

FIREPOINT



IAAI JOURNAL



Firepoint

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**FIREPOINT: IF YOU HAVEN'T PAID YOUR FEES FOR THE
CURRENT YEAR, PLEASE DO SO NOW.**

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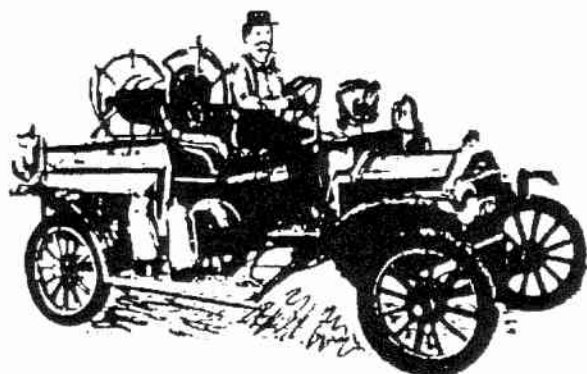
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EDITORIAL

In this issue there are two articles I have written, and one by the Victorian Firepoint Co-Ordinator (Russell Lee). We need more articles from you, our members. They need just be emailed to me. Share your case histories with other members. Contribute to the education of others. Let's hear fro you.

Wal Stern



CONCENTRATION OF ENERGY FOR AN IN-LINE ELECTRICAL IGNITION SOURCE

Russell F Lee

FIEAust CPEng

An understanding of the mechanisms involved in power and energy losses in electrical circuits may assist in determining the origin and likely ignition source for those fires suspected of having an electrical origin due to an overheated connection.

DEFINITIONS

Power is the instantaneous product of Volts and Amperes at a point in an electrical circuit, modified where necessary by power factor. The Unit of Power is the Watt.

Energy is the amount of power consumed or dissipated over time. The Unit of Energy is the Joule or Watt Second.

POWER AND ENERGY DISSIPATION

All operating electrical circuits contain power or energy losses. This is so even for highly efficient circuits such as super-conductor magnets and the like. At mains voltage and frequency, that is 415, 3

phase/240 Volts, single phase, 50 Hz, the principal loss causing parameter is resistance or impedance, depending on the circuit conditions. There is a difference between the two dictated mainly by power factor. At higher voltages and frequencies, electric and magnetic field effects may have an impact.

For the purposes of this paper, the power losses in an electrical circuit are manifested as heat. In some cases, the heat is desirable and usable, as in an electric radiator. But in most cases, the heat is a problem which must be controlled and mitigated as much as possible. Typical examples are the heat from an incandescent lamp, or the temperature rise in electric motors or cables.

The minor impact of heat losses is to reduce the service life of insulating materials, and to alter the characteristics of nearby materials. Examples are the degradation of rubber or plastic insulation so that it becomes brittle and loses its effectiveness, scorching of cloth or timber placed too close to the heat source.

The major impact of heat losses is to destroy switchboards, machinery or cables, or to provide an ignition source for a fire. Examples are significant electrical faults, or degraded connections which develop into a heat source.

THE RELATIONSHIP BETWEEN POWER, ENERGY AND TEMPERATURE

Power is defined as the product of Pressure (Volts) times Current (Amperes). That is...

$$P = V \times A \text{ (in Watts)}$$

or

$$P = VI \text{ Watts.}$$

The symbol "I" is interchangeable for "A" in electrical parlance.

Power is also defined as the product of Current squared times Resistance. That is...

$$P = I^2 \times R \text{ (Watts).}$$

This latter relationship is important as it ties the current flow to the resistance of the circuit. That resistance may be the resistance of the wires in the circuit, the resistance of terminal connections, the resistance of switching or plug-in contacts, or the resistance of insulation.

Energy is defined as the product of Power times Time. That is, for the above formula....

Energy = $I^2 \times R \times t$ (in Watt seconds or Joules).

Since current and resistance are related to instantaneous heat, the factoring in of time gives a measure of the amount of heat generated over a given time. By considering the mass of the body to be heated, the time of heating, the specific heat of the related materials, the radiation, convective or conducted losses, and the energy dissipated, one can estimate or perhaps establish the likely temperature rise of the heated body.

