

**EFI GLOBAL AFRICA –**

**Insurance Institute of Zimbabwe 2024**

*How quickly our best friend can become our worst enemy*



# Global solutions. Local expertise.

Count on EFI Global around the world

**Johan van den Heever**

Head of EFI Global Africa

- T: 082 300 7724
- E: [johan.vandenheever@efiglobal.com](mailto:johan.vandenheever@efiglobal.com)



**As part of Sedgwick, we function in Risk Management, and use forensics to cross sell our 4 main Service Offerings:**



**Fire & Explosion Investigations**



**Specialty Consulting**



**Environmental Specialist Services**



**Forensic Engineering**

## Introduction: **HOW QUICKLY OUR BEST FRIEND CAN BECOME OUR WORST ENEMY**

Briefly: Who is EFI Global and what do we do?

- Is the enemy predictable or unpredictable?
- Where is the enemy hiding?
- What power does it have?
- Who or what is this enemy called “FIRE”?
- How does this enemy operate?
- The enemy’s profile
- How do we unmask the enemy?
- Is there anything we can reclaim from what the enemy has taken?
- Can we beat this enemy?
- Can we learn from the enemy?



## FIRE: THE ENEMY.....Is this enemy Predictable or Unpredictable?



It is an “old” enemy....

Happened in Pudding Lane, and although the baker claimed to have put the fire out, about an hour later his house was an inferno.



**WHERE IS THIS ENEMY HIDING?**

It could even be in a laundry basket.....



06-18-2022 Sat 22:45:52

TILL VIEW

06-18-2022 Sat 22:46:32

TILL VIEW

06-18-2022 Sat 22:51:19

TILL VIEW

06-18-2022 Sat 22:56:12

TILL VIEW







In our cooling fans:



In our "flex" printing machines..

