Original article

Las evidencias dicen la verdad: Un caso de incendio

Evidences tell the truth: A Case of Fire

As evidências dizem a verdade: Um caso de incêndio

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Resumen: Uno de los mayores desafíos para los científicos forenses es la investigación de incendios, ya que los lugares de los hechos suelen estar gravemente alterados por las labores de extinción o por los intentos de las personas de salvar sus bienes. La obtención de materiales de evidencia sustancial resulta especialmente difícil debido a la complejidad del comportamiento del fuego y a las modificaciones provocadas por las acciones de control. Por ello, la reconstrucción precisa de la secuencia de los acontecimientos es esencial para determinar tanto la causa como el origen del incendio. Este trabajo presenta la metodología básica y fundamental utilizada en la investigación de incendios y casos de incendio intencional, ilustrada con un caso real ocurrido en las oficinas del diario Rajasthan Patrika en Jaipur. La investigación determinó que el fuego se originó en un interruptor de pared, donde se identificó un cortocircuito como la causa principal de ignición.

Palabras clave: *ciencias forenses; incendios; investigación científica; metodología; seguridad pública.*

Abstract: One of the greatest challenges for forensic scientists lies in investigating fire incidents, as the examination sites are often severely disturbed by firefighting efforts or attempts by individuals to save property. Obtaining substantial clue materials becomes particularly difficult due to the complexity of fire behavior and the alterations caused by suppression activities. Accurately reconstructing the sequence of events is therefore essential to determine both the cause and the origin of the fire. This paper presents the basic and fundamental methodology used in fire and arson investigations, illustrated through a real case involving a fire outbreak at the Rajasthan Patrika Daily Newspaper office in Jaipur. The investigation revealed that the fire originated from a wall-mounted on/off switch, where a short circuit was identified as the primary cause of ignition.

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Keywords: forensic sciences; fires; scientific research; methodology; public safety.

Resumo: Um dos maiores desafios para os cientistas forenses é a investigação de incêndios, pois os locais de ocorrência costumam estar gravemente alterados pelos esforços de extinção ou pelas tentativas das pessoas de salvar seus bens. A obtenção de materiais de evidência substancial torna-se particularmente difícil devido à complexidade do comportamento do fogo e às modificações causadas pelas ações de combate. Assim, a reconstrução precisa da sequência dos acontecimentos é essencial para determinar tanto a causa quanto a origem do incêndio. Este trabalho apresenta a metodologia básica e fundamental utilizada na investigação de incêndios e casos de incêndio criminoso, ilustrada por um caso real ocorrido no escritório do jornal Rajasthan Patrika em Jaipur. A investigação revelou que o fogo teve origem em um interruptor de parede, onde foi identificado um curto-circuito como a principal causa da ignição.

Palavras-chave: ciencias forenses; incendios; investigación científica; metodología; seguridad pública.

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1. Introduction

Forensic science is a diverse, interdisciplinary field that is rapidly expanding in terms of public interest and importance in the administration of justice. Through this report, we try to interpret of fire scene evidence used to help in solving arson/fire crime. The "arson" word comes from the Latin "ardere", to burn and the wilful setting of fires has been recognized crime for thousand of years. Fire investigation can be performed in to stages.

The first involves examination of the fire scene to determine the cause of fire, origin and development/spread of fire. The second involves laboratory analysis of samples recovered from a fire scene normally when arson is suspected (Paul, 1974; Béland, 1984; NFPA, 1992 & NFPA, 2001).

In this paper, we divided the paper into two sections: in (i) it deals with the basic methodology which is to be adopted during the investigation of fire and in (ii) a case study is also report with photograph. The purpose of this report is to give a brief and relativistic simplistic approach of how fire/arson case should be investigated.

2. Metodology

The investigation of fires or arson is an act as well as science. A combination of factual information as well as the analysis of the facts must be accomplished objectively and truthfully. The systematic approach recommended is that of the scientific method used in the physical sciences (U.S. Fire Administration, 1997). In the flow chart shown in Fig. 1 which is a result of thorough study of the reference literature (Hann, 1991; Phillips & McFadden, 1982), is developed for the sack in the help of the investigator to examine the fire crime scene in five steps. From the flow chart it is clearly seen that one should the follow the step during the examination. In STEP 1, one should have the knowledge of dynamics of fire and on which factor the fire development is depend and spread. In STEP

2, the crime scene investigator (CSI) has to examine the crime scene like char pattern, colour of smoke, colour of flame and residue parts etc. Inductive reasoning with all of the collected and observed information should be done in STEP 3. On the basis of data analysis, CSI should develop a hypothesis to explain the origin and cause of fire and test of the hypothesis in STEPs 4 and 5, Figure 1.