No electrical circuit is 100% efficient. There are always losses. The trick is to keep the losses as low as possible. For most electrical systems, the generation of losses as heat is limited by careful design. It is only in those circumstances where a system is unable to dissipate the inevitable normal operating heat effects, or a fault causes excessive heating, that degradation of insulation or surrounding materials occurs and fires can develop.

THE QUARTER RULE

For an efficient circuit, most of the power is dissipated at the machine or device being used to convert the power into what is required, such as a lamp, a motor, a toaster, or a radiator. Hopefully most of the power goes into the conversion, but the losses will for our purposes, always go into useless heat. Generally we can hope for up to 97% conversion in a reasonable motor, or about 20% in an incandescent lamp. The rest goes in losses which must be dissipated safely.

An important rule for steady state conditions is.....

"When all the resistance in a circuit except at the point of interest, is lumped together, the maximum power which can be dissipated at the point of interest occurs when the resistance at the point of interest equals the resistance of the lumped remainder. Furthermore, the maximum power which can be dissipated at the point of interest is equal to 25% of the power which could be normally consumed in the unaffected circuit."

For example, if a high resistance connection is developed in a given circuit supplying a motor rated at 100 Watts, the maximum power which can be dissipated at the high resistance connection is 25 Watts. This relationship arises from the rule $P = I^2 R$. For a point of interest resistance higher than the remainder, the value drops. For a point of interest resistance lower than the remainder, the value drops. Do a few sums and see for yourself. Remember the same current goes through both resistances, point of interest and remainder.

Thus is established a means by which it is possible to examine the heating effects which may occur at a poor connection which develops a high resistance. If you know the power consumption of a particular circuit, the maximum heating effect at some faulty connection will always be a proportion of the total power consumed in the circuit, up to a maximum of 25% of circuit output power.

Of course, the development of the increased resistance at the faulty connection robs the remainder of some of its power. A simple example is the old resistance type dimmers on theatre lighting circuits. As the lights dimmed, the dimmer resistances heated up.

Modern dimmers do not operate on the basis of resistance. Consider what would happen if you dissipated 25% of the lamp output in your lounge room into the small device in the architrave.

SHORT CIRCUIT CONDITIONS

The above relationship does not hold for short circuit conditions, which are much more complex.

For short circuit conditions, the power dissipated at the short circuit point is limited only by the impedance of the circuit so affected. That is, the whole circuit, including the generator, all the cables and overhead, the wiring in the premises, and the earth or neutral return. The supply authority or distribution company can identify the prospective fault level for a particular point of connection into the premises. The prospective fault level is a measure of the maximum power available. The energy which is dissipated at the short circuit depends on how fast the protection will operate to disconnect the fault.

Chemical Analysis of Fire Samples

Wal Stern
BSc, PhD, FRACI
Consultant and Analyst

There are approximately 90,000 callouts to fires by the NSW Fire Brigade each year. Some are hoax calls, some insignificant fires, but this still leaves an average of over 100 fires each day of some significance.

Approximately 30% of these fires are deliberately lit, and the annual death toll from all fires is around 30 people.

Fire can therefore be seen to be a serious problem, resulting in death, injury and a high cost to society.

For this reason all significant fires need to be investigated to see if such fires can be prevented in the future, to catch arsonists, to find out what is the cause of as many blazes as possible, and to apportion costs to those responsible.

The aim of any properly conducted investigation of a fire is always the same, regardless of whether the fire is to a house, a boat, a shop, a factory or to bush.

An investigation seeks to find where a fire started, and then to determine how a fire started at that location, at that time, under the unique circumstances at that moment (Origin and Cause determination).

The fire investigator requires multiple skills and knowledge for this task.

Every fire must be either accidental (an unplanned, chance event) such as oil catching fire in the kitchen, lightning striking, or the clothes dryer catching fire, or else it is a deliberately lit fire. There are no other alternatives.

If deliberately lit, the fire may have been deliberately lit for a designated purpose (e.g. to burn off some rubbish or vegetation), or it may have been lit maliciously and with reckless intent. In this case it is arson, a serious crime.