13-03-2021 Sat 02:13:22



## The enemy hides in our boilers...

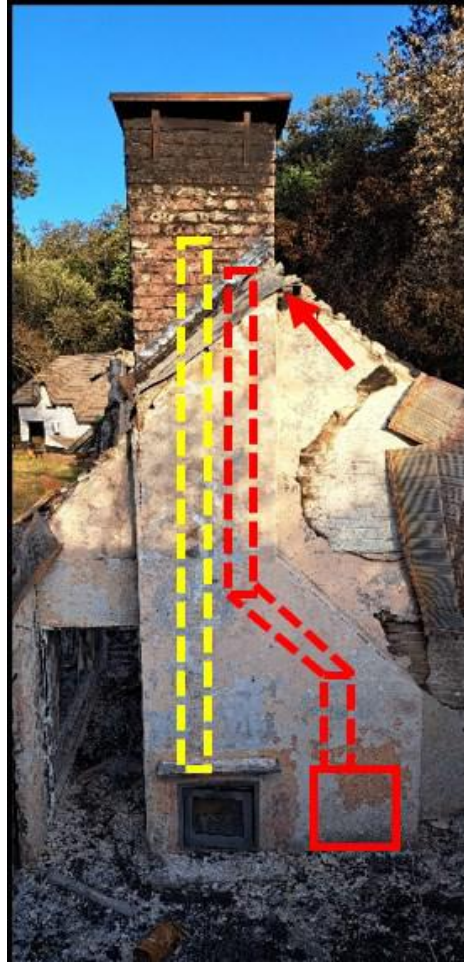


## The enemy takes from us....



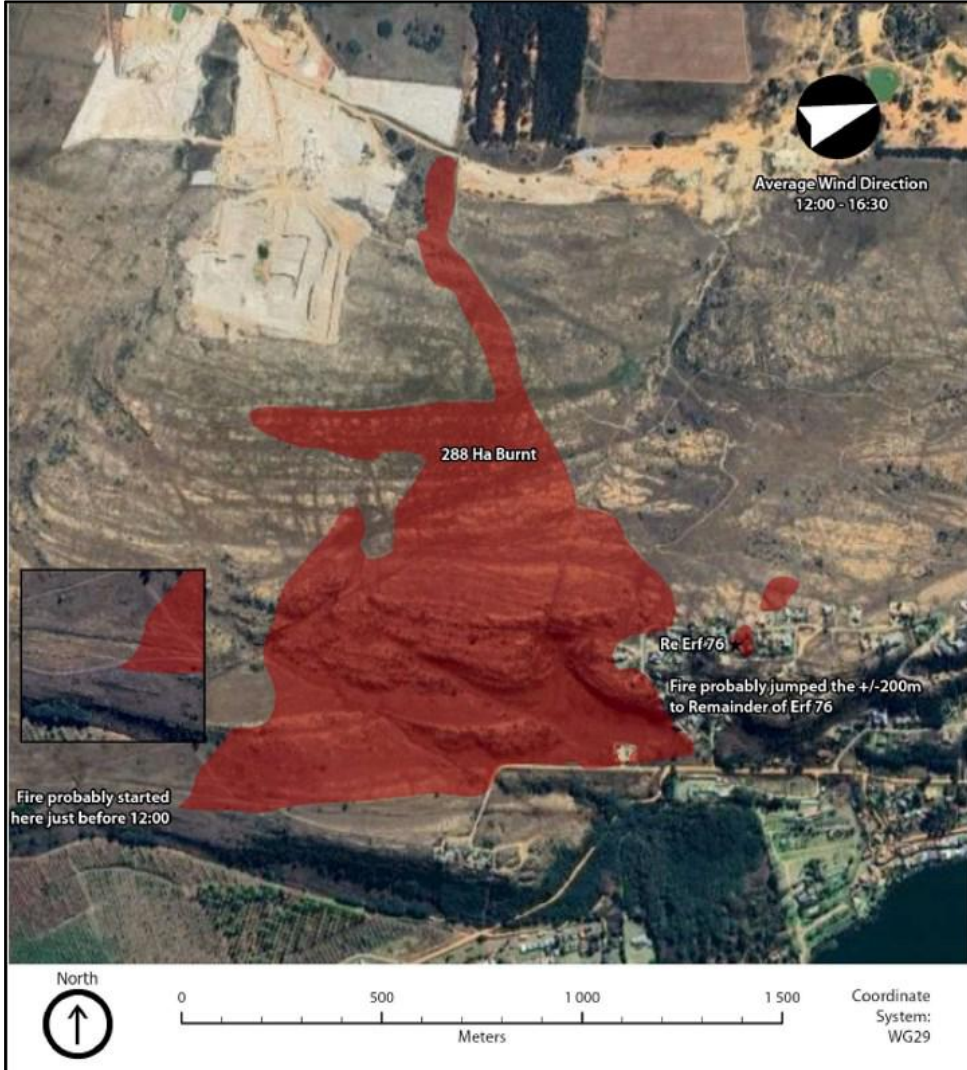


## A chimney .....

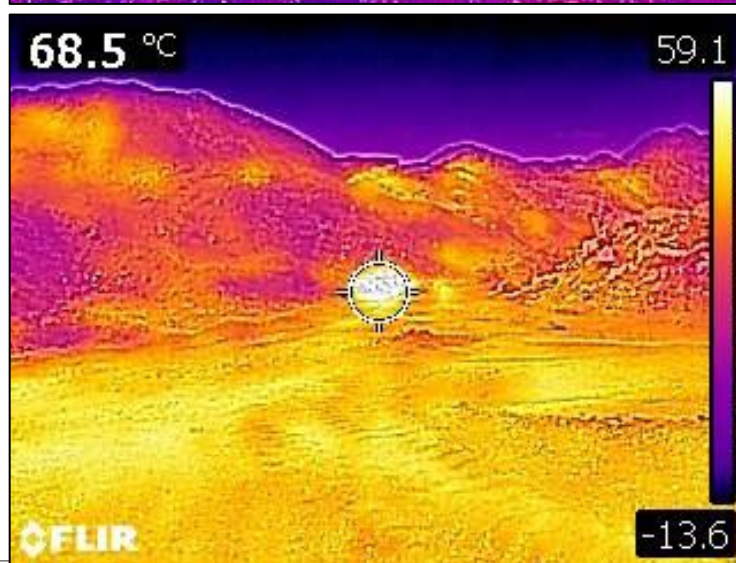
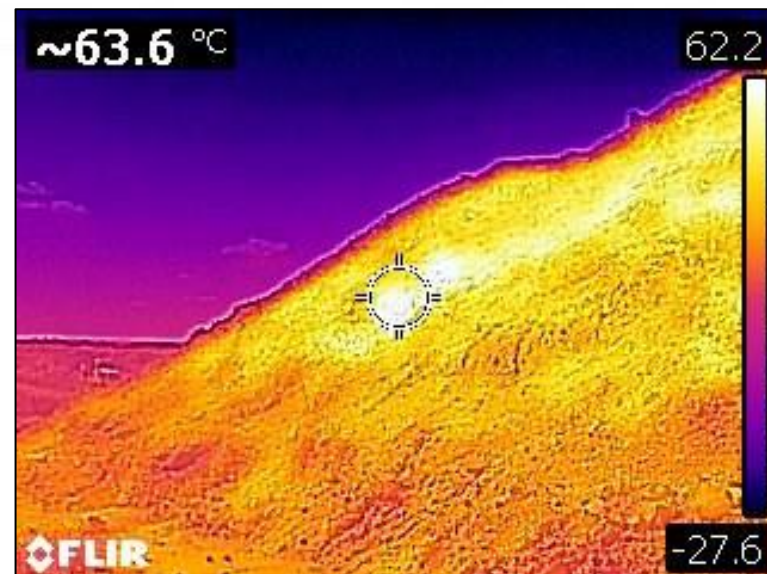
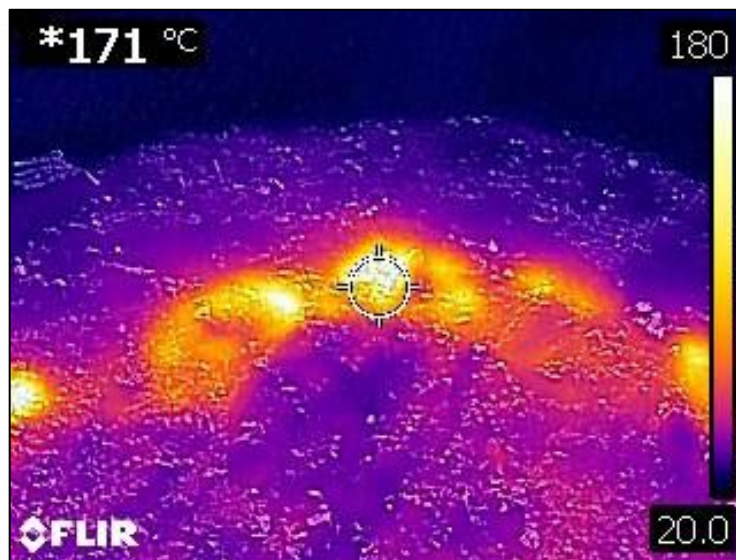




Forests, bush, homes, vehicles, shops, factories, mines....







## Our theatres.....



## In our shopping malls....



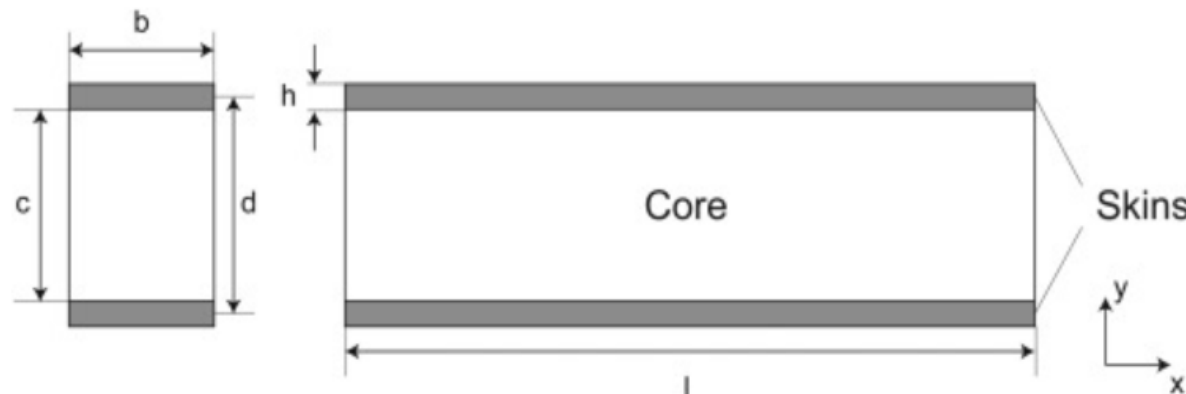
## Our storerooms....



**Even in Cold Rooms** (and other applications using sandwich panels or composite panels..... (URL accessed 24 Oct 24) <https://www.sciencedirect.com/topics/engineering/sandwich-structures>

### 8.13.1 Introduction

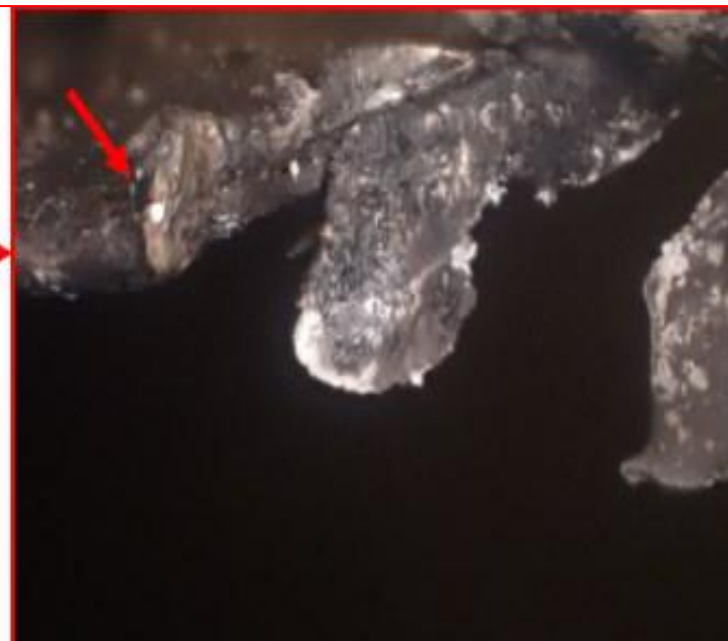
**Sandwich structures** have been found very attractive in many engineering areas including aviation, marine, automotive and energy applications<sup>1-4</sup> because of their high strength and stiffness to mass ratio. In addition, their noise reduction, thermal insulation, and impact energy absorption characteristics make them very favourable for engineering applications. Sandwich structures essentially consist of two thin layers of material with strong in-plane mechanical properties and a thick and light core to separate these two layers and to resist compression and shear forces. A schematic of a sandwich beam is shown in Fig. 1.











