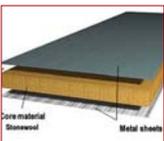


Forensics in focus

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Introduction - Professor James Lygate



Welcome to the last forensics in focus edition for 2013. I would like to start by passing on our thanks to you all for your support throughout the past year. 2013 has been a busy year, with IFIC Forensics striving to continue to develop services and deliver the service our clients need and deserve.

2014 is shaping up to be another exciting year for IFIC Forensics, with many improvements and developments in the pipeline to aid us in delivering the highest level of service support to aid our clients in their individual values, philosophies and processes. As part of this development, we are particularly excited to be in the final stages of upgrading our website and we will inform you as soon as it is live and ready for you to explore! As ever we are always keen to hear your feedback and suggestions, so please get in touch to share your thoughts.

Whilst we are looking forward to the developments and advancements that the next 12 months hold, this edition of Forensics in Focus takes time to reflect on some of the large cases we have witnessed over the course of this year. See our article on page 2, which examines trends in fatal fires, and analyses some instances where history has tragically repeated itself. We look at the lessons that should have been learnt previously and hopefully by taking lessons to heart and passing this knowledge onto the next generation, such catastrophes can be avoided in the year ahead.

In this edition you will also find a great article on page 6 which outlines our guide to the best practice in forensic investigation, a feature outlining the perils of sandwich panelled buildings, as well as a case study from Ian Thompson on a Qatar shopping mall fire which resulted in 19 fatalities due to staff negligence. Lastly for those marine insurers out there, we hope you find the article on counterfeit refrigerant contains some food for thought.

As part of IFIC Forensics philosophy of continuous development and passion for educating the next generation, see page 8 for a roundup of the experience of two of our investigators who attended a NITA training event in

September this year. The event was particularly relevant due to the increasing scrutiny placed on the quality of forensic evidence presented in court.

You may have recently seen us feature in some of the insurance trade press, detailing our guidance for insurers to brace themselves for an influx of escape of water claims, as weather experts are forecasting the coldest winter in 100 years. Last winter, insurers paid out £644m to homeowners and firms following damage caused by escapes of water.

In addition to a potential surge of escape of water claims due to frozen pipes, we are keen to raise awareness of the challenges of fraud; both opportunistic in the form of exaggerated damage from a genuine escape of water and premeditated, where policyholders purposefully tamper with pipes and fittings in order to make a claim for damage to the property.

Escape of water claims benefit from early, on-site forensic inspections. Routinely desk topping these claims leaves insurers exposed to fraud and limits their ability to pursue third party recoveries. Applying scientific investigation to origin, cause and damage, together with examination of incident date, Met office temperature data and policy terms and conditions, equips insurers to deal with what can be high volume and high value claims with a significant impact on the bottom line, swiftly and appropriately. To learn more about how IFIC Forensics could assist you in this cold spell, contact us today.

Lastly it just remains for me to wish you all a very Merry Christmas and my best wishes for a prosperous 2014.

Jim Lygate



Sandwich Panels – The Dangers Revealed

Professor James Lygate – Principal Investigator at IFIC Forensics

Back in June a fire in Mishazi China which left 119 people dead highlighted the dangers of sandwich panel buildings. Here we take a look at the risks posed by sandwich panels and how these risks can be mitigated.

Fires in sandwich panel buildings are known to spread rapidly. In one case I investigated in Fraserburgh Scotland a cold store nearing completion caught fire and burned to the ground in less than an hour.



Contractors had minutes to escape before their escape was impeded by thick black smoke and the collapse of the sandwich panels. This was one of many fires in the UK and across the world which prompted research by the Building Research Establishment in the UK and the Association of British Insurers to issue advice on the construction of sandwich panel buildings. This research led to Loss Prevention Standard LPS 1181.

