



C27 A Forensic Investigation Methodology for Accidental Events in Process Plants

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The goal of this presentation is to propose an investigative methodology to be used in forensics for accidental events occurring in process plants, to help judges determine the truth.

This presentation will impact the forensic science community by showing how the proposed methodology is based on the experience gained over the years in investigating processing plant accidents. It includes a number of cases where the accident was reconstructed and the causes were identified. Additionally, suggestions are made to prevent these accidents from happening again. Finally, ways to establish accident responsibility are shown.

Often because of the condition of aging equipment, existing plants are at risk of accidents. Even if maintenance procedures are fully compliant with required rules (API, ASME, ASTM), company standards, and local by-laws, there is still a risk of a defect. A crack may generate leakage, which is a danger for fire and explosion. Bad operations, lack of procedures, maintenance carelessness, negligence, and human errors are among the causes of a processing plant accident. According to statistics of a large number of pipe leakage accidents, media corrosion and cavitation erosion are the main reasons leading to accidental events. The percentage is higher than 50% of the total accidents.

A plant accident, often with deaths, usually leads to a court case with a judge asking why the accidental event occurred and if it should have been avoided, in order to assign responsibility. The proposed investigation methodology is based on the experience gained as a judge's consultant at different courts of law in Sicily, Italy, close to processing plant sites, and experience as a professor and researcher at the University of Catania in Sicily, working in the same field. The methodology deals with a routine procedure to be applied to process plant accident court cases.

Starting from testimonial information acquired after an accident, plant documentation is acquired and studied carefully. It includes drawings (plot plans, layouts, flow charts, Piping And Instruments Diagrams (P&ID)), operative manuals, equipment materials, and maintenance programs. Compliance with codes and standards, in force for that type of plant and the related country, is verified. Different rules are compared and checked to determine if they were followed carefully, as required. Plant components affected by the accident are tested first with Non-Destructive Testing (NDT) methods selected for the suitable application to the case.

Among them, an important role is played by Thermal Infrared Imagery (TIR), often coupled with another suitable NDT method for on-stream defects detection. This technique, developed in this research capacity, was named "adapted thermography." Subsequently, the components are subjected to destructive tests (not repeatable), to check how the accident occurred and its causes. The above tests are preceded by recalls of the main theory fundamentals, making the proposed methodology more scientifically founded.

When the causes of the accident are found and the event is reconstructed, organization charts of the personnel involved are acquired, to determine responsibility and prosecution. Several study cases regarding accidental events which occurred at the petrochemical sites of Priolo and Gela (both in Sicily), are reported and discussed with a number of figures, tables, photographs, and diagrams. The investigation was directly carried out, constituting a first-hand application of the proposed investigation methodology.

There is general expectation the methodology will become a significant part of the forensic activity of involved academic professors, researchers, engineers and professionals in the field, and judicial personnel (lawyers, judges, consultants). In fact, it provides a new routine investigation tool, for court cases involving process plant accidents.

Plant Accidents, Mechanical, Investigation