

# ROCHON REPORT

## ROCHON ENGINEERING INCORPORATED

**NON-DESTRUCTIVE TESTING USING X-RAYS – By Vincent Rochon, B.Sc., P.Eng  
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It is the responsibility of the Engineer or Technical Investigator to examine faulty equipment and systems in a non-destructive manner. This is especially important when the engineer or investigator knows that other interested parties will want to examine the exhibit. Non-destructive testing includes photographs, videotape, digital imagery, and x-rays.

In many cases, the Engineer or Investigator, will not be able to determine from a visual inspection whether a piece of equipment caused a failure. The Engineer or Investigator is then left with the task of collecting several exhibits from a scene and also is left with the uncomfortable position of not knowing the exact cause of loss. He/she will then be charged with the task of identifying all the interested parties and assembling everyone so that the exhibits can be examined in a destructive manner. The additional work and cost involved in this process can double or triple the cost of completing a forensic investigation.

Even after having assembled all of the interested parties including a manufactures, distributors, component part manufacturers, certification agencies, authorities having jurisdiction, etc., there is no guarantee that the exhibits collected by the Engineer or Investigator were responsible for the loss. In effect, the entire process may not provide a determination of the cause of loss. By the time the



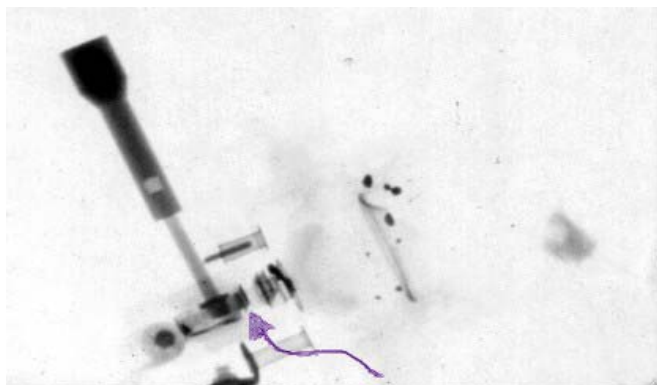
**Portable x-ray used at a fire scene.**

process is completed, the site conditions will likely have been altered and there would be no opportunity to reassess the cause of loss.

A portable x-ray machine solves the uncertainty of forensic investigation by identifying failures in equipment which could only otherwise be uncovered through destructive testing. A portable x-ray machine can be transported to a site and utilized on site where all the physical evidence is readily available.

Once the failure mechanism has been identified, the Engineer or Investigator can seize the relevant physical evidence so that it can be examined destructively at a later date. He/she can leave the

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Switch was "on"

loss location confident that he/she has identified the cause of loss.

### STANDARDS & GUIDELINES:

The National Fire Protection Association Number 921(NFPA 921), "Guide for Fire and Explosion Investigations", provides the basic and fundamental techniques which must be used during the course of the fire investigation. The American Society for Testing Materials (ASTM) has developed several standards which deal with technical investigations and technical experts. ASTM E-1188, "Standard Practice for Collection and Preservation of Information and Physical Items by a Technical Investigator" and E 860, "Standard Practice for Examining and Testing Items that are or May Become Involved in Litigation" apply to all forensic investigations and are referenced in NFPA 921.

When an Engineer or Technical Investigator is assigned the task of determining the cause and origin of a fire, he/she must comply with Chapter 9, "Physical Evidence" of NFPA 921.

Section 9-3, "Preservation of Fire Scenes and Physical Evidence", reads as follows:

*Every attempt should be made to protect and preserve the fire scene, as intact and undisturbed as possible with the structure, contents, fixtures and*

*furnishings remaining in the pre-fire locations. Generally the cause of a fire or explosion is not known until near the end of the investigation. Therefore, the evidentiary or interpretive value of various pieces of physical evidence observed at the scene cannot be known until, at, or near the end of the fire scene examination or until the end the investigation overall. As a result, the entire fire scene should be considered physical evidence and should be protected and preserved.*

The latest addition of NFPA 921 includes a new section on "Spoliation of Evidence". Spoliation of Evidence is defined as "the loss, destruction, or material alteration of an object or document that is evidence or potential evidence in a legal proceeding by one who has the responsibility for its preservation. Spoliation of Evidence occurs when the movement, change or destruction of evidence, or alteration of the scene significantly impairs the opportunity of other interested parties to obtain the same evidentiary value from the evidence as did the prior investigator.

Subsection 9-10.1, "Laboratory Examination and Testing" also states that if it is determined that testing will alter the evidence, all interested parties must be notified prior to this testing in order to allow them an opportunity to object or be present during the testing.