In our chemicals....



## WHO OR WHAT IS THIS ENEMY CALLED FIRE?

A ***rapid oxidation process***, which is a chemical chain reaction resulting in the evolution of ***light and heat*** in varying intensities.

***Fire dynamics*** is the detailed study of how chemistry, fire science, and the engineering disciplines of fluid mechanics and heat transfer interact to influence ***fire behaviour***.

The ***fire area*** is the boundary of fire effects within a scene in which the area of fire origin will be located, characterised by identifying the border between damaged and undamaged areas, which are ***distinguishable by fire effects and patterns created by flame, heat and smoke***.

The expert forensic fire investigator will document these, as well as the impact of ventilation on a fire incident, the distribution and type of flammables/combustibles involved, and the fire spread path.

## HOW DOES THE ENEMY OPERATE?

We need to do some chemistry first....

The three elements that are needed for a fire to start are:

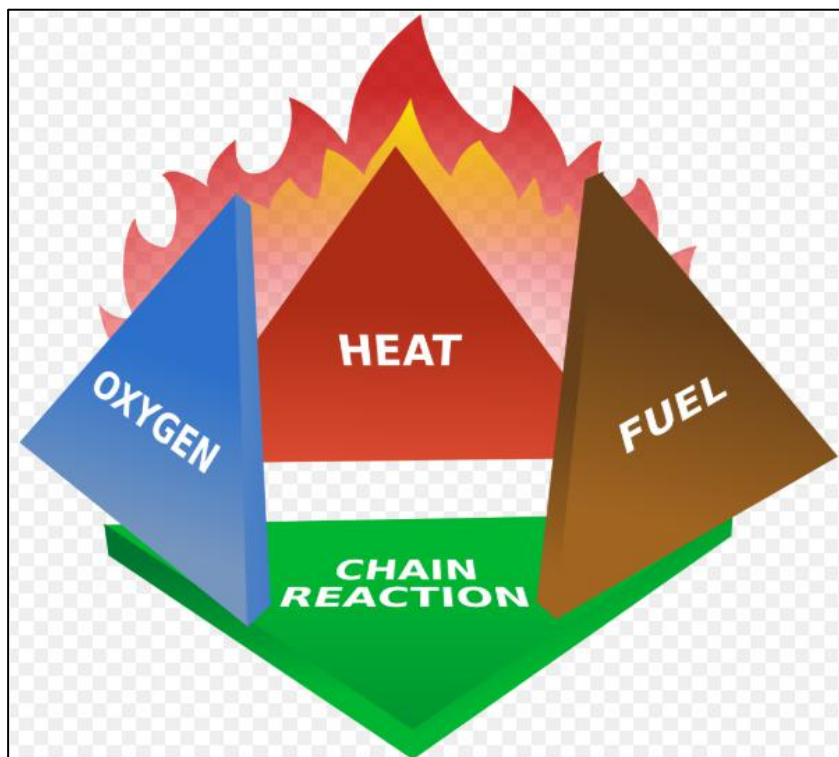
- Fuel – represents all flammable and combustible substances out there.
- Heat – the heat source that will initiate the chemical chain reaction.
- Oxygen – is needed for the chemical reaction to take place between the fuel and the heat source.

The best way to illustrate this relationship is with the ***Triangle of combustion***:

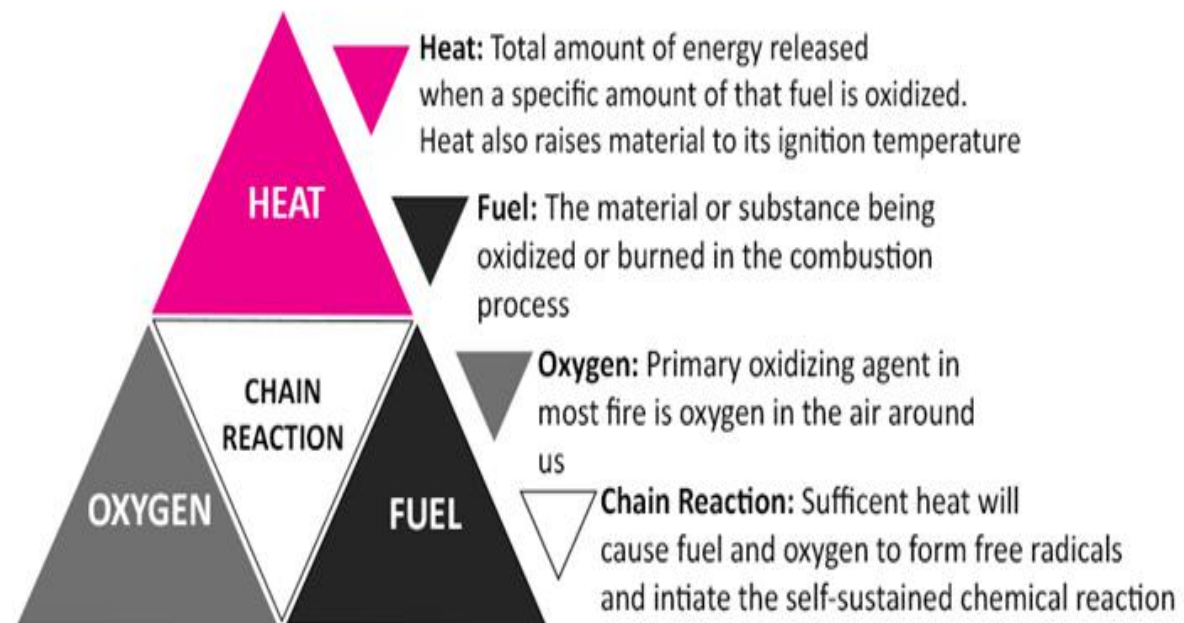
(There is also the “tetrahedron of combustion”)