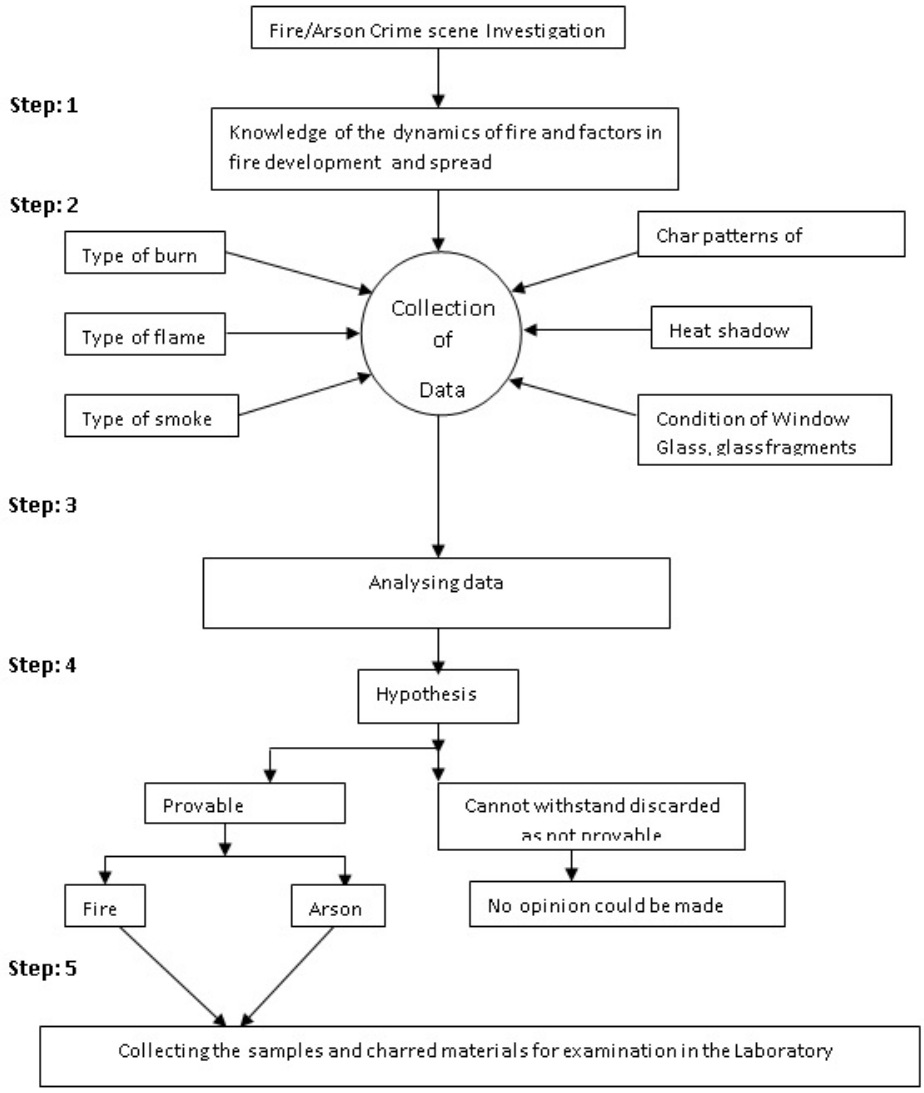

Figure 1: flow chart of steps 1 to 5 to analysing a fire/arson investigation.

Case study

In the present paper, we are also reporting a case study of fire/arson spot examination, in June, 2009, an incident of fire had occurred at the Rajasthan Patrika Daily News Paper office, Jhalana Doongari, Jaipur. The Forensic Investigator's team visited the spot along with team and equipment.

Observation at the spot:

The point wise observation with photograph illustration is explained here:

1. The place of incident was a large basement of the office and the floor was flooded with the water. The fire was extinguished when the team reached at the spot.

2. The debris of burnt/ partially burnt paper and furniture were floating in the water. The spot was thoroughly searched for cause of fire. The electric distribution board mounted in the wall has many on/off switches which were intact and already in off condition (Figure 2).

