly convey a message. Fire investigators must conform to this and produce reports and statements that meet these expectations. The hand drawn sketch and map rarely have the same impact as those produced by GIS programs.

Commercial GIS programs are expensive and may not be available to investigators, when and where they need them. The NSW Rural Fire Service uses Mapdesk, an ESRI program that is linked to its network. The number of computers on which it can be used are limited and this usually involves a trip to a Fire Control Centre. Cost and security have prevented FIs from having access on their personal computers.

For the volunteer FI a \$3000 licence fee for programs such as MapInfo or even the \$500 US for Global Mapper is usually out of the question. The alternative is to use a freeware program such as QGIS.

Many of the programs that were originally freeware, such as Global Mapper, were developed by government agencies; the US Geological Service in that case. Over time they have been sold to commercial interests and although significantly improved they have become expensive.

One that has kept its free and open source status, but is constantly being developed, is QGIS. Formerly Quantum GIS, this software allows users to analyse and edit spatial information, compose and export graphical maps. QGIS supports both raster and vector layers; vector data is stored as either point, line, or polygon features. Multiple formats of raster images are supported, and the software can georeference images such as aerial photos taken by drones or from web servers such as SIX maps.

The NSW government supplies a Base Map, topographical maps and aerial photos through a Web Server at the LPI Service. These will also be available through the Fire Services to their members. The LPI Web Map Server can be used to produce maps and sketches where ever you find yourself (as long as you have internet contact).

QGIS was developed by the Open Source Geospatial Foundation but was began by Gary Sherman in 2002. It is supported by several governments and agencies including the Swiss Canton of Glarus and Solothurn, the Austrian State of Vorarlberg and the Office of Public Works in Ireland. It has been translated into 48 languages and is used by many Universities, in Europe and America.

The program can be used with many plugins to increase the functionality of the program. Earthview and StreetView are two of these. They allow the user to search for addresses using Google Earth, while syncing the view in QGIS, so that when you have found the location the view is available in your browser and you can begin to use it.

There are many tutorials available on the internet to learn how to use the QGIS program. You can access the program through <http://www.qgis.org/en/site/>.

Rick Miller

Fire Investigator with the NSW Rural Fire Service.

Incident 62/17 - Unit Fire

Unit 25/1 Coss Lane, Lane Cove NSW 2066

Incident date: April 3, 2017

Investigator: Leading Station Officer Michael Forbes

BUILT ENVIRONMENT

Building

A three level unit which was one of 31 in a large complex. The ground level was the garage. On the first level was the living room and kitchen. On the first level were two bedrooms a small study and a bathroom.

Occupants activity

The occupants had left for work around 08:00 hours.

Fire / incident description

A fire in the kitchen filled the entire unit with smoke. The time of call was 11:14 hours.

INTERVIEWS

Fire & Rescue NSW (SO Luke CHALMERS 61C)

- Smoke visible from the road.
- The unit was completely sealed with no windows open. They forced the padlock on the gate leading up the stairs.
- They forced the door open. The unit was full of brown smoke. They commenced a left hand search. They then went up the stairs to the first level. A smoke alarm was operating. They completed the search upstairs, but could not find the seat of the fire.
- The second crew arrived and found flames issuing from a small window on the southern side of the building. This was in an adjacent unit's courtyard.
- The third crew then entered the unit to find the fire in the kitchen. They used the hose from the second crew through the window. The fire was located in the corner of the kitchen, and was knocked down quickly.
- Power was turned off at the circuit board located in the garage.

Occupant (Brendan TUBBS)

- Lived here for 5 months.
- Woke up about 06:00 hours. They both departed at 08:00 hours for work. They lock the front door when they leave and then also padlock the gate on the stairs.
- They have had some issues with the air conditioning, other than that, no electrical problems.
- They do not have contents insurance.



- In the corner of the kitchen they had five appliances. The microwave was on the shelf above the enclosed appliance cupboard. This was plugged into a separate single power point. The hutch on the bench top was open. Inside this were four appliances – a toaster, kettle, sandwich toasting machine and a nutribullet. In the hutch there was a four plug power point, which was fixed to the wall. All four were plugged in.
- They are not smokers. They have candles but have not used them for many days, and not in the corner of the kitchen.

PHYSICAL INDICATORS

External

- There was minimal fire damage visible from the outside. The only area was a small window on the southern side of the building. This window was a kitchen window but located in the courtyard of an adjoining unit. The fire vented¹ out this window (refer Figure 5).



Figure 5 showing the southern wall of unit 25. The window on the left is the kitchen window.



Figure 6 showing the balcony of the unit looking into the living room and front door.

Internal

- In the downstairs lounge room there was heavy soot² damage throughout. This was similar upstairs in the bedrooms.
- The main area of fire damage was in the kitchen, in particular the SE corner of the kitchen (refer Figure 7). Here the concrete ceiling showed areas of clean burn³ in the corner above the small window that had failed.

¹ Venting. The escape of smoke and heat through openings in a building. (*NFPA 921 Guide for Fire and Explosion Investigations 2017 p 19*)

² Soot. Black particles of carbon produced in a flame. (*NFPA 921 Guide for Fire and Explosion Investigations 2017 p. 18*)

³ Clean burn. A distinct and visible fire effect generally apparent on non-combustible surfaces after combustible layer(s) (such as soot, paint, and paper) have been burned away. The effect may also appear where soot has





Figure 7 showing the SE Corner of the kitchen. Note the clean burn to the top right side of the fridge.



Figure 8 showing the ceiling above the SE corner of the kitchen.

- All of the cupboards in this corner had been destroyed by the fire (refer Figure 9). This debris had fallen onto the bench top. Charring to the remaining timber cupboards pointed back to SE corner of kitchen. The fridge also showed an area of clean burn to its right side, pointing back to the SE corner.
- The microwave had fallen onto kitchen floor.
- AOO⁴ was the SE corner of the kitchen.



Figure 9 showing the remains of the enclosed appliance cupboard.

failed to be deposited because of high surface temperatures. (NFPA 921 Guide for Fire and Explosion Investigations 2017 p. 14)

⁴ Area of Origin (AOO). A structure, part of a structure, or general geographic location within a fire scene, in which the “point of origin” of a fire or explosion is reasonably believed to be located. (NFPA 921 Guide for Fire and Explosion Investigations 2017 p. 14)

Excavation

The five appliances were examined in detail.

- The kettle showed fire damage from above, with the underneath plastics still intact. This device was ruled out as the source of ignition⁵ (refer Figure 11 and Figure 12).
- The toaster was located on the right side of the enclosed appliance cupboard. When removed the toaster had plastic fused to its right side. The left side showed a horizontal oxidation⁶ burn pattern (refer Figure 13). This indicated that the heat came from above and from the left side of this device. The base of this device had underneath plastics not melted (refer Figure 14). This device was ruled out as the source of ignition.
- The sandwich press was located on the left side of the enclosed appliance cupboard (refer Figure 15). Its right arm was melted with minimal damage underneath (refer Figure 16). This device was ruled out as the source of ignition.

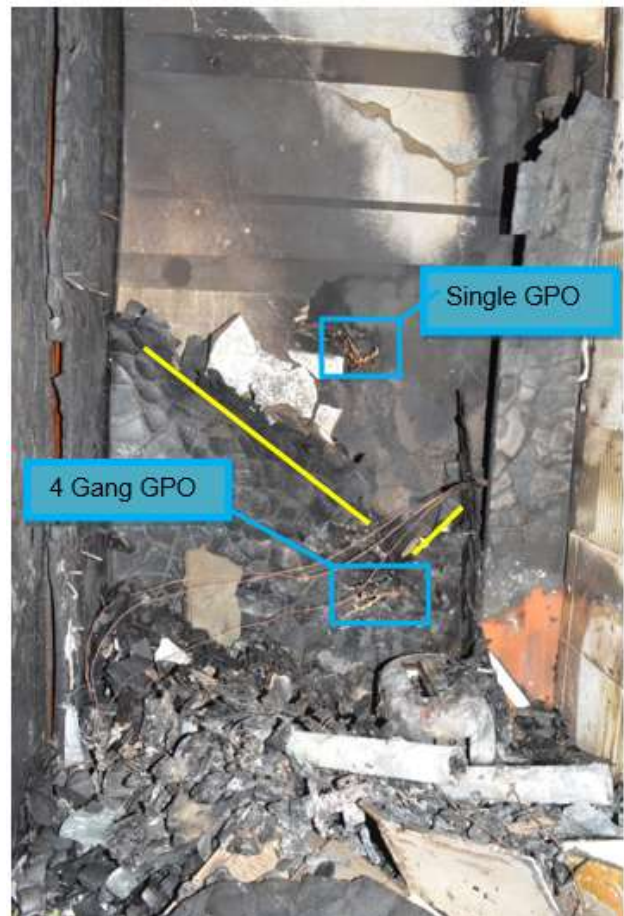


Figure 10 (photo 59) showing the AOO prior to excavation. Note the 'V' pattern on the back wall (yellow).