## The sophistication of the enemy.....

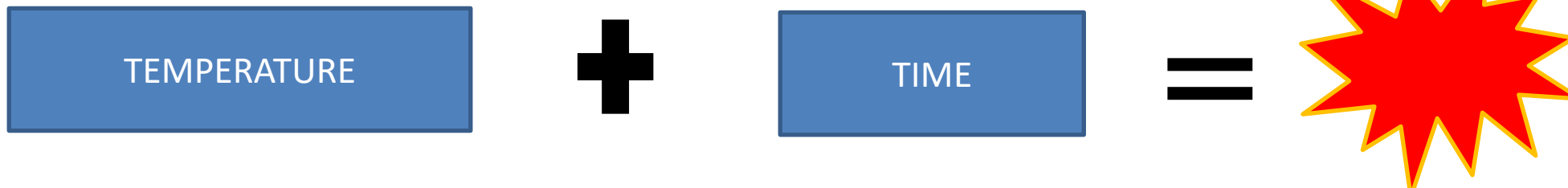


# FIRE TETRAHEDRON



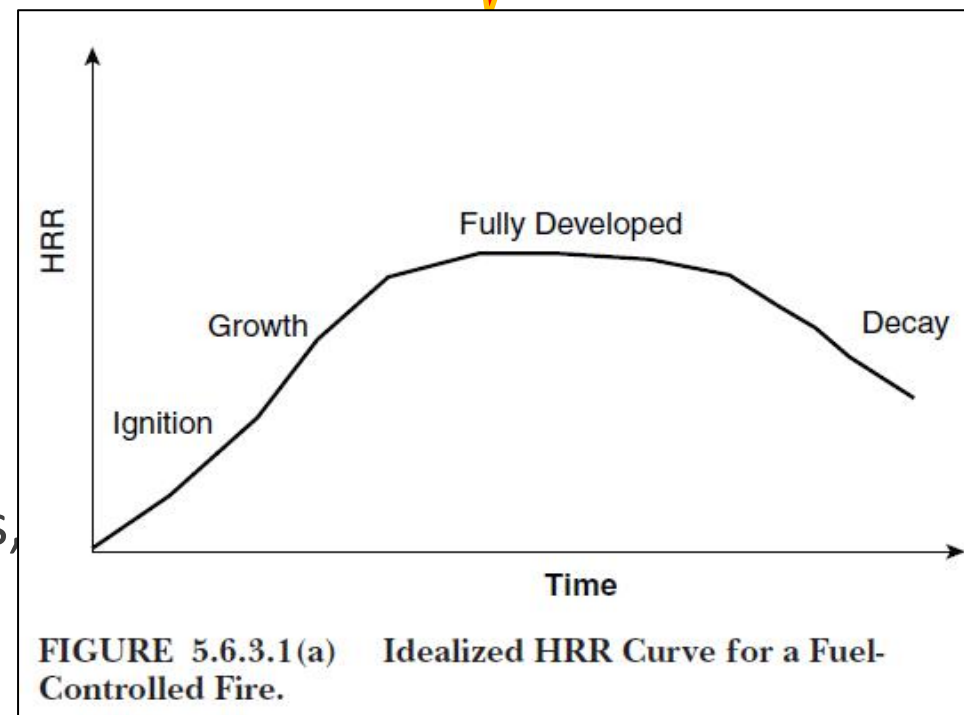
Direct Citations From: Goodson, Carl, and Lynne Murnane, editors. "Chapter 3: Fire Behavior." *Essentials of Fire Fighting*, 5th Edition, Curriculum, Fire Protection Publications, Oklahoma State University, 2007.

## How does the enemy launch an attack? Ignition which is dependent on:



### Sources of heat:

- Mechanical heat - friction
- Biological heat – hay bales/compost
- Chemical heat – polymerization (fatty acids)
- Bacterial heat – breakdown of organics
- Electrical heat – overcurrent, loose connections, resistive oxides at poor contact points.



## More attack strategies....

### Self-heating:

- A process whereby a material undergoes a chemical reaction and increases in temperature solely due to exothermic reactions between it (normally a solid, such as coal), in the surrounding atmosphere, normally air. (Pyrophoric materials ignite when exposed to air – white phosphorous, potassium)

### Exothermic reactions:

- When two substances react with each other, and the reaction generates heat, to the point that ignition of one of the substances (or both) occurs.

### Spontaneous Ignition:

- Initiation of combustion of a material by internal chemical or biological reaction that has produced sufficient heat to ignite the material.



The enemy's speed...



## **Some facts about the enemy: Thermal dynamics:**

### Flashover:

“A fire in a room, becoming a room on fire”.

Heat radiating from the superhot smoke layer at ceiling level, raises the temperature of all other combustibles in a room, to their auto-ignition temperature and they all start flaming almost simultaneously.

NFPA 921 – Guide to Fire and Explosion Investigation, describes flashover using the following illustrations:

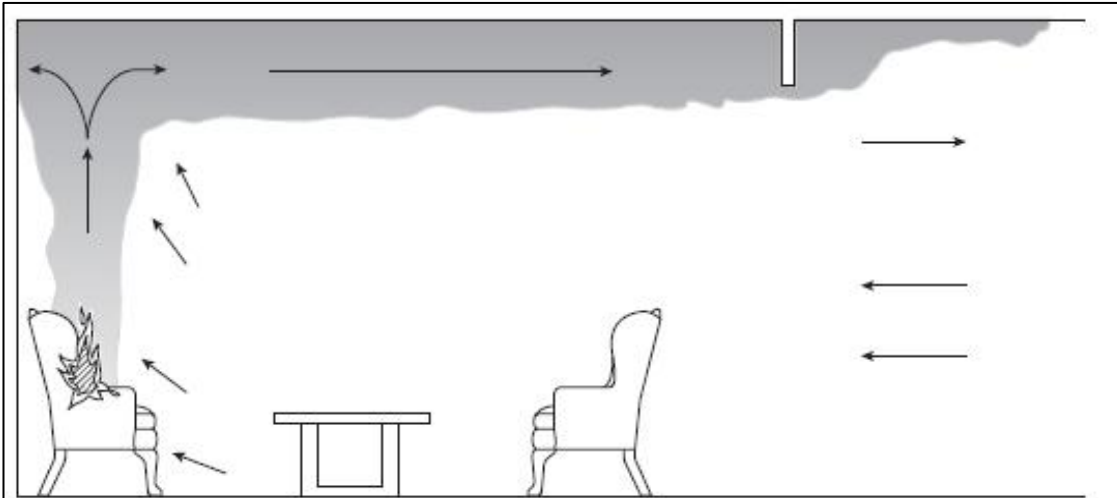


FIGURE 5.10.2.3 Upper Layer Development in Compartment Fire.

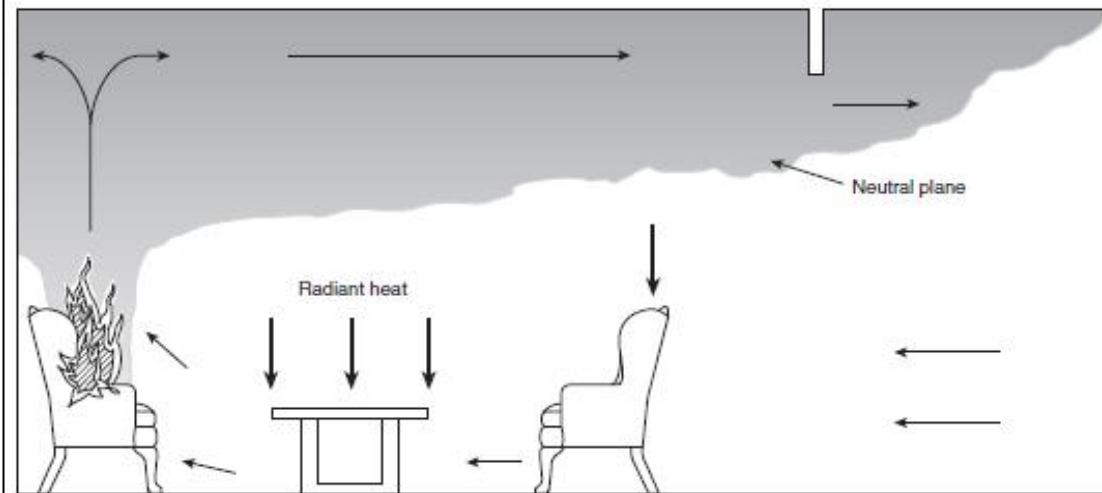


FIGURE 5.10.2.4 Preflashover Conditions in Compartment Fire.