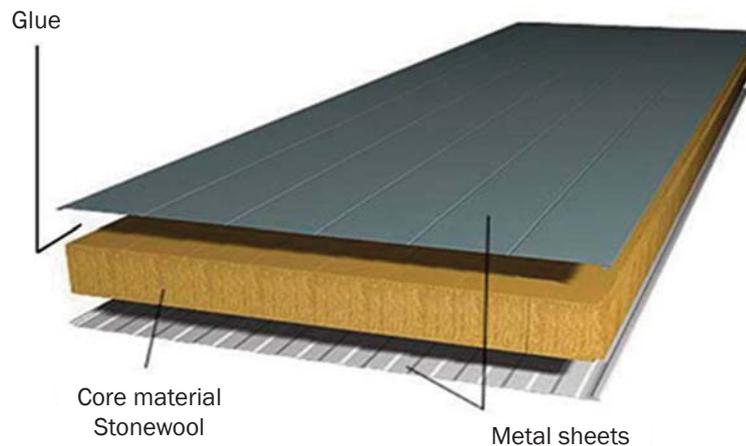
What are sandwich panels?

Sandwich panels generally consist of two outer metal sheets (steel, aluminium, other) with a stabilizing core of insulation sandwiched between them. The metal sheets are bonded to the insulation core with specialised adhesives.

The insulation core within sandwich panels varies. The core material generally falls into one of the following categories:

- Non-combustible mineral wool or fibreglass.
- Polyisocyanurate Foam (PIR)
- Polyurethane Foam (PUR)
- Expanded or Extruded Polystyrene (EPS and EXPS)

Sandwich Panel definition



Fire retarded variants of the combustible foam cores are available in which are more resistant to ignition but perversely tend to emit more and thicker smoke when they burn.

In Europe, Insurers encourage their policyholders to replace EPS panels with non-combustible cores or with FR grades of PUR and PIR. It is generally a policy condition that where electric cables are routed through combustible cores that the cable is routed in metal conduit and that the combustible core is not exposed.

What are the risks?

EPS and EXPS cores ignite easily and burn vigorously. Fires in sandwich panels are difficult to extinguish because the metal outer panels prevent extinguishing water from reaching the burning cores. Lateral spread in excess of 0.5 m/s have been postulated in real fires. Once established in the core of a suspended horizontal panel the bottom layer will debond with consequent rapid increase in burning because the combustible core is exposed.

Food processing buildings present a special risk as they are buildings within buildings. The temperature controlled spaces within food processing facilities are generally formed using EPS sandwich panels inside the external building envelope. The layout often presents challenges to escape due to their enclosed nature and the fact that the escape routes are formed of the same material.

When sandwich panels start to collapse they will bring down electric cables and other services which rely on the panels for support. This can cause the power to fail and but for emergency lighting plunge the building into darkness. Emergency lighting should be installed at floor level to illuminate escape routes given the likelihood of the routes being filled with thick dark smoke.

The majority of firefighter fatalities in the UK have been associated with fires in sandwich panel buildings meaning that the Fire Service will only enter such buildings if there are persons reported as being trapped inside the building.

How to mitigate these risks?

The prevention of fire by the control of ignition sources is paramount. That means enforcing no smoking, maintaining equipment, controlling hot work, preferably finding an alternative to it.

Somehow people consider that ordinary combustible materials are not capable of being ignited if they are cold. Often the opposite is true because material though cold is tinder dry because of low moisture levels in temperature controlled spaces.

In my opinion the only way to protect sandwich panel buildings is to install sprinklers.

The Investigation

The investigation in Mishazi, China will focus on the witness evidence to establish how and where the fire was first discovered. Press reports suggest there may have been an explosion followed by a fire and have speculated that it may be associated with the ignition of a release of ammonia used in the refrigeration equipment. No doubt the investigation will consider the evidence which supports this hypothesis.

Of first importance to the relatives of the deceased and injured will be that the investigation understands why so many failed to escape. Were there sufficient fire exits, were they blocked, worse still locked. Did they lock when the electrical supply failed? If so, why were they not on an emergency circuit? Was the emergency illumination sufficient? Was there sufficient warning of the fire and the alarm raised timeously?

The costs make it unlikely that China will retrofit EPS and EXPS sandwich panels. It may take a generation to phase them out by requiring new buildings to meet the equivalent of the LPS standard. However I envisage that there will be low cost solutions which Insurers can encourage their policyholders to take to mitigate the risk to life and property which will focus on detection, escape and suppression.

Learning from Disasters



It is a matter of debate if natural disasters such as Typhoon Haiyan are the result of human interference in the world's ecology causing the climate to change but the disasters in West Texas, Lac Megantic Quebec and Mishazi China were avoidable.