- The Ninja blender was located on the left side of the enclosed appliance cupboard (refer Figure 17). This device showed greater damage on its right side, with protection on its left side (refer Figure 18). There was no heat damage underneath. This device was ruled out as the source of ignition.
- The microwave showed severe fire damage with oxidation on most sides (refer Figure 19 and Figure 20). No plastic remained on the device. This appliance was located on shelf above the enclosed appliance cupboard and the 4 gang GPO⁷. This appliance is a possible ignition source.

⁵ Competent Ignition Source. An ignition source that has sufficient energy and is capable of transferring that energy to the fuel long enough to raise the fuel to its ignition temperature. (NFPA 921 Guide for Fire and Explosion Investigations 2017 p. 14)

⁶ Oxidation. The combination of oxygen with substances such as metals, rock, or soil that is brought about by high temperatures. (NFPA 921 Guide for Fire and Explosion Investigations 2014 p. 50)

⁷ GPO. A power point is technically referred to as a 'socket outlet'. It's also less commonly referred to as a GPO, which stands for 'General Purpose Outlet' or 'General Power Outlet', (<http://www.build.com.au/socket-outlets-or-gpos-power-points>)



Figure 11 showing the kettle. Note damage is consistent from above.



Figure 12 showing the underneath of the kettle. Note the plastic still intact here.



Figure 13 showing the toaster. Note the oxidation on the left side.



Figure 14 showing the underneath of the toaster. Note the plastic still intact here.



Figure 15 showing the sandwich press. Note the melting to the arm on its right side.



Figure 16 showing the underneath of the sandwich press. Note the plastic still intact here.





Figure 17 showing the ninja blender. Note there is greater damage to one side (right).



Figure 18 showing the underneath of the ninja blender press. Note the plastic still intact here.



Figure 19 showing the rear of the microwave.



Figure 20 showing the inside of the microwave. Note the areas of oxidation are consistent all over the appliance.

- A 'V' pattern⁸ of burning to the timber cupboard on eastern wall with its base pointing back to a 4 gang GPO. The timber backing sheet of the cupboard was pulled out and this showed a hole in timber sheet around the 4 gang GPO (refer Figure 21 and Figure 22).
- 4 gang GPO was examined. 3 buss bars remained. 2 which were of brass colour were the active and neutral while the remaining dark black one was the earth. The 2 brass coloured buss bars both had a red colouring to their right side. This appeared to be a hot joint. This was the POO⁹.

⁸ Plume-Generated Patterns. Fire plumes are three dimensional. Plume patterns represent demarcation lines of fire effects upon materials created by the three-dimensional (conical) shape of the fire plume being cut (truncated) by an intervening two-dimensional surface such as a ceiling or a wall. When the plume intersects with surfaces, it creates effects that are interpreted as patterns (conical sections). The rate of heat release of the burning fuel has a profound effect on the shape of the fire patterns produced. These fire patterns include the following:

- | | | |
|-----------------------|--------------------------------|------------------------------|
| (1) V patterns | (2) Inverted cone patterns | (3) Hourglass patterns |
| (4) U-shaped patterns | (5) Pointer and arrow patterns | (6) Circular-shaped patterns |

(NFPA 921 Guide for Fire and Explosion Investigations 2017 p. 61)

⁹ Point of Origin (POO). The exact physical location within the area of origin where a heat source and a fuel first interact, resulting in a fire or explosion. (NFPA 921 Guide for Fire and Explosion Investigations 2017 p. 17)





Figure 21 showing the wall behind the timber backing.



Figure 22 showing the back of the timber cupboard.



Figure 23 showing the remains of the busbars.



Figure 24 showing a close up of the right side. Note the discolouration of the busbars.



Figure 25 showing the excavated area with appliances in their original positions. The 4 gang GPO is above the toaster. The locations of the shelves are in yellow. The approximate location of the microwave is shown in blue.



ORIGIN

Area of origin

My hypothesis that the AOO for this fire was SE corner of the kitchen is supported due to the following reasons:

- The 'V' pattern of clean burn on the fridge indicated the fire came from the bench top in the SE corner.
- The charring to the remaining overhead cupboards on the southern wall indicated the fire came from the bench top in the SE corner.

Point of origin

- My hypothesis that the POO for this fire was the 4 gang GPO located in the enclosed appliance cupboard is supported due to the following reasons:
- The four appliances located within the enclosed appliance cupboard were ruled out due to the fire damage each had sustained.
- A 'V' pattern of burning to the timber back of the cupboard pointed back to the GPO.
- The damage to the microwave was so severe because it was located above the POO. It is therefore ruled out as the ignition source.
- The damage to the buss bar on its right side indicated that this was a hot joint.

CAUSE¹⁰

Ignitions ruled out

- The classification of Natural¹¹ for this fire is ruled out.
- The classification of Incendiary¹² for this fire is ruled out. The premises were secure at the time of the fire.
- The classification of Undetermined¹³ for this fire is ruled out.

¹⁰ Cause. The circumstances, conditions or agencies that brought about or resulted in the fire or explosion incident, damage to property resulting from the fire or explosion incident, or bodily injury or loss of life resulting from the fire or explosion incident. (*NFPA 921 Guide for Fire and Explosion Investigations 2017 p. 14*)

¹¹ Natural Fire Cause Classification. Natural fire causes involve fires caused without human intervention or action, such as fires resulting from lightning, earthquake, wind, and flood. (*NFPA 921 Guide for Fire and Explosion Investigations 2017 p. 221*)

¹² Incendiary fire Cause Classification. An incendiary fire is a fire that is deliberately set with the intent to cause a fire to occur in an area where the fire should not be. (*NFPA 921 Guide for Fire and Explosion Investigations 2017 p. 221*)

¹³ Undetermined Fire Cause. Whenever the cause cannot be proven to an acceptable level of certainty, the proper classification is undetermined. (*NFPA 921 Guide for Fire and Explosion Investigations 2017 p 222*).



CLASSIFICATION

Cause (opinion)

The classification for this fire is Accidental¹⁴ due to the following reasons:

- Evidence of a hot joint was observed to one side of the buss bars.
- The 'V' pattern of burning to the timber backing of the cupboard pointed back to the 4 gang GPO.
- Incendiary was ruled out.

Conclusion

I spoke with John GARDNER (Electrical Engineer and Fire Investigator) whilst at the scene. He was able to provide me with information in relation to the damage I was observing to the busbars on the wall. He informed me that the reddish colour observed is from a 'hot joint' within the GPO. A 'hot joint' would apply to the wiring connection terminal at the most discoloured busbar; but the possibility that there was poor connection at the fourth outlet along and the plug pins could not be ruled out. These pins were not making firm contact with the internal spring contacts - both of which indicate a fault in the 4 gang GPO.

Explanation of a "hot joint" is a high resistance connection which has overheated.

1. When two or more electrical conductors (wires) are joined together, the electrical resistance of the connection should be very low and about the same resistance as the copper or aluminium from which the conductors are made (This is achieved by firmly tightening the screw in the terminals).
2. A low resistance allows electricity (electrons or electric current) to flow freely along the conductors and through the connection. If the connection is slightly loose it reduces the surface area of the two conductors or surfaces in contact with one another (at the joint) and increases the resistance.
3. When electricity flows along a resistance it generates heat. The amount of heat generated (watts) is proportional to the current squared and directly proportional to the resistance. The formula is Power (heat in watts) = I^2 (current in amps) squared x R (resistance in ohms).

For example if we have 10 amps flowing through two wires (say 0.01 ohms resistance for argument's sake) connected together at a terminal, which is not fully tightened and has a resistance of 1.0 ohms, the heat dissipated along the conductors will be $10 \times 10 \times .01$ which equals 1 watt. The heat dissipated at the connection will be $10 \times 10 \times 1.0 = 100$ watts.

If we take a simplistic view then the heat generated at the connection would be the same as a 100 watt lamp.

4. The actual temperature generated at the connection for the same wattage increases as the contact area reduces, and decreases as the area increases. Typically electrical connections are only a few square millimetres in area, and 100 watts will cause the temperature at the connection to become extremely high and can melt the conductors (ie exceeding 1,000°C).

¹⁴ Accidental Fire Cause Classification. Accidental fires involve all those for which the proven cause does not involve an intentional human act to ignite or spread fire into an area where a fire should not be. (NFPA 921 Guide for Fire and Explosion Investigations 2017 p. 221)



If the connection was larger, such as in a two screw tunnel connector (theoretically twice the contact surface area) the temperature rise will be less. (There are thermodynamic formulas for calculating temperature rise).

5. Another important factor is that the resistance of a poor connection increases with time (provide current flows through it). If current flows through a connection which has some initial resistance, the moderate heat generated causes an oxide film to build up over time between the surfaces which are meant to be in firm contact with one another (which excludes oxygen).