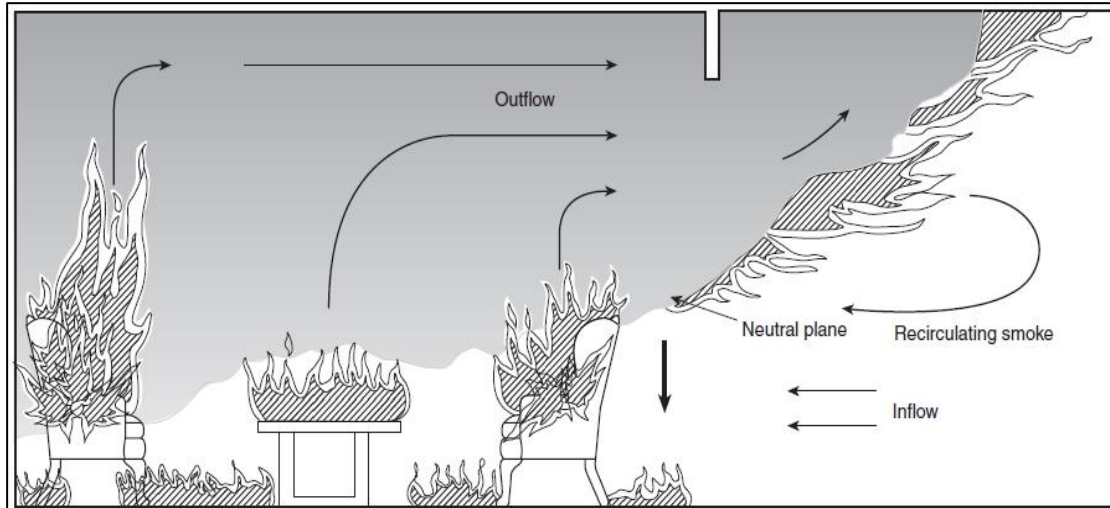
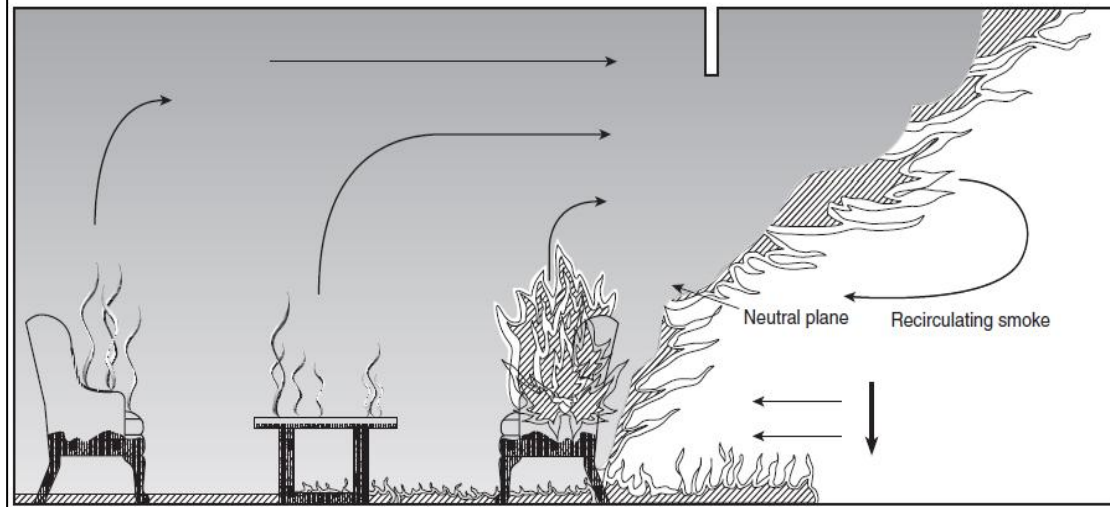
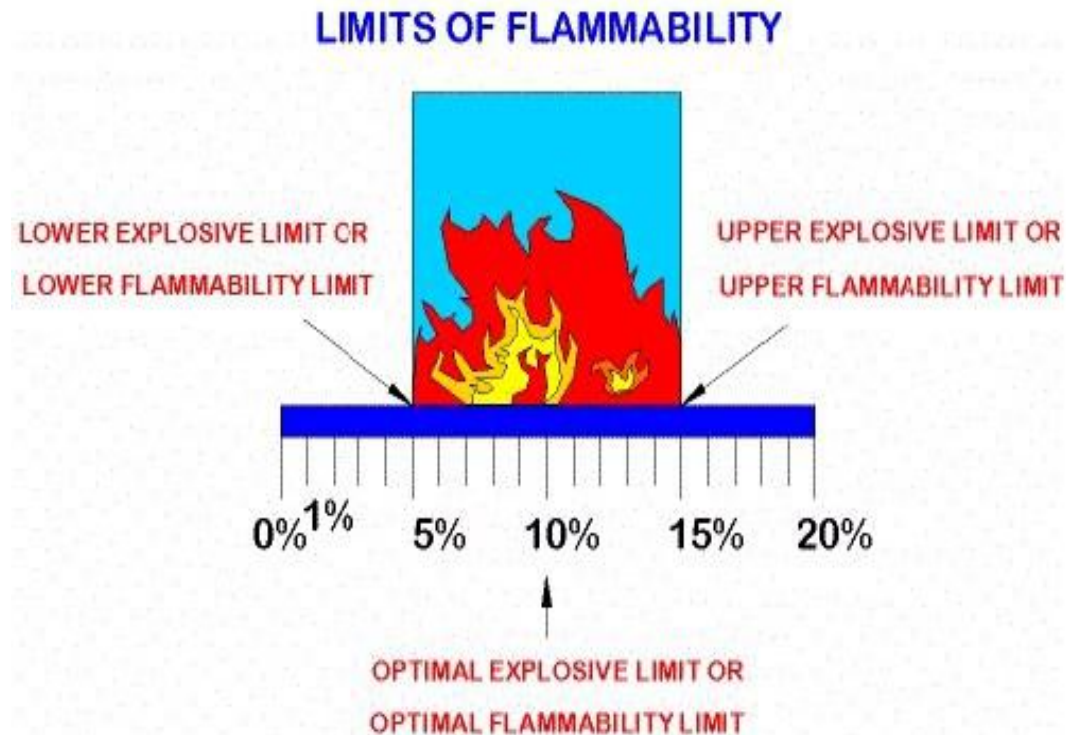


FIGURE 5.10.2.6 Flashover Conditions in Compartment Fire.