The guidelines and standards were developed to "level the playing field" so that all interested parties have an opportunity to view and interpret the evidence in its unaltered state. It is important that the loss site be clearly documented utilizing photographs, notes, accurate diagrams, and when appropriate x-rays and videotapes. In most cases, proper documentation of a loss site requires a team of two or more Engineers. In fact, NFPA 921 strongly recommends the use of two Investigators for safety reasons and for more complete documentation of the site. A team approach can reduce the overall time spent at a site and provide

superior investigative results. In many cases, the old adage applies, that “two sets of eyes are better than one”.

## CASE STUDIES

The physical evidence found at a site must be thoroughly documented with field notes, sketches, diagrams with accurate measurements, photography, video and x-rays. This documentation establishes the location of the physical evidence at the time of discovery and its relationship to the investigation. It also establishes that the physical evidence was not contaminated or altered during the course of the investigation. Physical evidence is usually examined and tested for its chemical composition; physical properties; conformity or non-conformity to legal standards; operation; inoperation or malfunction; or sufficiency or deficiency in design. **It is important to remember that when the physical evidence has been destroyed, its evidentiary value is lost forever.**

An x-ray can assist the Engineer by uncovering malfunctions, failures and design deficiencies without having to alter or destroy the evidence. In addition, spoliation of the evidence does not arise as a defense when the physical evidence has not been altered or destroyed.

### Case Study Number One:

In this case, the fire was discovered by the owner of the home in the basement of his house. The owner saw flames in the vicinity of the sofa but was forced back by the heat and smoke. During our investigation, we determined that the fire originated in the vicinity of the sofa (Figure 1). The fire damage to the sofa was typical of a careless smoking fire however, the owners were not smokers. A duplex receptacle outlet was located behind the sofa but the face of the outlet was clean (Figure 2). We disassembled the duplex receptacle from the outlet box and noted a small arc bead on the side of the outlet. The duplex receptacle was x-rayed and it was obvious from the x-ray that the

outlet had sustained massive internal failure (Figure 3). The arcing failure within the receptacle ignited the sofa in front of it.



Figure (1)

Fire originated in this corner

### Case Study Number Two:

A large loss fire occurred within a business resulting in flashover of the room of origin. Appliances and equipment within the room of origin were examined, however, destructive testing was required in order to determine whether the appliances were “on” at the time of the fire. Rather than collect all of the evidence and transport it back to our lab for further examination with other interested parties, we x-rayed the switches for the appliances. The photograph shows the portable x-ray machine being utilized on site to x-ray a switch from an incandescent pedestal light fixture (Front page). We determined from the x-ray that the

switch for the light fixture was in the “on” position (Page 2).

**REMEMBER !!!**

Physical evidence must be preserved. It cannot be destructively disassembled or altered until all interested parties have had an opportunity to view and to be present during the destructive disassembly or alteration of the evidence. It is also important to remember that interested parties must be able to object to the proposed tests or alteration of the evidence. Read the relevant guidelines and standards that reference evidence collection and familiarize yourself with the relevant case law. Take x-rays when necessary so that the evidence is properly documented.



Figure 2

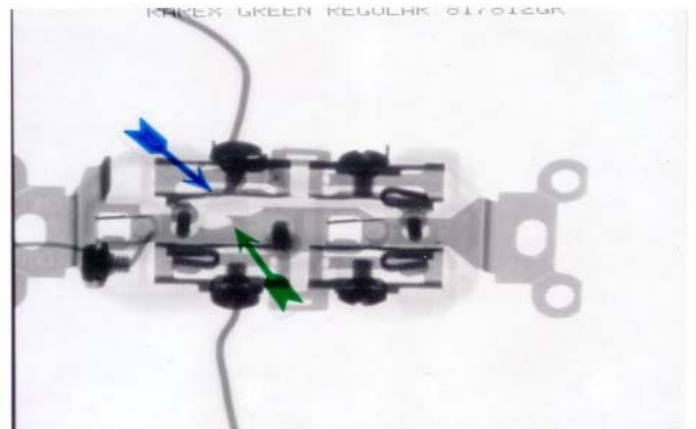


Figure (3) Arc damage visible in x-ray.

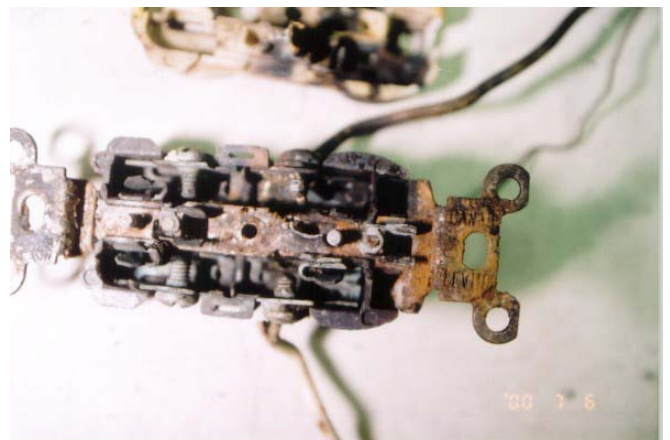


Figure (6)