The role of the fire investigator is to consider all of the possible accidental causes, and only to contemplate whether the fire could be arson when all accidental causes have been excluded.

One strong pointer towards arson is finding an accelerant present near the position of origin. An accelerant is usually an ignitable liquid and it is used to initiate or speed the spread of fire.

It is commonly a petroleum hydrocarbon mixture, such as petrol, kerosene, mineral turps or diesel, all readily available, and all good at producing a rapid, intense, hot fire.

Finding accelerant present indicates both intent and preparation, provided the materials found are not normal to the premises where the fire occurred.

The fire investigator should be looking for low level intense burning, and burn trails in the fire premises. There may also be present containers of fuel, multiple locations of fires, and odours of known accelerants, specifically petrol or kerosene.

The canine accelerant detector is trained to find and alert to accelerants at fire scenes, but should not replace the fire investigator's duty to determine the origin on the basis of witness evidence and the burn patterns and physical damage observed.

If there is any view formed that the fire may be deliberate, and have been initiated by an accelerant, samples should be taken at the position of likely origin for chemical analysis.

The samples (just a few hundred grams is enough) should be transferred into unlined metal cans or nylon arson bags (not glued cans, and not in polyethylene bags). They should be sealed, labelled and transferred to the chemical laboratory, where they should be kept at cool temperatures. A control sample, taken some distance from the origin should also be taken.

In the laboratory samples are extracted in one of a number of ways. One simple method is to heat the samples overnight in an oven in the presence of an activated carbon strip. Under these conditions, volatile components (liquids and gases) are adsorbed on to the carbon strip. In the morning the strips are removed and immersed in a solvent.

The solution obtained (1 millilitre) is next analysed by gas chromatography.

This technique separates a mixture of volatile compounds present into its components and prints out on a time line the number of components present, and the relative amount of each component present. It is like a fingerprint of the mixture present.

Kerosene and petrol give very distinctive, but very different fingerprints using this method.

After a fire however, there will not be pure petrol or pure kerosene present. Much of any accelerant present will have burnt or evaporated. Another fingerprint will be found in this case, with the lighter, more volatile components of the original gone, and larger concentrations of the heavier, less volatile components. It is possible to identify in this way kerosene or petrol residues in fire debris.

By using a mass spectrometer with a gas chromatograph (GC/MS) it is possible to identify each component of a volatile mixture, and to give its chemical composition and formula.

Thus we separate the mixture into its components (GC), find out the relative amount of each component (GC), and identify the structure and formula of each component (MS). And we can find just 1 microlitre (1/1000 of a millilitre).

In the extraction using the activated charcoal, the volatile liquids and vapours are separated from any non-volatile materials. This removes metals, soil, wood, plastic, paper, carpet, etc.

However there will be adsorbed onto the carbon strip other volatile liquids

and gases present (wood oils, and decomposition products from plastics, carpets, underlay, and glues).

The use of the mass spectrometer allows us to search for the specific compounds we know to be present in known accelerants. We can pick out the components of kerosene, petrol, mineral turps, diesel, etc. even if other impurities are also present.

Chemical analysis is a very useful tool for the fire investigator. How does its role fit in with that of the canine accelerant detector (the dog)?

Both of these techniques are invaluable aids to the fire investigator.

The dog goes to the fire scene. It is an aid, not a substitute to the investigator in a search for the position of origin, by detecting and alerting for the presence of an accelerant.

At fire scenes portable gas chromatograms have been used for this task, but they are not as efficient as the dogs.

In my view, if a dog alerts, samples must be taken for chemical analysis to verify the chemical nature of what has been found. Dogs have given false positives in certain cases.

One advantage of chemical analysis over the evidence of the dog is that the accelerant can be identified. The method discriminates between accelerants. Also more accelerants can be identified by chemical analysis than by the dog. Chemical analysis indicates the quantity of accelerant present. Impurities can be identified. The results can be examined and queried. The analyst can be cross-examined in court.

The dogs are not great in court, and the dog handlers have limited knowledge of what the dog has sensed.