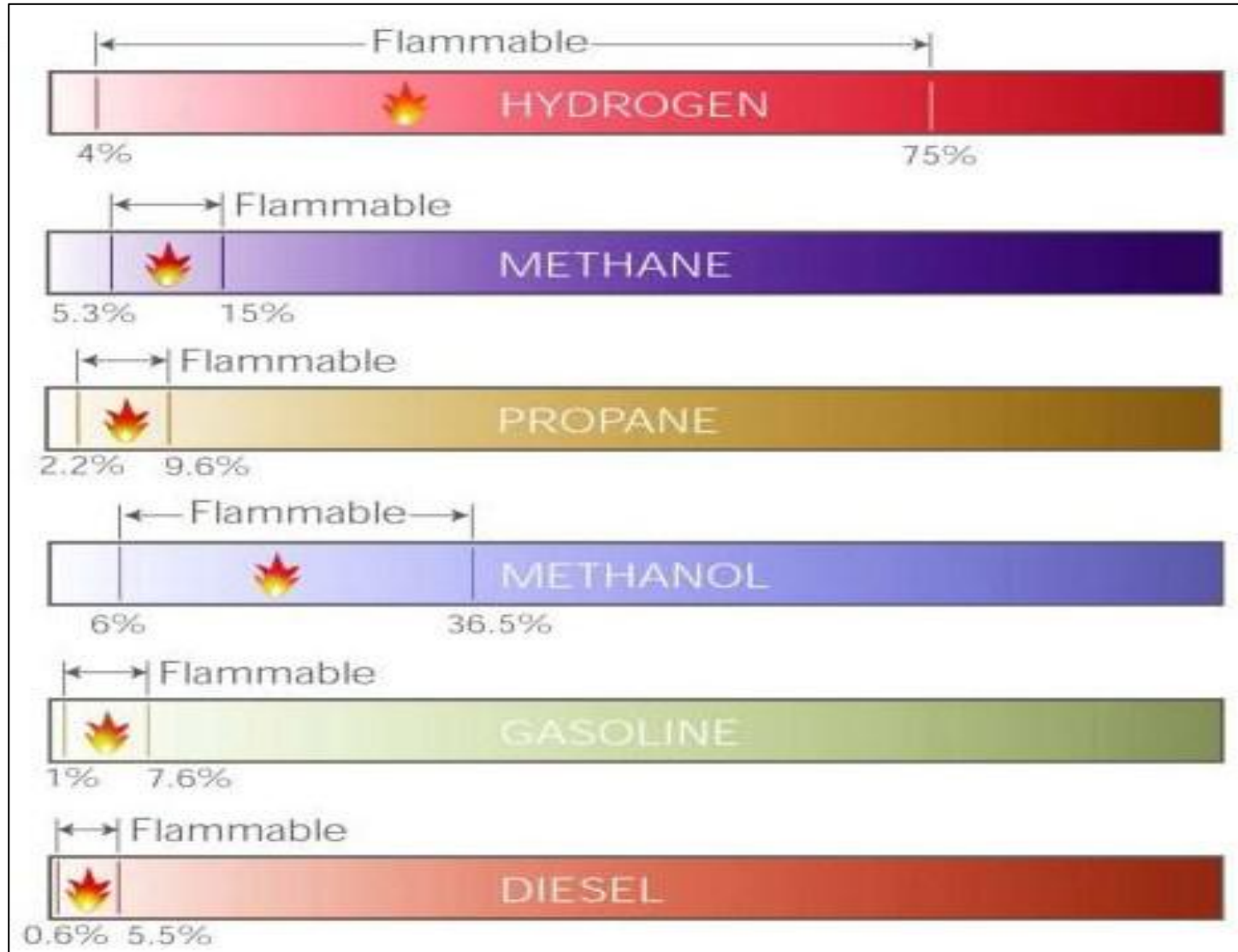


## Vulnerable targets.....Lower and Upper flammability ranges:

All flammable substances have a lower level (LEL) below which the air/vapour mixture is too lean to ignite, and an upper level (UEL) above which it is too rich to ignite. The LEL and UEL are unique.



# Some of the enemy's "easy" targets....



## The enemy's "fire power" .....

### Flashpoint of a flammable liquid:

- The lowest temperature at which a flammable liquid produces enough vapour, that when it mixes with oxygen and an ignition source is added, it flashes momentarily. Examples: Petrol -43 degrees, diesel 55 degrees.

**The lower the flashpoint, the more dangerous the flammable liquid is at room temperature!.**

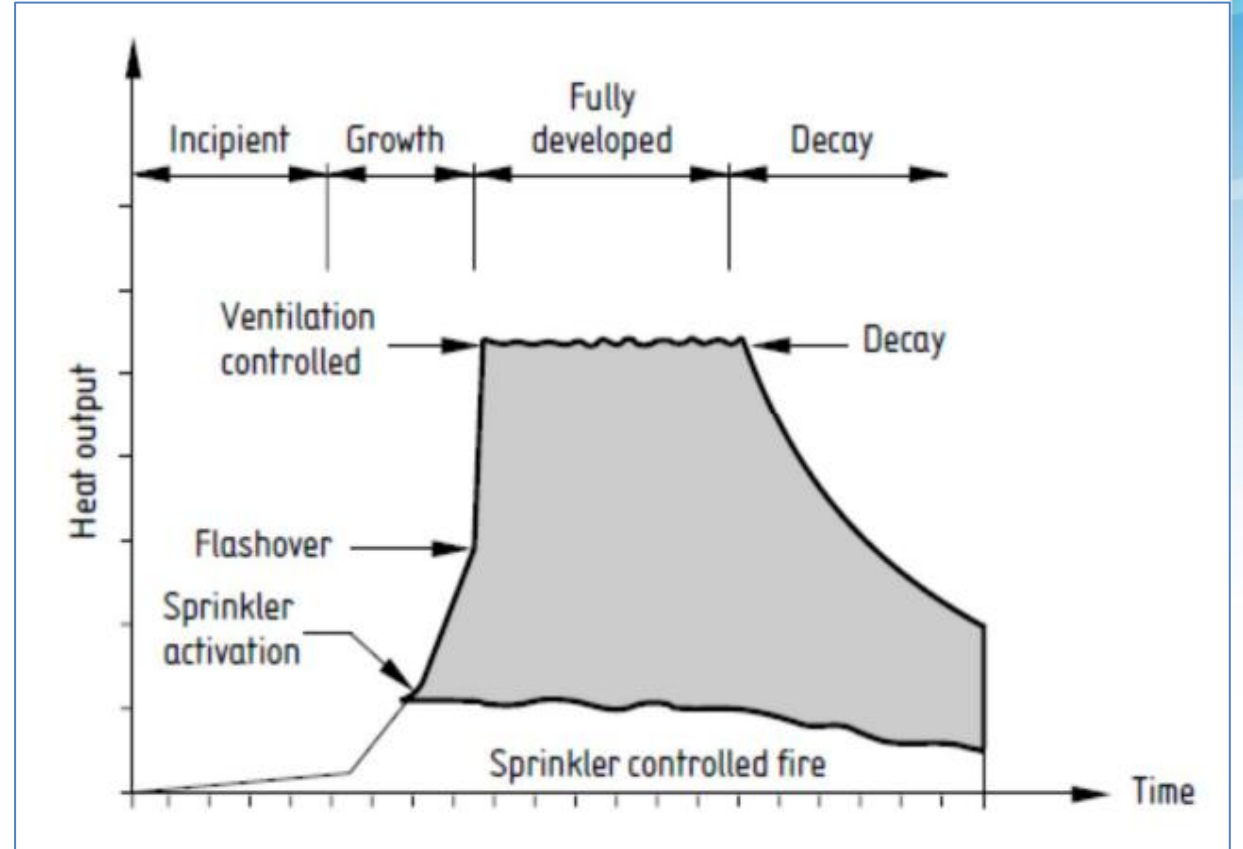
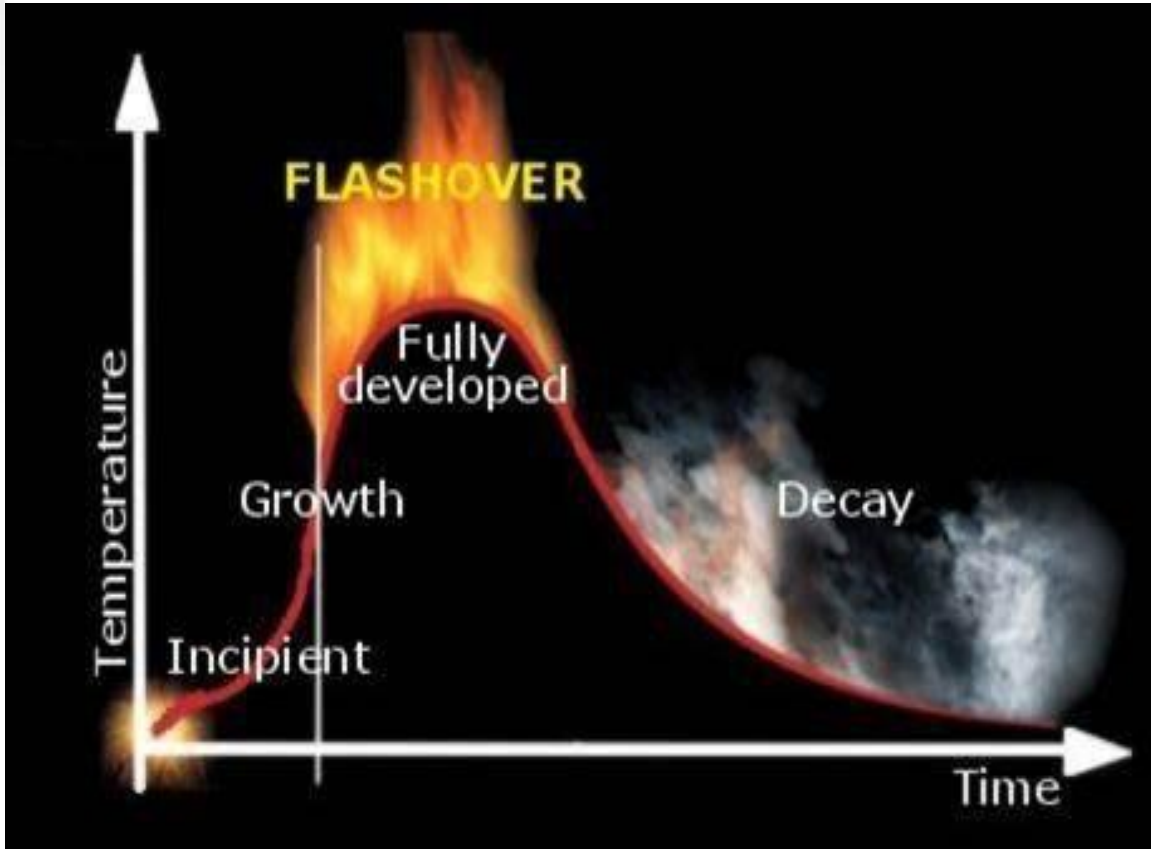
### Auto-ignition temperature:

