D32 Data Center Failures, Losses, and Litigation

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Learning Overview: After attending this presentation, attendees will understand some of the common causes of data center failures, which often lead to litigation, and preventive remedies of such failures.

Impact on the Forensic Science Community: This presentation will impact the forensic science community by helping experts to identify in data center failures: (1) cause; (2) origin; (3) responsibility; (4) preventability; and (5) how to assist with insurance and legal claims.

Data centers require reliable electrical power, Uninterruptable Power Supply (UPS) systems, batteries, back-up generators with reliable and sufficient fuel, cooling systems, transfer switches, and switchgears, including reliable protection systems.

Case 1: Water pipe and valve failures-flooding—Water cooling and circulating systems are required to withstand certain pressures, temperatures, and flow velocities in order to keep electronic equipment cooled. Pressure tests are usually conducted soon after installation. However, in-plant inspections of pipes, shut-off valves, and fittings before they are shipped to a site are seldom performed. Inspection in a manufacturer's plant can go a long toward catching defects before shipment.

Case 2: Back up diesel engine/generator failures—In some cases, improperly manufactured oil filters have allowed metal particles to bypass such filters and damage bearings. In other cases, defective diesel engine fuel injectors were found to leak and cause explosions in the exhaust system. Most emergency diesel generators are turbocharged and are sometimes not manufactured to tight tolerances. As a result, they have been known to fail and start lubricating fires since they operate at very high temperatures. Fuel supplies have been found to contain water and cause malfunction of diesel engines. In-plant inspections and review of specifications of diesel engines during manufacture are an important prevention remedy.

Case 3: Electrical protection failures—In large data centers, 480-volt switchgears usually contain overcurrent relays only. Directional overcurrent relays are often not used but should be used. Also, in many instances fuses and relays are not properly coordinated, thus causing larger outages in a system than necessary.

Case 4: Small UPS failures start fires—Small under-the-desk UPS units have been known to fail due to defective solder joints.

Case 5: 480-volt switchgear/4,000-amp circuit breaker failure and Automatic Transfer Switch (ATS) failures—Drawout circuit breakers require current-carrying contact fingers that can carry not only rated current but also fault current for a prescribed time, otherwise they may overheat, arc, and fail. Finger contacts are often improperly machined and thus have insufficient contact surface. There may also be insufficient contact pressure and misalignment. Corrosion on contact surfaces can also contribute to overheating.

Prevention Remedies: In-plant inspection as well thermography at various intervals during the testing and commissioning process can go a long way toward failure prevention.

In an actual case, a 1,600-amp ATS failed for the following reasons: the racking assembly roller was bent out of position by almost one-half inch, so that upon racking in the switch into its connected and operating position, the main finger contacts did not properly mate with the fixed plated copper stabs of the switchgear. Thus, only a few fingers in the contact cluster made contact. This had the detrimental effect of de-rating the current carrying capacity of the finger cluster-stab contact. Overheating over a period of time led to arcing within the contact, which melted the remaining contact surfaces. This was followed by an explosion where conducting copper vapor was produced which then created a phase to phase-to-ground fault. If the prevention remedies set out above had been followed, this loss would not have occurred.

Data Center, Failure, Litigation