The oxide film increases the resistance of the connection and therefore the rate of heat produced increases. This increases the temperature at the connection and causing more oxidation to form and further increasing the resistance.

This can develop slowly and rapidly increase exponentially until the connection melts or the temperature reached is high enough to ignite surrounding combustible material and start a fire.

Normally evidence of localised heating caused by a high resistance connection shows up as a reddish brown (annealed) colour on brass or copper conductors where the concentrated heat source has occurred and progressively less discolouration along the conductors further away (a very short distance sometimes) from the heat source.

6. The photos show a fairly bright red, at the ends of both busbars (active & neutral) near the connection terminals suggesting that the terminals may not have been sufficiently tightened when the power outlet was installed in the joinery unit, and appears to have been reconnected to old original wiring. (Why there is more heat discolouration at the ends, I don't know, but may have been because there was a higher current appliance plugged in to the end socket, or it was used more than the others).
7. Another possibility which might have the same outcome is if the spring contacts in the socket were starting to wear, and effectively reduce the contact area with the plug pins when an appliance was plugged in. This would increase the resistance of the contacts and heat generated could also have caused the surrounding plastic inside the outlet to ignite.
8. There does not appear to have been any arcing, so deterioration or breakdown of the insulation in the body of the outlet seems unlikely otherwise the busbars would have arced together before the fire started.

Michael Forbes
Leading Station Officer
Fire Investigation and Research Unit



Fire Investigators Association of New Zealand

Presidents Report

Welcome to the latest edition of FirePoint.

Fire and Emergency New Zealand

Since the last report the New Zealand Parliament has passed the Fire and Emergency New Zealand Act creating Fire and Emergency New Zealand (FENZ)

The new organisation, FENZ will bring together, professional, urban and rural fire-fighters who currently work under different agencies into a single national fire service to provide a national fire and emergency service.

The new act takes effect on July 1st; it provides new powers to Fire and Emergency New Zealand staff under the title of Inspectors and Authorised Persons. Inspectors will have powers to enter, inspect, search, seize and restrict access a fire scene, while authorised

persons have the power to restrict access to a scene while awaiting the arrival of an inspector

Peter Wilding, National Manager of Fire Investigation for the Fire Services explained:

“It’s important to understand the FENZ Act is not an update of the old Fire Service Act but rather a total rewrite with new empowering legislative abilities to better serve the functions of FENZ and the betterment of the New Zealand community.

Authorised Persons are given a range of powers to be able to manage an emergency incident

that FENZ attends and will typically be bestowed on all operational staff.

Inspectors are given powers:

- Power to enter land and buildings to carry out pre incident planning, post incident analysis (typically fire investigation) and to check for compliance under relevant fire safety legislation.
- Power to enter homes and Marae. Where there is no permission given by occupants to enter, FENZ Inspectors may apply for a warrant of entry for these properties.
- Power to restrict or prohibit entry to sites

Fire Risk Management Officers, members of the Fire Research and Investigation Unit and Level 2

Rural Fire Investigators will be appointed as Inspectors from 1st July.

Two other Inspector powers are available under the Act which includes the Power to deal with imminent danger and the Power to take samples and other things. As there has not been time to put in place the appropriate training and systems to manage these processes these powers are not being extended to all inspectors at

this time. A limited number of staff, strategically located across the country will be given these powers for 1 July to ensure that FENZ has some capacity to exercise these powers should the need arise. This is only an interim measure to ensure legal responsibility is covered for 1 July.



Training has been rolled out this month to Fire Service and Rural Fire staff that are being given inspector powers and the need for cooperation and coordination at fire investigations of all interested parties has been emphasised.

The FENZ Act provides for the right of certain parties to request access to restricted sites and for resolution of disputes.

All parties should seek to resolve differences at a local level first through constructive dialogue before formally escalating disputes. *"We have generally enjoyed constructive and effective relationships in fire investigation across the country up to now and there's no reason that this should change going forward"* says Peter.

Annual General Meeting:

We are intending to have a round table discussion with all FIANZ members at the AGM to discuss the implication of the FENZ Act, the new powers of FENZ inspectors with regards to Fire Investigation (principally powers of entry, evidence management, securing scenes).

The 2017 AGM is likely to be held in August, and we are organising to hold the round table discussion for FENZ and then have the AGM.

Other Matters

AAFI Conference: The next Australasian Fire Investigators Conference will be Victoria in 2018 and is going to be built around wildfire investigation and will include live bushfire burns.

It has been suggested that NZ hold the conference in 2020. FIANZ will be discussing this at our next AGM and make a final determination within 12 months.

FIANZ Annual Scholarship:

The 2016-2017 FIANZ annual scholarship to further the education and training of members in the field of fire investigation was awarded to Colin Melville.

In this publication you will see his report (page 29) on his attendance at the International Training Conference of the IAAI in Las Vegas in April.

Evidence Collection Technician (ECT):

As a result of Colins' and my attendance and discussions with the IAAI, FIANZ now has the have all the exams details and paperwork and the ability to proctor the IAAI, Evidence Collection Technician (ECT) practical exam.

Details of the process are going to be written up and will be put on the FIANZ website when completed.

Before finishing this report, I would ask that all members take time to ask why they joined their Fire Investigator's Association;

- Was it to have some letters after their name?
- To build up some detail in their CV.
- Because it is expected and someone pays the fees.

Too often we see the same people doing the same thing and there is a large number of members that give nothing back to the organisation, even a simple thing like responding or acknowledge emails updates.

To paraphrase Winston Churchill *"never has so few done so much for the many without any assistance from so many"*. The Question is are you one of the few or one of the many?

FIANZ can be contacted at either, admin@FIANZ.org.nz or by using the contact form on the FIANZ website, <http://www.fianz.org.nz/>

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Ken Legat

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Articles

Annual scholarship

Introduction

The 2016-2017 FIANZ annual scholarship to further the education and training of members in the field of fire investigation was awarded to Colin Melville, enabling him to attend the International Training Conference of the IAAI in Las Vegas in April 2017.

Colin works as a Scene of Crime Officer in the New Zealand Police. He has an interest in Fire Investigation and has previously served within the New Zealand Fire Service. He holds a Master's Degree in Fire Investigation, IAAI-FIT (V), IAAI-ECT, IFE and NZ Fire Brigades' Institute qualifications.

Ken Legat, FIANZ President

Las Vegas Conference Scholarship Report

By Colin Melville

I have recently had the privilege of attending the International Association of Arson Investigators International Training Conference in Las Vegas, having been granted a scholarship from the Fire Investigators Association of New Zealand. (FIANZ). My primary goal for attending the conference was to obtain proctor qualifications for the Evidence Collection Technicians Examinations. The Evidence Collection Technician (IAAI-ECT) is designed to verify fundamental knowledge with regards to evidence collection from fire scenes.



Image 1 Welcome to Vegas, not the casino just the airport.

New Zealand is currently undergoing major changes with the rewriting of the Fire Service Act. One of the major changes being that Fire Risk Management Officers will be granted authority to collect forensic evidence from the fire scene.

In New Zealand, the New Zealand Police currently have sole responsibility for this task. Therefore, the establishment of the IAAI-ECT programme will be vital to ensure Investigators fundamental knowledge can be measured against all job performance requirements and establish a professional, internationally recognised qualification.

Australasian Fire Investigators are at a disadvantage in that they have to travel to the United States to complete the comprehensive practical examination. In my case, I completed my practical at the San Diego Fire Department Fire Academy.

FIANZ is confident about being able to deliver the IAAI ECT programme in the near future, down under. This will result in the alleviating of the financial burden for Australasian members who are looking to obtain this qualification.

I travelled over with FIANZ President, Ken Legat. After 21 hours of travel time, we arrived at Las Vegas feeling sleep deprived. The taxi ride from McCarran Airport to the Rio Hotel/Casino was accomplished in such a short time and we were left wondering if the freeway was also used as a race track and whether our taxi driver had previously driven NASCAR.

We were in awe of the Rio Hotel's sheer size and facilities. We freshened up and headed to one of the many restaurants on site for dinner. The portion size was amazing, enough for a family of four back home.

At the training conference, we had the opportunity to proctor the practical examinations, which saw 13 applicants gain the ECT qualification.



Image 2 Ken Legat, at the start of the conference

The Evidence Collection Practical examination was conducted on the Sunday afternoon. IAAI-ECT examinations are conducted in accordance with NFPA921 and NFPA1033 standards.