- That temperature to which a flammable and combustible material is heated to, and it starts flaming without an ignition source.





## THE ENEMY'S PROFILE



## Calculating the enemy's movements.....

**Heat Release Rate** can be calculated: the “alpha t squared” formula....

**Heat Energy** can be calculated : the “alpha t cubed” formula...

(Useful in pre-loss to calculate safety distances between buildings, between racks, etc.)

### Fire effects:

The observable or measurable changes in or on a material as a result of a fire, such as melting, bending, discoloration, mass loss, fusion, deforming.

## The enemy's movements.....

The most common mechanisms are - Radiation, Convection and Conduction.

- **Radiation:** the heat that is felt the nearer a person goes to the heat source. Safety precaution: adequate spacing between buildings and better contents storage.
- **Convection:** heat transfer due to the kinetic energy of superheated smoke. Safety precaution: mechanical extraction of superheated smoke.
- **Conduction:** the transfer of heat through a conductor such as steel beams. Safety precaution: remove combustibles away from a beam, protect the beam.

We can add - *falling materials, burning brands, surface flame spread.*

## The enemy's footprints:

### **Fire patterns:**

The visible or measurable physical changes, or identifiable shapes, formed by a fire effect, or group of effects, such as localised spalled plaster, localised deep charring and clean burning, in a room where the rest of the walls still have some paint residue and soot, for example, often referred to as the “V-shape, U-shape” and their inverted versions, the “hourglass”, etc.

### **Fire spread:**

The movement of the fire from one place to another (remember the impact of ventilation – ventilation controlled, and “fuel” distribution – fuel controlled).



## What does an “act of aggression” look like?

### Explosion:

It is the sudden conversion of potential energy (chemical or mechanical) into kinetic energy with the production and release of gases under pressure, or the release of gas under pressure. These high-pressure gases then do mechanical work such as moving, changing, breaking, or shattering nearby materials, causing what we refer to as “high-order damage” – shattering effect on the confining structure or vessel, and long missile distances.

### ***Backdraft, Detonation and Deflagration***



## How do we unmask the enemy?

We deploy or “special task forces” and conduct proper forensic “origin” and “cause” investigations.....

## *We must start by determining the “origin” of a fire or an explosion?*

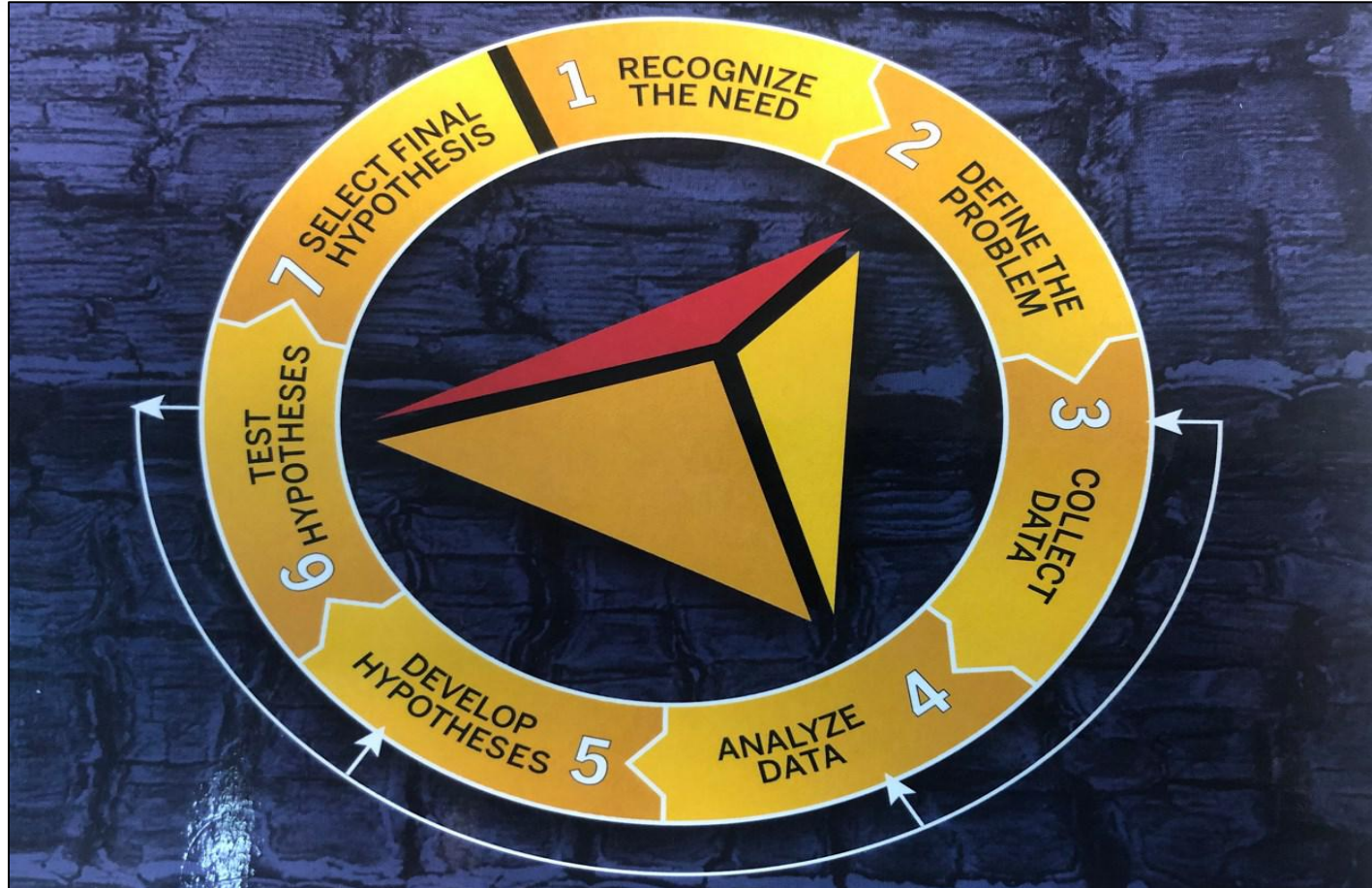
The “area of origin” is defined as a structure, or general geographic location within a fire scene, in which the “point of origin” of a fire or explosion is reasonably believed to be located.