In the US (New Jersey, 2006) the court has ruled that canine alerts are not admissible in the absence of laboratory confirmation.

In NSW (R v Tofaeono, 2011) the evidence of a fire officer about a canine alert was found to be admissible, but the court ruled that the fire officers were not qualified to give an opinion regarding the accuracy or reliability of laboratory tests, or to make a comparison between the reliability of the laboratory tests and the reliability of the dog's reaction.

Claims have been made that the dog has greater sensitivity than chemical testing, and can detect lower amounts. I warn against taking this path.

Chemical analysis can find a few microlitres, and if pushed can get well below one microlitre. But calling a positive at this low level can be dangerous. The background level, from a misfiring car engine, could produce this level. A rag from window cleaning left three weeks previously, might give this level of accelerant.

There are so many petroleum hydrocarbons all around us, it is as well to place a lower threshold on calling positives. American laboratories commonly have such a threshold.

The canine accelerant detector and chemical analysis of fire debris samples are both important and useful tools for the fire investigator. They both can play an important role.

My own experience is, having run over 5,000 fire debris samples over the years, and never been seriously challenged in the courts about such analysis, that the finding of an accelerant at a fire scene by chemical analysis, where not normally present, has been a very strong and persuasive indicator of arson.

Victorian Association of Fire Investigators Inc. Including Tasmania (VAFI)

Website www.vicfire.com

Progress with the arrangements for the National Conference 2012 in Melbourne is still accelerating. Calls for papers will soon be announced. The Committee has some overseas and other speakers in the pipeline but is anxious to hear from the membership in general. Your experiences and opinions are important to other members. Even if you have no experience in giving a presentation, the Committee is there to help you to prepare. Think about it. Remember we train each other.

At the July presentation meeting, Deputy Chief Magistrate Jelena Popovic spoke on sentencing options for offenders including alternative intervention programs, Dr Kate Middleton PhD spoke on current overseas research into the efficacy of JFAIP (Junior Fire Awareness Intervention Programme) in which young offenders are counselled and followed up to prevent a repeat offence, and SSO Murray Talbot (MFESB) spoke further about JFAIP and related programmes in Victoria. All three talks were well received and drew spirited questioning and comments.

The next Training Day is on 9 Sep 11 at CFA Huntly via Bendigo. The Annual General Meeting of the Association will take place during this event.

There are a number of Committee positions falling vacant, and elections to fill those vacancies will be held on the day. Get your nominations to the Secretary by 25 Aug 11.

At the Training Day the subject is Caravans and Clandestine Laboratories. There will be live burns of caravans with investigation scenarios, gas and electrical incidents in caravans, on-site safety and case studies for Clan Labs, and recognition of fire damaged electrical items. Get your attendance applications in quickly to Michael Weekes at ESV or Nicole Harvey at CFA, as there are limited places available.

There has been no VAFI scholarship awarded for 2010/11. Remember that each year up to \$1000 is available for studies in fire investigation. All members are eligible to apply for 2011/12. The Committee hopes to hear from you. The details are on the website.

If you think you have a topic which would be of interest to the membership, do not hesitate to contact the Committee. A speaker could be arranged if you do not wish to speak yourself but you might wish to speak yourself. If you require assistance with such a presentation, the Committee can help.

It's a Hoax!

The article highlighting the fire danger of CFL light bulbs in our last issue was apparently a hoax.

The article was forwarded to "Firepoint" by a well regarded and experienced member in good faith.

When the magazine was sent out, there were several immediate warning calls. Brian Richardson, QAFI President, wrote:

"This "incident" has been an email that has done the rounds in Australia. Electrical safety regulators have not been made aware of any particular incident as described."

Brian further indicated investigations to date have not verified any information in the incident (no sample has ever been sighted, no comments in the article have been able to be verified, the store mentioned has never sold that brand energy saving lamp), and "the conclusions to date is this is a bogus incident."

Similar emails (with same content and photo but different hardware stores named) have appeared in other countries.

Check out the following websites:

<http://www.snopes.com/inboxer/household/cflbulb.asp>

<http://urbanlegends.about.com/od/business/ss/Cfl-Light-Bulbs-Fire-Hazard.htm>

In light of the evidence "Firepoint" retracts the article and allegations

made without reservation.