Image 3 Candidates undertaking the ECT exam

Prior to undertaking the examination the candidate must meet the following requirements within the five years preceding the application:

- Have a minimum of 18 months of general experience in a fire investigation related industry
- Have collected 12 items of forensic evidence (must be supported with documentation)
- Complete a minimum of 29 hours of tested training, including the following mandatory classes from CFITrainer.Net®:
 - DNA (3 hours)
 - Documenting the Event (4 hours)
 - Ethics and the Fire Investigator (3 hours)
 - Evidence Examination: What Happens at the Lab? (4 hours)
 - Introduction to Evidence (4 hours)
 - NFPA 1033 and Your Career (2 hours)
 - Physical Evidence at the Fire Scene (4 hours)
 - The Practical Application of the Relationship Between NFPA 1033 and NFPA 921 (2 hours)
 - The Scientific Method for Fire and Explosion Investigation (3 hours)
- An undertaken the required readings of both;
 - NFPA921, 2011 Edition; chapters 3, 4,12,15,16
 - Fire Investigator: Principles and Practices to NFPA921 and 1033, Third edition; chapters 2,10,13,14 and 15.

The actual examination involved the candidates having to complete a total of ten different work stations and demonstrate their competency in being able to triage and package a variety of forensic evidence of varied types collected from fire scenes.

All the materials required to perform the assigned tasks were laid out on 10 tables. Under the watchful eye of a proctor armed with his/her marking sheet, each candidate had to verbally describe the correct procedure and also demonstrate 'hands-on' that they had mastered the task, including appropriate PPE, packaging, labelling, chain of custody, photos etc. with no prompts from the proctor with in a 15 minute time frame. A minimum 70% 'pass' mark on each station +was required.



Image 4 Colin Melville conducting the fingerprint examination

Should the candidate fail any station, they were de-briefed by their proctor and permitted one retest. I am happy to report that all the candidates appeared to have done their homework prior to attempting the practical's, demonstrating a high standard of proficiency.

The next morning was Day One at the Conference.

Day 1

The conference was divided into 4 tracks;

- Track A&B were related to fire investigation.
- Track C was running simultaneously and was a 32 hour fundamentals of fire investigation programme, designed to provide the new fire investigator with the pre-requisite knowledge to correctly determine origin and cause and to prepare him/her to sit the IAAI-FIT examination.

Track D was a two day seminar on Fire claims and Investigation. This year's conference was the first time the Insurance Committee on Arson Control were also present for combined training on insurance focussed topics.

I had the opportunity to interact with hundreds of other Fire Investigators, including Investigators from the FBI, ATF, State Fire Marshalls, Attorneys, Scientists and Insurance personnel worldwide, even sitting next to Doctor James Quintero at breakfast. I enjoyed meeting wonderful people and being able to network and discuss future opportunities for training and personal development.

The first presentation I attended was on Insurance Fraud: An Offenders Perspective. This was presented by Michael Vergon and Kenneth Allen. Kenneth Allen being the offender and he spoke of the part he played in the largest known arson for profit ring in US History. For all intents and purpose, Allen was well respected member of the community; attending church and involved in community youth sport groups.

However having set his first incendiary fire, he quickly became aware how easy arson fraud was to get away with, result ID hundreds of fires were lit for profit.



Image 5 First session of the conference

Former ATF Special Agent Vergon highlighted his role in the investigating the ring in which fifty persons were presented for prosecution and seventy three intentionally set fires cleared. A large number of charge were not laid due to statute of limitations and time delays in identify the offences.

This presentation highlighted the need for the investigator to conduct thorough interviews and the need for sound communication between insurance and private sector entities and public organisations.

For investigators without background knowledge of the history of "victim" and consideration of intent, it is all too easy for an investigator to classify a fire as 'accidental'.

Patience and diligence are vital in all investigations and there is also the requirement for the insurance sector to pay close attention to fire related claims and closely vet the reports submitted from fire investigators to see if they stand up to the scientific investigation process under NFPA 921.

The afternoon session was presented by ATF agents, on results from a series of eight laboratory controlled compartment fires. The testing was to examine the difference in resulting fire effects and patterns presentation from the different ignition locations and initial ventilation conditions. These observations lead to a challenging discussion on the trends and abnormalities and how the results may be applied to 'real' fire investigations.

During the evening Ken and I joined State Fire Marshalls from Minnesota, Louisiana, Maryland, Iowa and Kentucky to explore the lights and glitz of the 'strip'. The first of many trips; 'what happens in Vegas...'



Image 6 Mixing with State Fire Marshalls on the strip

The following morning was spent attending a presentation on 'non-destructive post fire survey of electrical wiring for fire origin determination'. An interesting class on arc-mapping techniques and to distinguish different types of post-fire electrical conductor damage.

I thought I would have lunch at one of the restaurants within the casino, 'Hash House A Go-Go' and settle just for a 'Kocomo Sandwich'. Fatal mistake. Two slices of bread about 50mm thick a huge slice of meatloaf with melted cheese in between and mustard, ketchup and fries hanging over a full sized dinner platter.

After doing my best to eat my way through fir'a snack', I attended the afternoon session presented by Board Certified Medicolegal Forensic Death Investigator and Fire investigator John Cox. Although more relevant for investigations conducted within the United States, it highlighted autopsy procedures and the need to be able to identify crucial evidence at a fatal fire scene.. For a person like myself whose daily role involves the attendance and investigation of crime scenes this presentation was extremely beneficial.

Tuesday night was the formal awards banquet and the installation of officers. A time to dust off the suit, have a sit down, served meal and listen to the speeches. Waiter service white tablecloths and silver.

The Wednesday morning presentation on 'commercial motor vehicle and heavy equipment fires' presented by Russ Colosi was extremely informative, being a mix of case studies, basic pattern analysis and hypotheses regarding heavy vehicles and machinery. Potential ignition sources were discussed,



along with vehicle electrical systems and what vital data to assist the investigator can be stored and how to go about recovering this data.

An Expo had been established and as a result of a number of purchases I was seven kilos over my allotted weight. The Forensic Supply presentation/display and I purchased PID at a fraction of the cost back home. Apparently the suppliers only had three PIDs at the expo, all which were swooped on and purchased by Kiwis!

The afternoon session was on 'wildfire fire pattern indicators', a subject striking close to home given the recent fires in Christchurch and the wildfires which occur each summer in Australia. The presentation highlighted the need for the investigator to clearly document physical evidence and fire pattern indicators. The ability to identify 'red-flag' indicators such as serial arson, the use of behavioural evidence analysis and indicators of a fire-fighter suspect were also discussed.

The conference wound up at midday Friday after a morning session on fire protection systems. This presentation covered the inspection, testing and maintenance of these systems and the role they can play in the fire investigators case management.

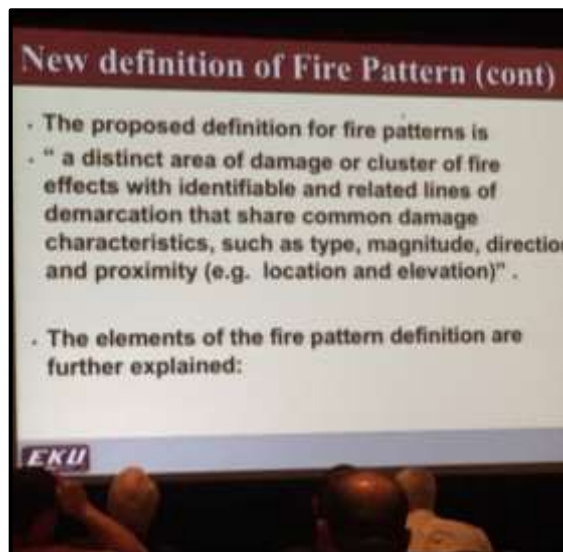


Image 7 One of the discussion point that got people thinking

I opted to stay on in Vegas after the training conference to partake in the usual tourist events. That said I would very highly recommend the Pink Jeeps combined Grand Canyon West Rim and Hoover Dam tour – 'O for awesome!!!' I also spend some time with the Las Vegas Metro Police and Fire Departments, very impressive compared to New Zealand.

Lighter in the wallet, I set about the long return flight to Auckland flying with Virgin America (good service), and getting slightly lost in LAX airport. No wonder; check-in level 2, Koru lounge on Level 6, and departure gate 133 for my Air New Zealand flight on level 4.

Since my return I have been working on how to deliver the IAAI-ECT programme 'down-under' and hope to see this become a reality in the near future and will peruse further training opportunities in post bomb blast investigations, as in these unstable times it is not a matter of if but when.

This conference highlighted to me as fire investigators, we are specialists and 'truth seekers' and highlighted the level of a scientific approach to investigations that was occurring in the United States that was now occurring in due partly to poor science in the beginning. If we in New Zealand are serious regards fire investigation we must continue to undertake quality training and personal development

I would wish to extend my sincere thanks to the board of the Fire Investigators' Association of New Zealand for the unique opportunity to attend this training conference, gaining so much knowledge and being able to network with fellow fire investigators from across the globe nothing better! Thanks once again!



Investigation and Analysis of Electrical Accidents

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Abstract

This chapter will discuss the investigation and analysis of electrical accidents. It will describe what evidence should be examined, documented and preserved from an incident scene for further analysis. Subsequent analysis of retained evidence will be discussed. Six casework/examples of electrical investigations and analyses will be presented to illustrate the techniques used; electrical damage, a wildland fire, two personal injuries, an electrocution and a Church fire.