Professor Trevor Kletz sadly passed away in October after a lifetime promoting safety culture first in ICI and then to the wider process industry. I attended one of the first courses in Hazard Analysis and Hazard and Operability Studies which Prof Kletz and Dr Bert Lawley pioneered at Loughborough University in 1980.

In his book "Lessons from Disaster: How Organizations Have No Memory" Prof Kletz illustrates how hard won lessons fail to be passed down to the next generation and proposes solutions as to how organisations can retain such knowledge and experience.

Each of the three disasters I have mentioned above illustrate the importance of learning from experience.

Texas is no stranger to ammonium nitrate explosions. The Texas City disaster of April 16, 1947 was the deadliest industrial accident in U.S. history when about 2,100 tons of ammonium nitrate detonated as a result of a fire on board the SS Grandcamp docked in the Port of Texas City. It killed at least 581 people, including all but one member of the Texas City fire department. Why would the Texas authorities allow a residential neighbourhood in West Texas to be built around an ammonium nitrate storage and distribution facility?

The UK learned the hard way about the speed with which fires in sandwich panel buildings spread. In one fire I investigated in a cold store under construction the structure began to collapse



within 15 minutes of the first call to the Fire Service. As a result of this and other fires the Government and ABI sponsored research into the dangers of sandwich panel buildings which resulted in the publication of the ABI's guide The fire in Mishazi China which left 119 people dead in June featured sandwich panel construction and allegedly locked fire escapes from which people could not escape. We know the risks – why were they not eliminated or at least minimised by design and best practice?



The failure of the handbrakes on an engine caused the derailment of a runaway train carrying 72 carloads of crude oil, led to a seven-mile downhill race by the unmanned train before the explosion in Lac Megantic, Quebec on July 6 2013. After derailling, the crude cars exploded at about 0115 hrs, instantly wiping out up to 30 buildings and killing 47 people. Fires from the explosion raged for over a day after the accident. There are questions about whether enough manual safety brakes were properly set after firefighters disconnected the train's pneumatic brakes following a small fire when the engine was stationary.

So what's the solution? According to Prof Kletz it is to spread the message: publishing accident reports is particularly useful; to discover for yourself in group discussion rather than attend a lecture; to have a database of old reports which are in an accessible format; to capture the knowledge from those retiring from the industry. The internet, google's intranet search tools and wiki's provide the means to pass on knowledge to the next generation and allow them to discover old lessons afresh and not make the mistakes of the past.

IFIC Forensics are committed to helping the next generation avoid mistakes made by their forebears.



Counterfeit Refrigerant: It's Getting Hot in Here



In 2011 IFIC Forensics were appointed by a leading marine insurer to investigate a series of ship fires containing refrigerated containers.

Safety alerts were raised in connection with reefer containers designed for use with a particular refrigerant, but which were being re-gassed with counterfeit refrigerant. Over a period of approximately eight months there were five documented reefer compressor explosions, in which three people were killed, along with a number of other minor incidents, such as smoking valves or flaming oil.

Through rigorous forensic investigation, the cause was established to be counterfeit refrigerant containing a blend of poisonous and reactive chemicals. When combined with other components in the compressor the counterfeit refrigerant forms volatile chemicals which burn spontaneously causing the explosions.

The documented incidents appeared to be connected to re-gassing carried out in Vietnam. As a result, over 1,000 reefer units were quarantined, but it is estimated that only 2% – 3% of these units are actually dangerous.

Since these original cases, there have been no documented explosions, but counterfeit refrigerant has been found in other countries and on board ships. On a reefer container fleet of about 1.3 million units, there are in the region of five million Pre-Trip Inspections per year, with counterfeit gas being reportedly discovered in approximately 5% of units tested.

Following these incidents, a number of shipping lines and some container lessors and depots, have implemented testing regimes for reefer machinery. But more importantly, many depots have started testing refrigerant gas supplies prior to use. Testing of refrigerant continues to reveal various contaminants, which are either not compatible with compressor lubricants or simply inefficient as refrigerants.