As the article mentioned a Victorian fire service, the MFB, the Victorian Association of Fire Investigators are anxious to distance themselves from the article and requested the following disclaimer be published :

"The Victorian Association of Fire Investigators does not endorse the information or comments contained in the report titled 'Dangerous Light Bulbs' that was published on page 22 of the June 2011 edition of Firepoint Magazine and has no knowledge of the author or it's origin."

This is not the first time, nor likely to be the last, that such "urban myths" have indicated a false fire hazard. For a more devastating example of how such a hazard can effect a product see the example of plug-in air fresheners at:

<http://www.snopes.com/inboxer/household/glade.asp>

A false accusation can cost a company one hell of a lot of money. In the case cited, a huge recall occurred of 5 million items, without any proof of a fault.

As Editor of "Firepoint" I am anxious to get feedback from readers.

However, preferably not the kind I got from this matter!

Wal Stern
Editor
"Firepoint"

N.S.W. Association of Fire Investigators Inc.

(International Association of Arson Investigators (Chapter 47))



President's Message

Hello again to all our members,

Welcome to our wonderful winter months. In NSW we have had fatalities and injuries from home fires all too frequently, and if each and everyone of us can cause this to decline, we would be doing a great job.

Unfortunately, the message is still not getting through with regards to Fire Education, but we can only try so much.

Our education nights are being well received and attended and if you have any suggestions for further speakers please let me know.

At our last meeting Wal Stern discussed the chemical analysis of samples taken from fire scenes, and the

complimentary role of the canine accelerant detector and laboratory analysis. An article on this topic is included in this issue.

The AGM for NSW is coming up shortly, and if you would like to be part of our committee, please put your name down.

You will be volunteering about 2 hours per 6-8 weeks in helping keeping our association in top stead. We welcome some new members coming to join us on the committee.

Don't forget about our next Conference in Victoria next year, for which further details will come out soon.

**Mark Black
President**

The IAAI Code of Ethics

I will conduct both my personal and official life so as to inspire the confidence of the public.

I will not use my profession and my position of trust for personal advantage or profit.

I will regard my fellow investigators with the same standards as a hold for myself.

I will never betray a confidence nor otherwise jeopardize their investigation.

I will regard it my duty to know my work thoroughly. It is my further duty to avail myself of every opportunity to learn more about my profession.

I will avoid alliances with those whose goals are inconsistent with an honest and unbiased investigation.

I will make no claim to professional qualifications which I do not possess.

I will share all publicity equally with my fellow investigators, whether such publicity is favorable or unfavorable.

I will be loyal to my superiors, to my subordinates, and to the organization I represent.

I will bear in mind always that I am a truth-seeker not a case maker; that it is more important to protect the innocent than to convict the guilty.

Queensland Chapter Report

www.qafi.com.au

The QAFI committee are progressing training and networking events for members and those with an interest in fire investigation.

June saw a successful breakfast session with several presenters offering their expertise and experience to members and guests. The range of topics from issues with forestry planned burns and safety for fire-fighters; investigation of smouldering factory fires and how work practices could be modified to remove some ignition sources; and fire reconstruction experimentation and clarity on what the reconstruction is intending to represent; gave the audience plenty to ponder and insight into the complexity of the broader issues of fire investigation.

Thanks to all the presenters including committee members **Gordon Hemphrey** and **Darren Smith** and also **Peter Leeson** from Queensland Parks and Wildlife Service.

Thanks to the QAFI sponsor **SAA Approvals** for their continued support, which assists in these training days being able to be presented.

The QAFI would also like to thank **Forensic Services Australia** for some of the unsung background support they provide the association.

The major seminar for the year is on Thursday 15th September with the topic of transportation fires. This whole day seminar will be conducted at the **Queensland Combined Emergency Services Academy** and will include presentation on causes of vehicle fires, case studies, electric vehicle discussions, legal issues as well as live burns and examination to witness the fire progression in motor vehicles and caravans.

Conducting live burns in an important aspect of understanding fire investigations and the committee are pleased to be able to again present such excellent training for members and those interested in the benefits of fire investigation.