Key Words

Arcing, arc mapping, circuit breaker, electrical, electrocution, eutectic, fire, fuse, panelboard, power, receptacle, service, short circuiting, utility, wildland.

Glossary

Arcing – A discharge of electricity through a gas.

Burn patterns – The damage caused by fire.

Circuit breaker – A device designed to open and close a circuit by non-automatic means, and to open the circuit automatically on a predetermined overload of current.

Conductor – A substance or body that allows a current of electricity to pass continuously along/through it.

Electrocution – The destruction of life by means of electrical current.

Exemplar – Something that serves as a model or example.

Fuse – An electrical safety device consisting of or including a wire or strip of fusible metal that melts and interrupts the circuit when the current becomes too high.

Lock-out – To open an electrical circuit and place a lock on it so that it cannot be closed without removing the lock.

Overhead – Aerial utility power supply equipment to buildings or structures.

Panelboard – A single panel or a group of panel units containing buses, switches, fuses and/or circuit breakers for the control of light, heat or power circuits.

Resistance – The physical property of an element or device to rest/oppose the flow of electricity through it.

Service – Electrical wires and/or equipment supplying electrical power to buildings or structures.

Specifications – The design requirements.

Tripped – The position of a circuit breaker's operating handle when it opens due to an overload current.

Underground – Subterranean utility power supply wires and/or equipment to buildings or structures.



Investigation

The investigation of electrical phenomena began in Europe in the 17th century [1]. The first electrical investigators were called electricians. One of the first electrical investigators was Benjamin Franklin. He made on-site inspections of churches, which were struck by lightning, [2] wrote newspaper articles requesting information about lightning damage [3] and read articles about lightning damage to churches to determine the effectiveness of church bell ringing [4], which was believed to disperse lightning. Franklin found that bell ringing during a thunderstorm is a very dangerous occupation. There was not a great need for electrical investigations until the inventions of Alexander Graham Bell's telephone in 1876 and Thomas A. Edison's incandescent lamp in 1878. Now we are surrounded by electrical fields, wiring and devices which can, and do, cause injury or property damage.

The on-scene electrical investigation should be conducted as soon as possible after an event, before evidence is moved, discarded or altered by repairmen, rescue workers or first responders.

The electrical investigator utilizes the same scene investigation techniques as the crime scene investigator [5], except that electrical items are the focus of the investigation. As a result, it is imperative that the electrical investigator have substantial practical knowledge about electrical equipment, wiring and devices. Practical electrical knowledge is obtained through education and experience in designing, installing, maintaining and repairing electrical devices, appliances and equipment.

Before visiting the accident scene, any available information about the accident or suspected cause should be obtained from eyewitnesses, private investigators, insurance adjusters, police officers, firemen, first responders and/or attorneys. The information could be used to confirm or refute what is found at the scene. The suspected cause must be evaluated. Upon arrival at the scene, photographs should be taken of the area surrounding the accident. The electrical power service to the scene should be inspected and documented with photographs and/or diagrams. Is it a residential, commercial or industrial overhead or underground electrical service? Is there any evidence of recent work and/or repair to the exterior electric service?

Next, the investigator must determine the origin of the electrical accident. Sometimes the origin is where the greatest amount of damage is found. However, combustible materials in the area could cause severe damage remote from the origin. This is where the information obtained from eyewitness accounts might be helpful.

If an area of origin cannot be determined, all the electric lines/wires passing through damaged areas should be inspected. The investigator should be looking for evidence of electrical arcing or short circuiting on the wires. Electrical arcing or short circuiting generates temperatures in the range of 3,000 to 20,000°C [6]. It is the heat generated by the arcing or short circuiting of electricity that causes most electrical damage and injury. The wires are normally made of copper or aluminum. Copper melts at 1083°C and aluminum at 570-660°C. Normally, fires do not generate sufficient heat to cause copper to melt [7]. Therefore, the copper wiring will remain intact except for the insulation which might have burned away. Evidence of melting on copper wiring indicates that electrical arcing or short circuiting may have occurred at the melted location.

Photographs should be taken to document the area surrounding the melted wiring and close-up photographs of the melted wires. Aluminum wiring is quite frequently found melted by a fire, since fires can, and do, generate sufficient heat to melt aluminum. Subsequently, melted aluminum wiring may not be evidence of electrical arcing or short circuiting. Any melted aluminum wiring should be photographed in place. Wiring suspected of short circuiting or arcing should be retained for further analysis. As much of the wiring as possible should be retained especially undamaged sections which may contain manufacture's labeling and specifications. All sources of electrical power to the accident area should be inspected and photographed. If damage is found upon power supply components, they should be retained for further analysis.

All fuses should be tested with a continuity tester to determine if they have opened. The position of all circuit breakers should be documented as to whether they are "on/off" or in a middle "tripped" position.

Evidence of overheating on power supply components, a blown fuse or tripped circuit breaker might aid in the determination of the accident's origin. All electrical devices in the damaged area should be inspected for evidence of internal damage, which could indicate the origin of the problem. In addition, the installation and condition of undamaged electrical equipment in the vicinity of the accident should be inspected. The undamaged equipment might reveal an installation or component problem that caused the electrical accident.

If the area of origin can be determined, it should be photographed from various angles before anything is moved. Everything electrical should be retained from the area of origin and labeled to identify where they were found at the scene. Manufacturer's labels and specifications on electrical equipment should be documented. If a specific electrical device or product is suspected of causing the accident, the accident area should be searched for a similar device, product or installation.

An exemplar product or installation could reveal what precipitated the accident. The source of electrical power to the origin should be inspected and traced back through the electrical distribution system to where it obtains electrical power. The fuse and/or circuit breaker protecting the distribution system should be inspected and photographed. Any damage to the fuse and/or circuit breaker would require that it/they be retained. They should also be retained if evidence of electrical arcing, short circuiting or conductor overheating was found in their vicinity. The distance from the fuse and/or circuit breaker to the area of origin should be documented/measured. If the distance is too long, the circuit breaker or fuse will not provide adequate protection. The resistance of a long circuit reduces the fault current through it and impedes the operation of a circuit breaker or fuse. Electrical conductor overheating is another way electricity can cause damage by igniting combustible materials in contact with it.

Electrical conductor overheating is normally prevented by a fuse or circuit breaker that opens and removes electrical current from the conductor before it overheats. However, sometimes the fuse is too large (mismatched) for the conductor or the circuit breaker fails to properly operate.

The size of the fuses or circuit breakers should be documented and whether any of the fuses opened or circuit breaker positions, “on/off” or “tripped”.

The investigation should be conducted with no electrical power feeding into the accident area. The investigator should have a voltage detector to verify that there is no electrical power. A continuity tester would facilitate determining which fuse or circuit breaker fed electrical conductors in the area of origin or if a switch is open or closed. Small digital microscopes that operate with laptop computers provide excellent close-up photographs of electrical devices. A quality 3 Charge Coupled Device (CCD) progressive scan video camera can provide excellent video of the accident scene and show items from a different perspective than a still photographic camera. It will also bring your audience into the accident scene. Small hand tools are required to open up electrical devices such as panelboards, receptacles, switches and fixtures. Wire cutters of various sizes are a necessity. A wire caliper would be useful in determining the size of electrical wiring. A very bright light source such as a high power LED flashlight will aid the investigation.

When photographing electrical wiring or components, a dark blue cloth used as a background will produce the best quality photographs.

Electrical devices retained from the scene should be opened to inspect their internal components for evidence of electrical arcing, short circuiting or overheating.

The exterior of the devices should be photographed before disassembly begins and during various phases of the disassembly. However, if a device cannot be disassembled without altering its appearance, it should be x-rayed to examine its internal components. X-rays will normally show evidence of electrical arcing or short circuiting within the electrical devices. However, the x-rays will not show evidence of overheating. The x-rays will aid in the destructive examination/disassembly of the device.

If the electrical accident involves personal injury or death, the medical records should be obtained to determine the injuries sustained by each victim. Electrical entry and exit wounds, degree of burns and their locations are normally reported. A low-voltage electrical shock (120 volts alternating current or less) might not leave an entry or exit wound, especially if water is involved. The water cools the area and prevents burning of the flesh. The medical records may indicate significantly elevated serum creatine phosphokinase (CPK) levels due to the muscle contractions caused by the electrical current if the victim remains in the circuit for seconds or minutes while alive [8]. The clothing worn by the victim(s) at the time of the incident should be examined, including their footwear. Any protective clothing and gear should be retained for further examination/analysis. The type of flooring in the accident area should be documented along with the environmental conditions. Architectural plans, construction drawings and permits of the accident area should be obtained.

An internet search may reveal videos or photographs of the accident taken by eyewitnesses. Sometimes exemplars, manufacturer's operation manuals, and drawings can be obtained through the internet. Complaints concerning the product or service might be posted online or at websites such as the Consumer Product Safety Commission (CPSC).