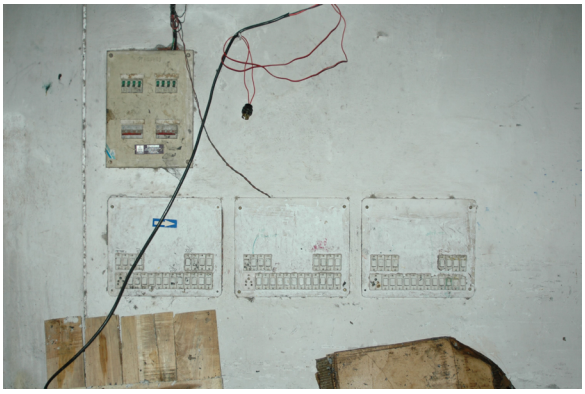

Figure 2: showing on/off switches which were intact and already in off condition.

3. The main distribution circuit was intact and there was no sign of sparking. The insulation of the wires and armoured cables were intact with out sign of heat or flow of heavy current (Figure 3).

Figure 3: showing distribution circuit were intact.

4. The whole circuit of the office was intact and main switch connected to the transformer was also found switch off condition.

5. Inner electrical circuit of the basement was concealed in the wall in conduit pipes. The effect of high temperature was observed at the left side rear corner of the basement. Partially burnt/charred loose papers were lying on the ground near the heat affected area it was observed after floor was cleaned by workers. (Figure 4)

6. The electric circuit of the basement was examined thoroughly and it was observed that one partially burnt/charred wooden extension board (22 cm x 11 cm approx.) with three on/off electric switch and one three pin 5 Amp socket was recovered from the debris of the papers near the heat affected area. This board was used to supply electric current to the two tube lights placed in the wall near the ceiling of the left rear side corner. This board was in addition to the concealed electrical circuit and externally mounted on the masonry pillar near the heat affected area (Figure 5 (A), (B) and 5 (A)). Heap of loose papers were collected just below this externally mounted board.

Figure 4: showing the externally mounted wooden extension board at the heat affected corner.

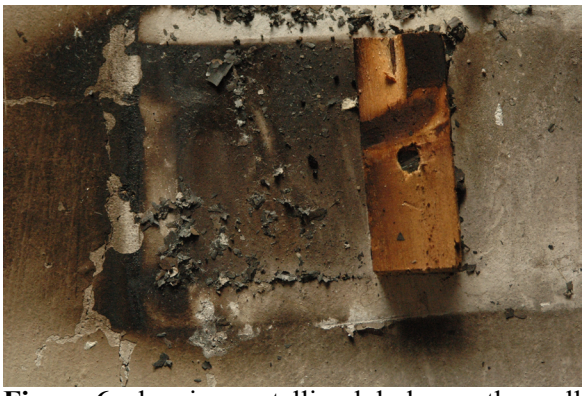

Figure 6: showing metallic globules on the wall where the electric circuit board was mounted.

7. The place where the wooden extension board was mounted was identified. Soot was found deposited in the half portion of the board on the wall where the board was mounted (Figure 6).

8. By examination of the inner side of the contact point of the board it was observed that the socket was in melted condition. The bunch of connection wire and there insulation was heat affected in this extension board.

9. The margins of the extension board were intact in the outer side but the effect of heat and sparking was observed in the inner side. The surface of the pillar where this extension board was mounted had microscopic globules of copper metal.

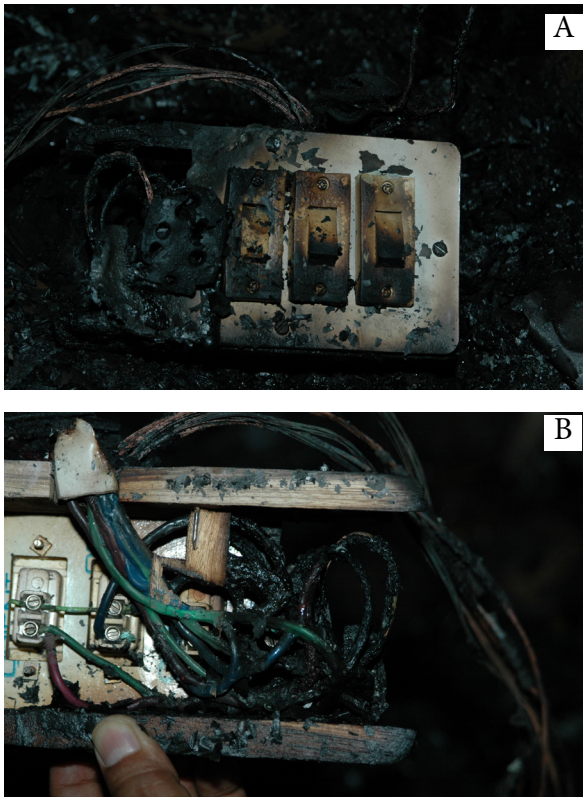

Figure 5: (A): close-up of front side view of the electric circuit board; while in photograph 5(B): Close-up inner side view of the electric circuit board and heat affected insulation is shown.