Alongside the counterfeit refrigerant giving rise to potentially dangerous reactions, and the subsequent risk of injury, contaminated refrigerant is likely to result in reduced cooling capacity, increased power consumption, inability to maintain consistent temperature control, greater frequency of breakdowns and higher M&R costs for the machinery in the long run.

Steps to Avoid Counterfeit Refrigerants:

KNOW YOUR SUPPLIER Obtaining refrigerant from a trusted and well-known source that can provide traceability is good practice to prevent contamination of an HVACR [heating, ventilation, air conditioning and refrigeration] system.

VERIFY REFRIGERANT IN CYLINDER BEFORE USING

Proper verification of refrigerant in service cylinders prior to use can ensure authenticity of the refrigerant. Checking refrigerant cylinders in the field with a portable refrigerant analyser can also help prevent contamination.

VERIFY REFRIGERANT IN SYSTEM BEFORE REPAIRING/SERVICING

Proper verification of refrigerant identity and impurity profile in the refrigeration systems prior to repairing and/or servicing the system is a good industrial practice and is imperative to safety. Testing refrigerant in systems prior to removing the charge can also prevent possible contamination of recovery equipment and recovery cylinders.

PROPERLY LABEL AND ISOLATE CONTAMINATED REFRIGERATION SYSTEMS

Properly label all suspected contaminated refrigeration systems to ensure that systems containing contaminated refrigerants are quarantined until they can be dealt with properly.

The Container Owners Association (COA) is compiling the 'COA Reefer Service Facility Directory', a database of reefer service companies globally, including information concerning implemented gas supply testing procedures, which is now available through the COA's website. Now that is in place, shipping lines would be prudent to utilise facilities that can demonstrate sound gas management practices.

As has been stated previously, the ability to prevent the recurrence of accidents, as well as protecting machinery performance, is best served by securing the refrigerant gas supply chain. If both new and re-cycled supplies are rigorously tested prior to introduction into reefer container machinery the industry can be secured against counterfeiters and the potential losses incurred should the worst happen.

Good Practice in Fire Investigation

- Systematic evidence gathering
- Analytical approach
- Understand fire behaviour
- Analyse data using Inductive Reasoning
- Develop and test hypotheses using Deductive Reasoning and knowledge of scientific processes

Process

- Scientific Method
 - Gather evidence
 - Consider evidence
 - Develop hypotheses
- Determine the area of origin
- Determine the point of origin
- Determine the cause of the fire

Determining area and point of origin

- Geometrical patterns
- Time temperature patterns
- Electrical indicators
 - Operation of fuses / MCBs
 - Arc mapping
- Protection patterns
- Excavation and Reconstruction
- Alarm and detection systems
- Witness evidence