Analysis

Electrical wiring can melt as a result of a eutectic reaction which is the lowering of the melting temperature of a metal by a melted metal having a lower melting temperature [9]. The eutectic melted wire can resemble an electrical short circuit or arcing damage. A metal such as aluminum, which melts due to fire exposure can fall onto copper wiring and cause it to melt, as well. Elemental analysis of the melted areas by scanning electron microscopy/energy dispersive x-ray spectrometry (SEM/EDS) can determine if there is foreign metal present in the melt [7]. If electrical arcing or short circuiting is confirmed, “arc mapping” can be conducted to aid in the determination of the accident’s origin [10].

Arc mapping involves plotting the location arcs or short circuits on a diagram of the accident area. The arc or short circuit that is found furthest downstream from the source of electrical power most probably is closest to the origin of the problem. Since, it was the first location where the electrical system sustained damage. Upstream electrical short circuits would prevent the occurrence of downstream short circuits, if they occurred first. Consequently, electrical short circuiting or arcing found at the point of the accident’s origin downstream from the power source is most probably the initial location of the commencement of the accident. The reason for the arcing or short circuiting should be determined. Did the installation of the wiring meet the requirements of the local electrical codes? In most of the United States, the National Fire Prevention Association’s (NFPA) National Electrical Code (NEC) [11] applies to the installation of electrical wiring in residential and commercial buildings. The National Electrical Safety Code (NESC) [12] applies to the installation and maintenance of electric utility wiring and distribution equipment. Many large cities and states have their own electrical codes

which follow the requirements of the National Electrical Code and the National Electrical Safety Code with more stringent requirements.

The x-rays of a suspected defective circuit breaker should be evaluated with design drawings or the x-rays of a properly functioning exemplar circuit breaker. If no discrepancies are found, the circuit breaker should be tested to determine if it meets the requirements of its certifying laboratory, (Underwriters Laboratory, Inc. for low voltage in the USA)[13]. The National Electrical Manufacturers Association, NEMA [14] and IEEE [15] have standards which apply to low voltage and high voltage circuit breakers that could be of use in an investigation. The testing should be done prior to disassembly of the circuit breaker because it is very difficult to reassemble a circuit breaker exactly as it was prior to disassembly. After testing, the circuit breaker should be disassembled in order to inspect/examine the internal components for evidence of overheating and arcing, which might not be apparent in the x-rays.

Testing should be performed on protective components in electrical equipment and devices to verify that they function as designed.

These safety components may be intended to protect against overcurrent, overvoltage, under voltage, temperature limiting, liquid level control or ground fault protection.

Construction specifications, work invoices and daily job site reports may be useful in the analysis. The building codes of NFPA [16], American Society for Testing and Materials (ASTM) [17] and The International Building Code (IBC) [18] may also assist in the analysis of the accident scene.

Casework/Examples

Case study 1

The first example involves an electrical accident or more appropriately an electrical incident which occurred at a sporting club. The incident originated at an outdoor racquetball court, photograph 1.



Photo 1

A 12 kilovolt electrical power line had dropped down and made contact with the metal screen around the racquetball court, photograph 2.



Photo 2

The power line continued down and burned a hole in the metal floor of the racquetball court, photograph 3.



Photo 3

Luckily, no one was utilizing the racquetball court at the time of the incident. Severe damage was found underneath the racquetball court where oil heaters and fans were located to heat the court since it was located in a temperate climate location, photograph 4.



Photo 4

None of the fuel ignited even though there was evidence of electrical arcing surrounding the fuel storage tank, photograph 5.



Photo 5

An electrical panelboard near the racquetball court was completely destroyed, photograph 6.



Photo 6

The metal siding on a club house located approximately three meters from the court was damaged by electrical arcing, photograph 7.



Photo 7

The ground conductors of various appliances that were plugged in at the time of the incident were burned away. Ground conductors of wiring within the club house were damaged, photograph 8, and evidence of electrical arcing was found on a fuel line, photograph 9. Fortunately, the fuel in the line did not ignite.



Photo 8



Photo 9

Inspection of the area surrounding the sporting club found that the local utility was installing power line poles and power lines at the time of the incident, photograph 10. There were no environmental factors that could have caused the line to fall since the weather was clear at the time of the incident.

Subsequently, the power line most probably fell down as a result of the work activity in the area by the utility company.



Photo 10

The damage was the result of installing an electric power line above the metal racquetball court in violation of electrical code requirements. The National Electrical Safety Code [12] requires a vertical clearance of 3 meters above the metal racquetball court and a horizontal clearance of 2.4 meters.

Case study 2

The next example involves a wildland fire. A wildland fire is a fire which originates in an uninhabited area of land. It might subsequently spread and damage/destroy inhabited buildings and areas of land. Inspection of the burned land areas indicated that the fire originated near a utility electric pole, photographs 11 and 12.





Photo 11



Photo 12

The utility pole was made of wood, photograph 13.



Photo 13

Two levels of power lines were on the utility pole with 69 kilovolt lines at the top, photograph 14.



Photo 14

Inspection of the power lines found splices in the power lines, photograph 15.



Photo 15

The power lines crossed over a gully where burning was still occurring underneath a twelve centimeter layer of ash at the time of the investigation, photograph 16



Photo 16

The power lines were traced to the utility substation which controlled them. The wildland fire had destroyed vegetation and buildings in its path as it spread, photographs 17 and 18.



Photo 17



Photo 18

Electrical ground conductors were found severely heat damaged in buildings that were not ignited by the fire as the result of an electrical power surge, photographs 19 and 20.



Photo 19

The weather in the area was extremely dry with very little rain fall and at sunset the wind would pick-up, sometimes exceeding 100 kilometers per hour.

Information was obtained from the utility company concerning protective devices in the utility substation meant to protect the power lines located in the area of the fire's origin. The lines were protected by an electrical recloser. A recloser is a device that senses an electrical problem on a power line such as contact with a tree branch.

The recloser will momentarily remove electrical power from the line and then attempt to reclose in order to restore electrical power if the problem has gone away.



Photo 20

The number of attempts the recloser will make is determined by its settings. After a set number of attempts has been tried without success, the recloser will lock-out and prevent further power from flowing through the power lines that it protects. To re-energize the power lines, a utility worker must manually reclose the recloser at the utility power substation. The records for the subject recloser indicated that it had locked-out and been manually reclosed twice. Depositions of the utility workers revealed that on the night of the fire, one individual was at the utility power substation manually closing the recloser while another worker was on a hill looking to see where the power lines sparked or arced in the darkness. Both utility workers ran from the area after realizing they had ignited a wildland fire.

This fire was the result of the inappropriate action by the utility workers. The utility workers should have walked along the power lines inspecting them until they located the problem with the power lines.

Manually closing the recloser after it had locked-out without inspecting the power lines resulted in this fire.

The power line came down because the wind in the area quite frequently exceeded the capacity of the components on the wooden utility pole in the area of fire origin after sunset. The wooden poles were replaced with metal poles that have a higher wind capacity and they look like wooden poles from a distance.



Case study 3

The third case study involves a serious electrical injury to a maintenance worker.

The maintenance worker had been assigned the task of cleaning the roof gutters on a large three-story building utilizing a motorized man lift, photograph 21.



Photo 21

The manlift was rented from a local company and they brought the manlift to the building location for the maintenance worker to use. The maintenance worker proceeded to clean the gutters of the roof and while lowering the manlift at one point, his head made contact with a 12,000 volt power line. The 12,000 volt power line was in close proximity horizontally to the building and approximately 2 meters below the level of the roof gutters. The ground sloped away from the building, which required the manlift to have something to stabilize it when the platform is raised.

The manlift had warning labels on it, photograph 22 which read, "Danger electrocution hazard". "Do not operate this machine unless you have been trained in the safe operation of this machine." "Training includes complete knowledge of safety and operating instructions contained in the manufacturer's manuals". "This machine is not insulated". "You must maintain a clearance of at least 10 feet between any part of the machine or load and any electrical line or apparatus charged up to 50,000 volts."



Photo 22

The tires and base of the manlift were in contact with wet vegetation near the perimeter of the building, which provided a high resistance current path from the lift's base to ground, photograph 23.

This manlift did not have outriggers on it. Outriggers are devices which extend from the base of the lift in order to provide stability, particularly when the lift platform is raised. Outriggers are normally made of metal, which would have provided a low resistance current path from the lift to ground. The operator's platform could be entered through a metal gate on the platform, photograph 24.



Photo 23

Inspection of the interior side of the entrance gate revealed evidence of burning and clothing material adhering to it, photograph 25.



Photo 24



Photo 25

Evidence of burning was also found on the frame of the platform near the operator's controls, photograph 26.



Photo 26



The operator's controls were covered with spackling materials, photograph 27.



Photo 27

An unlabeled black box was found on the platform which was also covered with spackling materials, photograph 28.