3. Results and discussions

In some cases of fire external heating involve the wire or wiring device as 'victim' of fire and not as the initiator of fire. But some situations do exist where external heating of wiring serves as the initiating event. In many cases, arcing occurs after sufficient overheating. The NFPA921 Guide for Fire and Explosion Investigations 2004, (National Fire Protection Association [NFPA], 2004) provides photographic examples of wires with parting arcs, but it includes no metallurgical investigation. Aparting arc in this case would have occurred after the fire had started, as the hot, energized wire was pulled apart. The arc was not considered to be the cause of the fire because of its short duration, but it was evidence for flowing current.

Careful examination of the insulation tells the truth of internal or external heating of the metallic conductor. Experiment conducted in our laboratory to study the effects of heat on insulation. The insulation around the metallic conductor was examined microscopically and the blistering patters on the PVC insulation were characterised in two categories as external blistering and internal blistering. External blistering appears at the outer surface of the insulation indicate that the temperature is out side of the insulated wire. Internal blistering can be seen at the inner surface which is in contact of the metallic conductor. one of the cause of the pits appears near the metallic conductor is the gases of vapours of the PVC tries to expand but are not able to create enough pressure to escape out of the thick sheet of the insulation in turn cause microscopic pits near the core metallic insulation. Internal blistering was found in the present case. Further, microscopic copper globules also indicate overheating of the copper conductor due to high voltage may be for a fraction of second. Melting of the copper by heating it externally need high temperature i.e 1083 degrees Celsius which can vaporise copper which is practically impossible in ordinary domestic fire incident because the A C Voltage is 220 volt at 50 Hz.

In 1974 the author of a textbook on electrical insulation wrote: “The fundamental breakdown processes are not understood; not for lack of experimental observations but because our background knowledge is too crude.” Unfortunately, even today this statement remains true, as concerns wiring and wiring devices in buildings (Sillars, 1974).

4. Conclusions

In the present case, on the basis of the observations made at the spot and the condition of the socket of the extension board, cause of fire was detected as electric spark in externally mounted wooden extension board.

During an investigation to determine the origin of fire and cause of fire, evidence may be uncovered which indicates the fire was started due to electric spark. These fires are often the result of natural curiosity and experimentation, while some are wilfully and maliciously set for a variety of reasons. Because, all fire incidents are different. Through this paper, the authors have explained an attempt to provide a methodology which can help for a re-construction of a fire/arson investigation.

Conflict of interest

The authors declare that there is no financial, personal, or academic conflict of interest that has inappropriately influenced the conduct of this research or the preparation of this manuscript.

Data availability

The data used in this study are available upon reasonable request from the corresponding author.

Authors' contribution

S.M. and S.M. participated in the conceptualization of the study, formal analysis, investigation, project management, validation, visualization, drafting of the initial manuscript, review, editing, and final validation of the manuscript.

5. References

Béland, B. (1984). Electrical damages—Cause or consequence? Journal of Forensic Sciences, 29(3), 747–761.

DeHaan, J. D. (1991). Kirk's fire investigation. Prentice Hall.

National Fire Protection Association. (1992). NFPA 921: Basic methodology in fire and explosion investigations. NFPA.

National Fire Protection Association. (2001). NFPA 921: Guide for fire and explosion investigations. NFPA.

National Fire Protection Association. (2004). NFPA 921: Guide for fire and explosion investigations. NFPA.

Paul, K. L. (1974). Fire investigation (2nd ed.). John Wiley & Sons.

Phillips, C., & McFadden, D. (1982). Investigation of the fire ground. Prentice Hall.

Sillars, R. W. (1974). Electrical insulating materials and their application. Peter Peregrinus.

U.S. Fire Administration. (1997). Fire in the United States: 1985–1994 (9th ed.). U.S. Fire Administration.