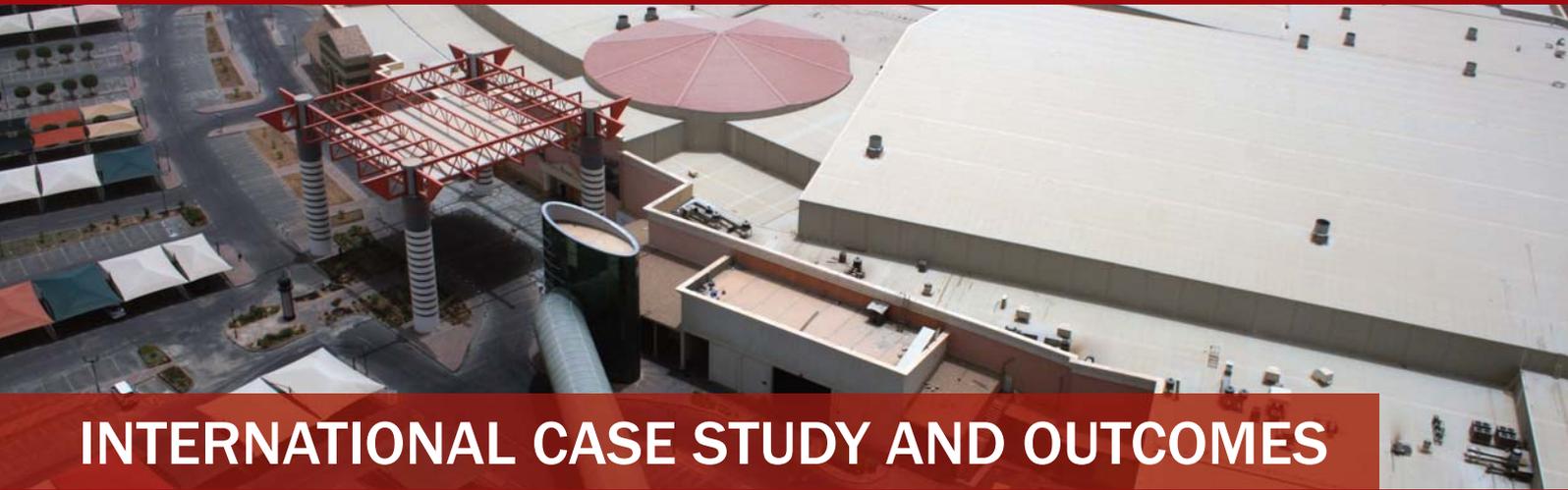


Good fire investigation is.....

- Systematic
 - Use of checklists
- Scientific
 - Importance of CPD
- Comprehensive
- Compliant with NFPA 921 (US National Fire Protection Association Guide for Fire and Explosion Investigations)
- Measures investigator competence against national occupational standards (NOS)
- Takes cognisance of the Forensic Regulator

Further Reading

- Recent research into the creation of "clean burn" fire patterns by Carman
- Case of Todd Willingham convicted in 1991 in Texas of starting a fire that killed his three children. Review determined "flawed science" in determining the blaze had been deliberately set.



INTERNATIONAL CASE STUDY AND OUTCOMES

BACKGROUND

IFIC Forensics was instructed on behalf of insurers to investigate the cause and origin of a fire which occurred in Doha, Qatar during May 2012. The fire occurred within an enclosed shopping mall and entertainment complex which had opened for business during June 2006.

IFIC Forensics was initially instructed to examine the retail premises of two tenant outlets in Area B of the mall, both policyholders of the insurers.

The investigation was undertaken by IFIC Forensics Senior Investigator, Ian Thomson.

DISCOVERY

The fire was discovered when an automatic fire alarm panel activated within Area B, indicating the store of origin. A mall security guard ran to the store as did the mall manager.

The store manager was present and a developing fire was evident at mezzanine level, centred around a ceiling mounted fluorescent light fitting that had fallen to the floor.

Attempts were made to extinguish the fire using hand held fire extinguishers, but apparently had to be abandoned due to heavy smoke building up within the store and mall corridors.

Shortly thereafter, the fire alarm of the adjoining store, closer to the policyholder's premises, also activated. Mall staff, tenant's staff and shoppers all left the building.

Qatari Civil Defence firefighters arrived to commence fire fighting activities. It was established that children and staff from a nursery within Area B had not evacuated the premises.

Firefighters entered Area B and accessed the enclosed corridor leading to the nursery. The occupants were removed outside from the nursery, some via the roof. All thirteen children and the four nurses who had been in the nursery died as a result of the inhalation of toxic smoke and fire gases, as did two firefighters.

FIRE SPREAD

Our examination of the two tenant outlets revealed compartmental deficiencies and inadequate fire stopping at roof level, with gaps between the roof and party walls extending to the area of origin. The nursery was located between the two tenants outlets and the store where the fire originated, it is accessed via a long corridor.

CAUSE OF THE FIRE

The Qatar Special Higher Committee concluded that the fire resulted from an incendive electrical defect within a light fitting in the store where fire was first discovered.

ADDITIONAL INVESTIGATIONS

Expensive clothing and furnishings within a number of stores in the mall were found to have suffered dust contamination following the fire at the mall.

Insurers required to establish whether the dust was soot arising from the fire or wind-blown dust from the desert following the loss of air-filtration capability at the incident mall.

As a qualified chemist, Ian was able to advise on and demonstrate sample collection techniques, instruct two accredited analytical laboratories and assess the laboratory findings.

LEGAL PROCEEDINGS

During June 2013 a Qatari court sentenced four people, including the mall manager, the mall chairman and the two co-owners of the nursery to six years imprisonment over negligence that caused the fire and fatalities.

An official who provided a permit for operation of the nursery to the co-owners was sentenced to five years imprisonment. All remain on bail and have the right to the appeal.