Photo 28

Cleaning the roof gutters did not involve the use of spackling materials. The spackling material covered the latches of the box and verified that it had not been opened by the maintenance worker. The unlabeled black box contained the manlift manufacturer's instruction book/users manual for the safe operation of the lift.

The evidence of burning found on the interior side of the entrance gate and on the frame near the operator controls indicates that electricity exited the maintenance worker's back and left hand. 12,000 volts contacting the head of a person and exiting out their back and hand would normally electrocute them. However, the tires of the lift provided some isolation (high resistance) to the flow of electricity through the manlift to ground. A manlift with outriggers should have been supplied by the rental company since the land around the perimeter of the building sloped away from it causing the manlift to be unstable when the platform was raised. However, metal outriggers would have provided a low resistance path through the manlift to ground and would have resulted in his electrocution. Instead, the worker was seriously burned and unconscious for more than a month. This incident was the result of the use of inappropriate equipment in a hazardous area by maintenance workers that were not aware of the hazards, or appropriately trained to perform the work.

Case study 4

The next case study is severe burn injuries that a building maintenance worker received from electrical arcing while attempting to change a door on a motor control center.

An electrical contractor had installed capacitors on a motor control center to improve the power factor of the electricity coming into the building, photograph 29.



Photo 29

Electric utilities quite frequently charge their customers additional fees for bad electrical power factors. Power factor is the ratio of total watts to the total root-mean-square of volt-amperes [19]. A disconnect switch for the capacitors was installed in the bottom of the motor control center, photograph 30.



Photo 30

The electrical contractor did not install the correct door to operate the capacitor disconnect switch in the bottom unit. Subsequently, the contractor asked a maintenance worker of the building to replace the door with the correct unit. The motor control center had warning labels on it. One warning label stated "DANGER: hazard of electrical shock or burn. TURN OFF POWER supplying this equipment before working inside.", Photograph 31.



Photo 31



DANGER
HAZARD OF SERIOUS OR FATAL
ELECTRICAL SHOCK OR BURN
TURN OFF POWER AT UTILITY
BEFORE WORKING BEHIND THIS COVER
THE LINE SIDE BUS OF ANY MAIN BREAKER OR SWITCH REMAINS
ENERGIZED WHEN THE MAIN IS IN THE OFF POSITION

A manufacturer's label on the motor control center indicated that the voltage within it was 277/480 volts, three phase and it had a current rating of 2000 amperes, photograph 33.



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The cardboard covering the bottom opening of the motor control center was removed and evidence of burning and arcing was found within it, photograph 34.



Photo 34

The disconnect switch that was previously located in the burned opening had been retained, photograph 35.



Photo 35

Electrical arcing burned a hole through the steel at the top of the unit and through its back, photograph 36.



Photo 36

The building maintenance worker was not an electrician. He had no knowledge of the hazards involved in working within this motor control center. He was not wearing any personal protective equipment such as eye goggles, face shield, insulating gloves, insulating sleeves or insulated safety hat. When he was trying to change the door on the capacitor control compartment, his screwdriver slipped and made



contact between a charged 277 volt component and the grounded enclosure. This caused an arc blast within the unit that vaporized copper and steel components of the compartment. Since he was bending over in front of the compartment at the time, he was severely burned from the top of his head to his waist.

To safely change the door on the motor control center, electrical power would have to be turned off at the electrical utility's supply point and locked-out. The capacitors should be discharged and the power supply conductors grounded to drain off any residual electrical charge within them, prior to attempting maintenance work.

Case study 5

The fifth example/case study is an electrocution which occurred at a luxury hotel.

The hotel had four ways of traveling from its registration desk to its guest rooms; walking, golf cart, boat or electric train, photograph 37.



Photo 37

A maintenance manager at the hotel had found a loose cover over the electric train track which passed through a pedestrian walkway, photograph 38.



Photo 38

The walkway was wet since the canal for the boat system was located in close proximity 2 meters away. The maintenance manager was concerned that a guest might slip and fall and hurt themselves. Therefore, he attempted to tighten bolts which held the covers in place, photograph 39. While reaching underneath the train track cover, he was electrocuted.



Photo 39

Examination of the underside of the train revealed that it received electrical power from electrical buss bars energized with 480 volts of alternating current beneath it, photograph 40. Electrical contact shoes, photograph 41, would slide in a groove of the buss bars as the train moved along its track to obtain power for its traction motors, photograph 42.

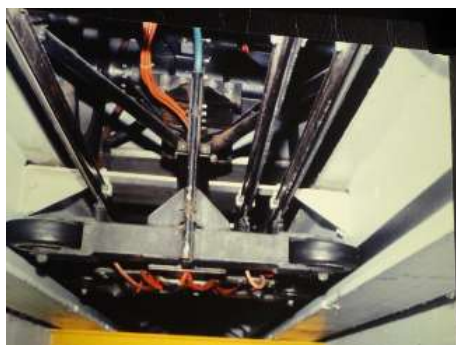


Photo 40



Photo 41



Photo 42

An electrical joint compound was utilized to reduce the electrical resistance between the buss bars and electrical shoes, photograph 43.

No evidence was found that the manager made contact with the buss bars. However, an electrical joint compound which conducts electricity was found between the buss bars and bolts which held the train track cover in place. Subsequently, the man was electrocuted when he touched the electrical joint compound while kneeling on the wet concrete walkway which grounded him. Electrical current entered his body through his hand, passed through his heart and exited out his knees, killing him.



Photo 43

Case study 6

The sixth and final case study is that of a church fire, photograph 44. This church was utilized by two different denominations, with differing beliefs and an arsonist was known to be active in the area.



Photo 44



Photo 45

A clockwise inspection of the church exterior found smoke residue around an opening along its base near the Northeast corner, photograph 45.

Examination of the burn patterns within the church indicated that the fire originated in the Northeast corner below the first pew, photographs 46 and 47.



Photo 46



Photo 47



Electrical copper and aluminum wiring was found passing through the area of fire origin, photograph 48.



Photo 48

Fused disconnect switches located in the basement of the church supplied electrical power to the wiring which passed through the area of origin, photograph 49.



Photo 49

One fused disconnect switch was missing its fuses and the aluminum wiring previously attached to it had been cut off, photograph 50. Heat damage was found on the cut-off wires, photograph 51. The manufacturer's label on the inside of the fused disconnect switch was clearly heat damaged, photograph 52.



Photo 50



Photo 51



Photo 52



The aluminum wiring was traced to a second-floor gymnasium attached to the church that was utilized to play basketball. The aluminum wiring was spliced within a junction box in the gymnasium that fed power to an electrical receptacle. When the junction box was opened, a distinct odor of burning electrical insulation was detected and evidence of overheating was found on the spliced wiring, photograph 53.



Photo 53



Photo 54

The insulation of the aluminum wiring attached to the receptacle showed evidence of overheating, photograph 54. The receptacle had a room air conditioner plugged into it that did not have the capacity to cool the gymnasium. Therefore, it would draw its maximum rated current when turned on. Testing of the air conditioner found that its compressor motor had shorted out and it would draw more current than rated when turned on. On the day of the fire, there was basketball practice in the gymnasium and the temperature outside the building exceeded 38°C.

Electricians making repairs in the church were contacted and the fuses previously located in the fused disconnect switch were obtained, photograph 55.

The fuses were rated at 100 amperes and showed evidence of overheating, but they had not opened. The aluminum electrical wiring that they protected was rated at 50 amperes. The 100 ampere fuses would not properly protect the 50 ampere wiring and the resistance of the excessively long circuit limited the fault current. Consequentially, the fire was caused by overheated aluminum wiring that passed through the area of fire origin where heat was entrapped by wooden framing which eventually ignited.



Photo 55



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What killed the Tiger

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Important Notice

The recent publication of "What Killed the Tiger", a book narrating the history of Loss Adjusting in Australia, New Zealand and Asia, authorised by the Australasian Institute of Chartered Loss Adjusters (AICLA) has recorded some inaccurate information on the New Zealand Chapter of IAAI known as Fire Investigators of New Zealand inc.(FIANZ).

In 2001, the outgoing President of FIANZ for that term carried out a research exercise on the history of the FIANZ from it's inception to that year and arranged printing of a small book outlining important events. This was titled "The History of Fire Investigators Association New Zealand Inc, 1980 to 2001". A complimentary copy was provided to all members of FIANZ at that time.

The book records the first New Zealand member of the International Association of Arson Investigators (IAAI) was Don Bird, a Chartered Accountant and Chartered Loss Adjuster of Dunedin. Don was in fact the only member in New Zealand holding membership from the late 1950's to the mid 1970's at which time his membership was inadvertently discontinued.

In 1980, Jim Carn-Bennett, New Zealand Fire Service Fire Safety Officer and Silverdale Fire Brigade Chief, joined IAAI.