The committee appreciate the support of the **Queensland Fire and Rescue Service** and **Bernie Nunn** in assisting with the use of these facilities.

Please contact the QAFI at qafi@uttinglibke.com.au for details on this event, or if you have missed it send an email with your details to get onto the QAFI mailing list so that you can be kept informed of upcoming events.

Brian Richardson
QAFI President on behalf of the QAFI committee



TRANSPORTATION FIRES SEMINAR

The *QAFI* is proud to host a one day seminar in Brisbane on Thursday, the 15th September 20 comprising a half day of lectures and a half day of live burn demonstrations of transport vehicles.

The seminar will benefit all those involved in fire investigation and subsequent activities that occur from these investigations. Police, Fire Service, Electrical Examiners, EPA, Local Government, Loss Adjusters, Factual Investigators, Forensic Investigators, Insurance Claims Personnel and Insurance Lawyers are some of the industry categories that would find benefit in attending this seminar.

Seminar will include morning and afternoon tea and lunch

NUMBERS ARE STRICTLY LIMITED DUE TO LIVE FIRE SITE RESTRICTIONS – PLACES WILL BE ALLOCATED ON A FIRST COME FIRST SERVED BASIS, SO EARLY BOOKINGS ARE HIGHLY RECOMMENDED.

Topics will include:

- **NFPA 921 Guide for Fire and Explosion Investigations – Motor Vehicle fires**
- **Analysis of and detection of causes of vehicle fires**
- **Legal issues**
- **Case study**
- **Electrical hybrid vehicle: unique features**
- **LIVE BURNS**

Topics may be subject to change



Cost to Attend

	MEMBERS	NON-MEMBERS
Individual	\$300-00*	\$350-00*

*Note – including GST

10% discount for groups of 5 or more

(Note: Discount applies where bookings made on one form with one payment OR reference is made to the organisations booking.)

Members include – QAFI, AFI NSW, VIC AFI, FIANZ, IAAI

Payment

All prices are in Australian Dollars. Payment to be made with registration by cheque, credit card or Government Purchase Order.

Registration cancellation policy – Registration cancellations will only be accepted when made in writing. The registration fee will be refunded in full if cancellation is received before **9 September 2011**. After this date, an \$80 administration fee will be retained or where payment has not yet been received, an \$80 fee will be charged and payable. No refunds will be given after **9 September 2011**. As an alternative to cancellation, your registration may be transferred to another person provided we are advised in writing.

SPONSORS



A P P R O V A L S [®]

Ph 07 3393 9455

Website: www.saaapprovals.com.au

Registration

The Queensland Association of Fire Investigators Inc (ABN 77 330 409 047) is now registered for GST which has been charged on the seminar registration fees. A copy of the registration form (when completed) should be retained as your Tax Invoice.

To ensure you are registered for the conference, your completed registration form must be received by the dates specified on the registration form.

Members – include financial members of the QAFI (NSW), VIC AFI, FIANZ and IAAI.

Registration Fee - includes session admission morning and afternoon tea and lunch on the day of attendance.

Whilst every effort has been made to ensure the accuracy of all details listed herein, the Conference Organiser reserves the right to alter or make amendments as necessary.

Venue

**The Venue –
Queensland Combined Emergency Services
Academy
15 Howard Smith Drive
LYTTON**

NOTE: no parking on site, however parking on side of Howard Smith Drive adjacent the entrance of the facility is permitted.

Park on side of road then proceed to main administration building. Delegates will need to complete sign in procedure.

General Information

Time: 8:30 am – 4:30pm

Dress

The conference dress code is neat casual.

Essential dress: For the sessions on the live fire pad the following must be observed:

- Long sleeves (or overalls, dust coat or appropriate jacket)
- Long pants
- Enclosed footwear

NOTE: Delegates with protective hard hats are requested to bring them along for the live fire sessions

Recommended:

- Hats, Sunglasses and Sunscreen

Seminar Managers

All enquiries should be directed to -

**Queensland Association of Fire Investigators Inc.
Administration Officer – Tony Libke**

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