The mall assistant manager and the head of mall security were cleared of all charges.

It emerged during the court proceedings that the nursery was included as a playroom for children rather than a nursery. The distinction is important as nurseries in Qatar require to be licensed and Civil Defence officials and firefighters would have been aware of its existence.

It also emerged during the court proceedings that mall officials did not respond to requests from fire alarm and sprinkler companies to undertake much needed maintenance on the mall equipment, as recently as the week before the fire occurred.





IFIC Forensics

Experts In The Witness Box

Over the years IFIC Forensics have forged strong links with the Centre for Forensics Science at Strathclyde University and it was through this association that we were put in touch with Rory McPherson of Thompsons Solicitors & Solicitor Advocates in Glasgow.

Rory has been involved in the US based National Institute for Trial Advocacy (NITA) training programme for a number of years and he explained the purpose of the programme to IFIC Forensics Operations Manager John Gow. John, a Senior Investigator at IFIC Forensics saw the benefits for such training, particularly at a time when the quality of forensic evidence presented in court is under scrutiny. This type of training also gives delegates an opportunity to deal with forensic specialism's that they may not come across often in practice.

The benefits for IFIC Forensics were that two of our investigators were given the opportunity to enjoy a day in court!

The advanced advocacy course is run on behalf of the Society of Solicitor Advocates and the Law Society of Scotland with the event being managed by Ms Lizzie Fisher of Origin Events (Scotland) Ltd.

The training provides an opportunity, for practitioners with some trial experience, to learn from experienced NITA trial lawyers covering topics such as:

- Direct Examination/Cross examination on Qualifications of an expert witness
- Direct examination/Cross examination on the basis of the experts opinion
- Destroying assumptions relied on by the opposing expert
- Direct examination on teaching the area of expertise/Cross examination to obtain agreements
- Dealing with Problem Witnesses
- Direct/Cross examination of expert witnesses

IFIC Forensics provided two expert witnesses specifically with fire investigation expertise to participate in the course. Our experts Maurice Dallaghan and Barry Wheater were keen to attend the course, which was convened in Edinburgh during September 2013.

The course was organised over a number of days however, the experts were required to attend for one day only.

A case specific file comprising of almost one hundred pages was issued in advance of the course. The original case file was Flinders v. Mismo. Flinders was an Aluminium Fabrication Corporation who had been denied an insurance claim as the result of a fire. The insurers, Mismo Fire Insurance Company alleged the fire had been set deliberately.

Maurice and Barry met some of the organisers the evening before they were due to "give evidence". A friendly, informal discussion took place and the NITA trainers provided an insight into the particular role requirements for the following day.

Maurice and Barry took the role of the state fire investigator who said in his report the fire was set deliberately. They also role played the private fire investigator working on behalf of Aluminium Fabrication Corporation who said the fire was not the result of a deliberate act. There were two separate fire investigation reports issued to us.

On the morning of our "experts" day in "court" they were introduced to the delegates who would be given the opportunity to direct and cross examine them.

Each delegate now had the chance to test their skills during direct and cross examination of an expert witness. The fire investigation reports had been written with some "openings" ideal for "scrutinisiation" by each delegate.

Maurice was first to "take the stand" for a direct examination. The first delegate started with the usual type questions such as name and experience. Further questions followed requiring more detailed answers such his opinions into causation and fire development.

During each session of questioning the delegate was given constructive criticism regarding their line of questioning or how to get the required answer from the expert witness.

Our experts were certainly put under pressure by some delegates during the "cross" as it was referred to on the day. Each delegate now had the opportunity to try get the expert witness to "break" by the use of carefully planned questions. Maurice admitted that some delegates managed to throw in a few excellent questions that tested his knowledge and expertise.

On one occasion a sharp minded delegate exploited the opportunity to undertake a verbal execution of one of our experts. An experience, our expert, will remember for some time to come!

The "mock" court was kept small with around eight delegates per room. Each delegate was also able to witness the strengths and weakness of their colleagues during the questioning. A most valuable experience for the expert witnesses also.

The day was very professionally organised but in a friendly and relaxed atmosphere. It was a very enjoyable and most educational experience.

Maurice Dallaghan
Senior Investigator
IFIC Forensics



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