This was followed the year after by Ian Robinson, Claims Manager for New Zealand Insurance Ltd, who joined IAAI during a visit to the USA where he met

Dan Lemieux, First Vice President of IAAI at the time. Dan suggested Ian contact Jim with a view to forming a New Zealand Chapter of IAAI.

Ian did this on his return and together he and Jim canvassed likely members in the industry.

A steering committee was formed consisting: Jim Carn-Bennett, Ian Robinson, John Pateman, Phil Roigard, John Kelliher, Frank Norris, Richard Shortt, Rory Shanahan and Ian Nicholls. These people were from various organisations and from all parts of New Zealand.

In early in 1992, New Zealand Insurance Ltd sponsored John Barracato the current IAAI President for that term to visit New Zealand and give a series of talks in the main Cities to raise the level of arson awareness around the country.

This encouraged those working as Insurance Loss Adjusters, NZ Fire Service officers, Forensic and Private Investigators, Claims Officers and Engineers to become IAAI members.

Within a short time, there were sufficient numbers becoming members for a New Zealand Chapter to be formed. This enabled the granting of Chapter status (number 44) by the International IAAI, USA which took place at the beginning of 1983.

On May 12th 1983, a Special General Meeting was called in Auckland where an announcement was made that "The International Association of Arson Investigators had bestowed a Charter for a New Zealand Chapter, number 44".

An Election of Officers for the New Zealand Board was held, and thus the IAAI, New Zealand Chapter was created. This was followed by the showing of a set of "Fire Prevention slides" which was

taken in with interest by those in attendance. And thus a Chapter of International Association of Arson Investigators had arrived in New Zealand.

On another note of interest, the New Zealand chapter applied for and was "awarded the right to host a full International Association Of Arson Investigators Association AGM-Training Programme Seminar". This was the first time this important IAAI AGM-Training Programme had been presented outside of North America. It took place in Auckland on 10th March 1993 where it created a lot of interest and was considered by the International IAAI as a "very successful programme".

Contribution reward

Congratulations to:

- Michael Masters - **I know what started the fire, but what is it?** and
- Grant Weaver - **Trailer fires involving metal to metal wear.**

Both these awards were from **FirePoint Issue 3, December 2016**. For providing articles to the last edition of FirePoint, you both will be receiving a \$100 voucher, please contact the editorial committee to discuss receiving your voucher.

A Forensic Method for Evaluating Electrical Receptacles

A Forensic Method for Evaluating Electrical Receptacles

Kayla Tumajek

Eastern Kentucky University—Fire, Arson, and Explosion Investigation Bachelor of Science Program

Introduction

One task fire investigators are requested to complete while performing a scene examination is the evaluation and elimination of potential ignition sources. Much of this analysis is dependent upon the individual's knowledge, experience, and training without any formal guidance provided. Frequently investigators must evaluate electrical receptacles within the area of origin, yet no formal method or procedure exists to assist investigators in making the decision to effectively rule out a receptacle as a potential ignition source. The purpose of this research is to provide fire investigators with a method for excluding receptacle failures as the cause of a fire.

Methods

The following process is designed to evaluate residential receptacles (200V) for damage consistent with failures. The purpose of this method is to determine if the receptacle can be excluded or if it needs further testing by an Electrical Engineer or by use of a Scanning Electron Microscope.

Step 1: Determine if the receptacle is in the area of origin and if there is damage sustained from the fire. To determine current flow, check the breaker box and utility pole. Also consider the possibility that circuits were turned off late in the fire through witness statements, are mapping, etc.

Step 2: After confirming current flow, determine where the damage is located on the receptacle.

Step 3: After removing the receptacle from the wall, examine the components within the box including the wires, screw terminals, and bus bars.

References

- NFPA 921. (2014). *Guide for Fire & Explosion Investigations*. National Fire Protection Association. Quincy, MA.
- Sesniak, J. (2014). *High Resistance (Following) Connections on Electrical Receptacles: A Study of the Post Flashover Persistence of Pre-Flashover Heat Effects*

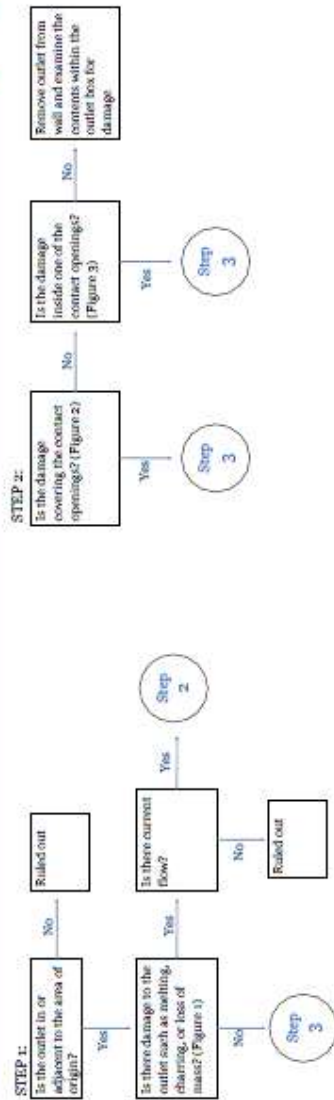


Figure 1: Damage covering the contact openings.



Figure 2: Receptacle with damage inside the contact openings.



Figure 3: Screwing of the wire insulation.



Figure 4: Receptacle with damage to the plastic components around the screw terminals.



Figure 5: Localized damage around the screw terminal.

| Characteristics of failure | Characteristics of No failure |
|--|--|
| • Oxidation and/or discoloration of metal terminals (Sesniak, 2014) | • No damage |
| • Localized melting, charring, and/or loss of mass of plastic components (Sesniak, 2014) | • Melting on face plate |
| • Radial pattern of damage around screw terminals (NFPA 921, 2014) | • Charring and/or melting of wire insulation but no arcing on the wire |
| • Sleeve of insulation on wires (NFPA 921, 2014) | • Melting and/or charring of terminals but consistent along the body of the outlet |
| • Melting and/or charring of materials around the screws (NFPA 921, 2014) | • No damage to screws or bus bars |

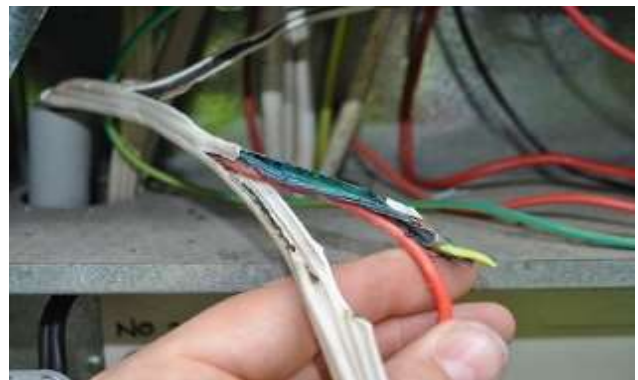
Authors Biography

Kayla Tunajek is a senior at Eastern Kentucky University earning a Bachelor of Science degree in Fire, Arson, and Explosion Investigation. She is also earning two minors in Fire and Safety Engineering Technology and Criminal Justice and graduates in May of 2017. Ms. Tunajek also works as a tutor where she helps students in various Fire and Safety classes including fire behaviour, fire dynamics, and technical report writing. Ms. Tunajek conducted research and developed a method for evaluating and excluding electrical receptacles involved in a fire which was presented at the International Association of Arson Investigators Training Conference in Las Vegas, Nevada. Fire investigators are tasked with determining origin and cause and evaluating electrical receptacles is a part of that process. Much of this analysis is dependent upon the individual's knowledge, experience, and training without any formal guidance provided. Frequently investigators must evaluate electrical receptacles within the area of origin, yet no formal method or procedure exists to assist investigators in making the decision to effectively rule out a receptacle as a potential ignition source. This research is specific to 120 Volt duplex receptacles with side wiring and focuses on damage investigators are most likely to encounter at a fire scene. The purpose of this research is to provide professionals with a scientific process for evaluating and excluding electrical receptacles.

Eastern Kentucky University (EKU) is one of the few schools in the United States where one can earn a degree in Fire, Arson, and Explosion Investigation. ECU also has two other degrees: Fire Protection Administration and Fire Protection and Safety Engineering Technology. All three programs are accredited by the International Fire Service Accreditation Congress (IFSAC) and the Fire Protection and Safety Engineering Technology degree is accredited by the Engineering Technology Accreditation Commission of the Accreditation Board for Engineering and Technology (ABET). Each of the degrees offered in the Fire and Safety program are also offered online. ECU's Fire and Safety degrees are unique in that each program is hands-on and the classes are taught by professionals still active in the field. ECU also has facilities dedicated to its fire program which include a fire suppression lab, twenty rooms dedicated to full scale burns, and a fire chemistry and evidence inspection lab. Another unique aspect of this program is that the students complete internships which ultimately lead to job opportunities. ECU's fire program is truly one of a kind.

Interesting facts

Evidence of a broken distribution cable neutral at a fire scene at a domestic property



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