Fire Investigation Principles

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Origin and cause a – reminder!
Defining fire investigation

‘The process of determining the origin, cause and development of a fire or explosion’

NFPA 921 2014
Defining ‘origin’

‘The general location where a fire or explosion occurred’

NFPA 921
Defining ‘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
The nature of a fire investigation

Establish origin

THEN

Investigate cause

BY DETERMINING

Ignition source

Material first ignited

Ignition factor

An FPASA Training Programme
It can be complex!
It can be complex!

PRE-FLASHOVER / FULL INVOLVEMENT

POST-FLASHOVER / FULL INVOLVEMENT
It can be complex!
Sometimes a little easier!
Methodology is paramount

- Scientific method should be used (also known as systematic approach)
- Needs to be applied to both origin and cause components
- Provides an organizational and analytical process for successful investigation
Scientific Method (NFPA 921)

Recognise need → Define problem

Collect data

Analyse data

Develop hypothesis

Test hypothesis

Select final hypothesis

Inductive reasoning

Deductive reasoning
About the scientific method

Possible result when applied to origin determination:
• Area of origin
• Point of origin
• Origin insufficient to continue with cause determination

Possible result when applied to cause determination:
• Cause of fire
• List of potential causes
• Insufficient information to determine cause
Level of certainty

- Based on data collected, the analysis of the data and hypothesis testing
- Probable: >50%, hypothesis is more likely to be true than untrue, can be expressed with reasonable certainty
- Possible: <50%, hypothesis is feasible but not probable
  ‘Suspected‘ unlikely to qualify as expert opinion’
Use all analytical tools and techniques available

Analytical Tools

- Time Lines
- Systems analysis such as FMEA, HAZOP, Fault Tree Analysis
- Mathematical modelling such as Heat Transfer Analysis and Fire Dynamics Analysis such as Zone and CFD models
- Fire testing and experiments
Example of testing

The area of origin
Example of testing
Example of testing
Testing and Modelling
Rhode Island Nightclub

- The Station
  “Nightclub” Fire
- Rhode Island, USA
- February 2003
- 96 Deaths
- 115 Injuries
- 219 Escaped
Testing and Modelling Rhode Island Nightclub
Testing and Modelling
Rhode Island Nightclub

CFD modelling to evaluate:
• Fire spread (SMARTFIRE)
• Evacuation/ fatalities (EXODUS)

NIST fire testing to evaluate:
• Fire spread – Without sprinklers
• Fire Spread – With sprinklers
Use all analytical tools and techniques available

Techniques include:

• Fire effects and pattern recognition
• Reconstruction
• Understanding of misconceptions
• Use of fire and security system data (detection, CCTV)
• Interpretation of damage to electrical systems and equipment (Arc Mapping)
About Arc Mapping

- Relies on a circuit severing due to arcing
- Section downstream of severed a point de-energised
- Upstream may stay energised and arc further depending on activation of protection
- Where there is multiple arcing on a conductor, furthest damage from supply may be the failure point
- May provide additional data for origin and cause evaluation
A quick case study
Ignition source: Smoking material

Material first ignited: Exposed chair padding

Ignition factor: Carelessness (smoking in bed)
What does a fire investigator need to know!
About NFPA 1033

- Identifies the minimum Job Performance Requirements (JPR’s) for fire investigators
- Specifies the minimum JPR’s for serving as a fire investigator in both the private and public sectors
How does a fire investigator achieve the requirements of NFPA 1033
About NFPA 921

- Establishes guidelines and recommendations for the safe and systematic investigation or analysis of fire and explosion incidents
- The document has been developed as a model for the advancement and practice of fire and explosion investigation, fire science, technology and methodology
The need for professional registration

- Preliminary Stakeholder meeting held in July 2014
- Working Group formed, has met twice and formed a task team to draft competency and registration requirements
- Working Group will present proposal to a Full stakeholder meeting expected in 3\textsuperscript{rd} quarter of 2015
- SACNASP on-board as the registration authority