During the data collection stages, we use directional indicators on a “macro” scale, continued by using directional indicators on “micro” scale to find the origin of the fire.

Documenting and correctly interpreting fire effects and fire patterns is now crucial.



At the very least, a basic methodology and a systematic approach must be followed:



Note: area of fire origin and all causal factors must all be dealt with through:  
***formulation + testing of hypotheses = final hypothesis.***

We often see “varying” approaches to fire investigations....

- Some only document what they physically see on site and theorize thereon.
- Some identify the “area of most burning” and call that the origin and the cause.
- Some look for ignition sources first, then they take it from there.
- Some call the ignition source the cause of the fire.
- Some hear from witnesses where smoke was first seen and call that the location where the fire started (same with flames).
- An accelerant dog is only one of many tools and techniques.
- EFI Global work to a forensic level, applying a predetermined systematic methodology.

## **Then follows “fire cause” determination:**

**Note:** the “area of the fire’s origin” must first be determined, before the cause can be determined.

***Causation*** = the total sum of the conditions, circumstances, agencies, the contributing factors, that brought the ignition source into contact with the first material to ignite, in the presence of an oxidiser, and the fire spread path.

The forensic fire investigator will know the extent of his or her level of expertise and will recognise when the expertise of other subject matter specialists must be called upon.

The forensic fire investigator, will secure samples and have it analysed at an accredited laboratory, and will ensure the chain of custody of evidence.

**The developing level of certainty is a vital aspect throughout the entire forensic investigation**

**Developing full confidence is a vital aspect (NFPA 921 2024)**

Lastly, the forensic fire investigator is a “truth seeker” and not a “case maker”.

## IS THERE ANYTHING WE CAN RECLAIM FROM WHAT THE ENEMY HAS TAKEN? Most certainly..



### Environmental waste beneficiation

*Our experts in South Africa specialise in environmental services, including consultations, assessments, investigations and project management. We offer both waste consultation and waste beneficiation — delivering a range of professional and highly technical consulting services.*

#### What is waste beneficiation?

Beneficiation is used in manufacturing processes, whereby raw materials are altered through physical, mechanical or heat treatment processes to enhance their properties or economic value.

Waste beneficiation focuses on waste streams, which are generated during:

- Failed manufacturing and production processes, such as rejects
- Road, rail and air accidents
- Products and materials involved in fires, floods, collapsed buildings, warehouses and/or shelves
- Batch recalls on products due to health and safety concerns
- Non-chemical product contaminations
- Recalled or expired products

The owners/producers of a waste stream are required to implement the following principles:

- **Reduce:** Prevention of waste by identifying processes to reduce waste production or waste volumes for disposal
- **Reuse:** Consideration of the waste generated and how it might be repurposed or used in alternative processes
- **Recycle:** Consideration of salvage or waste beneficiation processes for suitable materials
- **Disposal:** Suitable disposal methods of any materials that cannot be further reduced, reused or recycled

Waste treatment and disposal are considered the final steps in the waste management process, if the first four processes cannot be implemented.

EFI Global's environmental specialists can advise clients on the best beneficiation options for their particular waste streams, including:



## Assist the Loss Adjusters with:

### Claims management

During the claims handling process, the use of contractors and suppliers is restricted to:

- The insured's/client's preferred suppliers and contractors who receive their instruction from the policyholder
- Those in the local market who are available to Sedgwick and its EFI Global division for rendering the required services in line with the insured's consent and requirements
- Specialists operating under arrangements agreed upon by Sedgwick/EFI Global and are external to the company's database

In cases where the insured's contractor or supplier cannot be engaged in an appropriate time frame, EFI Global can provide an alternative option. Our goal is to avoid any delay that would prejudice the insured's position or potentially increase the loss. The policyholder's consent to proceed must be clearly recorded by means of a consent form or a written instruction.



## CAN WE BEAT THE ENEMY? Fore sure! (But it will always exist)

What is a “Fire Risk”? (The relationship between competent ignition sources and flammables/combustibles)

- Fire Risk = the **likelihood** of a fire occurring X the **consequence**

What is the Fire Risk Profile?

- Fire Risk X **Frequency**.

What is the actual “unmanaged/threatening” Fire Risk?

- The worst Fire Risk Profile minus Fire Protection/precautions = **Residual Fire Risk**



***FIRE RISK MUST/SHOULD BE ASSESSED AND MITIGATED USING A FUNCTIONAL APPROACH***



### Risk management and loss control services

Our risk management and loss control solutions help clients minimise injuries and lost productivity while supporting cost control efforts. We provide a variety of property value, general liability and product liability services. As part of our commitment to building mutually beneficial, long-term partnerships, we also offer education and training opportunities for professionals in the insurance, legal and corporate communities.

- Tailored Physical Risk Reporting

## Why **EFI?**

### Comprehensive services

- Widest range of forensic engineering, fire investigation and environmental services available worldwide
- Strategic solutions tailored to your specific requirements
- Latest technology combined with innovative practices to maximise value for our clients

### Responsive support

- Global response team available 24/7, ready to quickly respond and assist with everyday projects or catastrophic losses
- Dedicated, single point of contact to standardise program requirements and deliverables across borders
- Consistent and timely report delivery

### Diverse expertise

- Services designed for a wide variety of industries including insurance, legal, financial, commercial, residential, healthcare, construction, manufacturing, transportation and more
- Worldwide solutions delivered through local experts
- Exceptional, credentialed, accredited talent with the best technical skills and outstanding industry knowledge



**We must acknowledge that fire is not an “exact science”.  
There is always something new to learn about the enemy.**

**The enemy can be full of new surprises.....  
(Lithium based batteries.....)**

**Talk to us....**

**[forensicsa@efiglobal.com](mailto:forensicsa@efiglobal.com)**

**[environmentalsa@efiglobal.com](mailto:environmentalsa@efiglobal.com)**



## Our Sedgwick core values



**Empathy**

We care for those we are entrusted to help in their time of need.



**Accountability**

We are responsible stewards of the interests and resources of our clients and stakeholders.



**Collaboration**

We work as one company, one team and take care of one another.



**Growth**

We support individual and organisational development, innovation in our industry and the betterment of our communities.



**Inclusion**

We embrace uniqueness and promote a culture of belonging.



*caring counts*

Thank you.  
Questions?