Electrical Fire and Accident Investigation: Arc Mapping, Evidence and Root Cause

15 – 19 February 2027
Dubai - Five-star CBD venue



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Ref: 345_12889 **Date:** 15 – 19 February 2027 **Location:** Dubai - Five-star CBD venue **Fees:** 21450 SAR

Introduction:

Electrical fire and accident investigation often goes wrong at the first step: a burnt panel is cleared before anyone photographs it, a melted conductor is named as the cause without testing that reading, or a shock fatality is closed as operator error while a defective earth path stays in service. This Core Concept course trains investigators to determine where and why an electrical event began, applying the scientific method and arc mapping as NFPA 921 describes them, and to defend that conclusion. Participants produce an Electrical Origin and Cause Investigation Report from a case file.

Course Objectives:

- Identify the electrical ignition and injury mechanisms that can explain a fire, shock or arc-flash event, including arcing, resistive heating at connections, overload and insulation breakdown
- Apply the scientific method as NFPA 921 describes it to form, test and eliminate origin and cause hypotheses
- Secure an electrical incident scene, make the installation safe and preserve evidence against spoliation with a documented chain of custody
- Interpret arc sites, melted conductors and protective device condition to define the area of origin and the sequence of circuit failure
- Reconstruct the event timeline from interviews, protection records and equipment examination results
- Write an origin and cause investigation report with a root cause statement and corrective actions that withstands technical and insurance review

Target Audience:

- Electrical engineering staff who examine failed installations and equipment after fires and injuries
- HSE investigation staff who lead or support inquiries into shock, arc-flash and electrical fire events
- Loss adjusting and insurance claims staff who assess the origin, cause and recovery potential of electrical losses
- Fire safety and fire service staff who determine origin and cause at scenes involving electrical systems
- Asset integrity and maintenance staff who act on investigation findings for switchgear, cabling and appliances

Course Outline:

Day 1: Electrical Ignition Mechanisms and Failure Modes

- Resistive Heating at Loose and Corroded Terminations: Glowing Connections and Heat Build-Up
- Overcurrent and Overload Ignition in Conductors, Flexible Cords and Protective Devices
- Insulation Breakdown Paths: Surface Tracking, Carbonisation and Mechanical Damage
- Parallel and Series Arcing Faults as Competent Ignition Sources
- Electric Shock and Arc-Flash Injury Event Patterns for Post-Incident Review

Day 2: NFPA 921 Methodology and Investigator Competence

- NFPA 921 Scientific Method Cycle: Data Collection, Hypothesis Development and Testing
- Origin Determination: Fire Patterns, Heat and Flame Vectors and the Area of Origin
- Cause Hypothesis Ranking: Ignition Source, First Fuel Ignited and Ignition Sequence
- NFPA 1033 Investigator Knowledge Areas and the Role of the Forensic Electrical Engineer
- Expectation Bias and Confirmation Bias Checks During Hypothesis Elimination

Day 3: Scene Examination, Evidence Handling and Arc Mapping

- Scene Safety Assessment and Making the Installation Safe Before Entry
- Evidence Preservation, Chain of Custody Forms and Spoliation Avoidance
- Photographic Documentation, Scene Sketches and Circuit Layout Diagrams
- Arc Mapping Survey: Tracing Branch Circuits and Plotting Arc Sites
- Distinguishing Arc Beads from Fire Melting on Copper and Aluminium Conductors

Day 4: Equipment Examination, Timelines and Complex Cases

- Laboratory Examination Protocols: Joint Examination, Radiography and Controlled Disassembly
- Protective Device Forensics: Circuit Breaker, Fuse and Residual Current Device Condition
- Witness and First Responder Interviews for Electrical Event Sequencing
- Timeline Reconstruction from Protection Relay Logs, Alarm Records and Supply Data
- Arc Mapping Limitations: Non-Uniform Fire Spread, Conduit Bends and Shielded Wiring

Day 5: Case Study: Electrical Origin and Cause Investigation Report

- Switchroom Fire Case: Arc Site Plot and Area of Origin Defence
- Industrial Shock Fatality Case: Earthing Path Testing and Causal Chain
- Insurance Claim Case: Appliance Failure Versus External Fire Attack
- Root Cause Statement and Corrective Action Register for Electrical Systems
- Electrical Origin and Cause Investigation Report Drafting and Peer Challenge

Skills You Will Gain:

- Electrical Ignition Source Analysis
- Hypothesis Testing and Elimination
- Scene Safety Control
- Evidence Chain of Custody
- Arc Site Interpretation
- Protective Device Examination
- Event Timeline Reconstruction
- Forensic Report Writing

Why Attend This Course:

- Leave with an Electrical Origin and Cause Investigation Report built on a realistic case file and challenged by peers
- Tell arc damage apart from fire attack on conductors before it turns into a disputed conclusion
- Stop evidence loss by knowing what to isolate, photograph, tag and retain before clean-up or repair begins
- Compare investigation practice with engineers, adjusters and HSE staff from power, industry, buildings and insurance

Conclusion:

A defensible electrical investigation rests on safe scene control, preserved evidence and hypotheses tested against physical findings. The course moves from ignition and injury mechanisms, through the NFPA 921 scientific method and investigator competence, to scene safety, evidence handling and arc mapping, then to laboratory examination, protective device forensics, timelines and the limits of arc evidence. The final day applies these methods to switchroom, shock and insurance cases and produces an Electrical Origin and Cause Investigation Report with corrective actions.