

## **TECHNICAL BULLETIN: Handling Flood Damaged Electronics and Equipment Mitigation Checklist**

The recent Mississippi and Ohio River flooding has proved to be the enemy of any business and homes. The toll on electronics and equipment continues especially after the water recedes. If energized during the event the affected equipment and machinery may have sustained more damage to the circuit breakers, in-line fuses, motors and main fuses which may have “blown and shorted” from the initial onslaught of water infiltration. Electrical shorting will result when the water is present under power conditions- this can almost always signal a future intermittent problem or worse an eventual catastrophic failure. The second onslaught of damage to electronics is “ongoing and continues” even as the water recedes. Electrical wiring, motors, computers, motor starters, contactors and control cabinets received contaminates from the flood water (ground water and salt water from flooding is very contaminated with bio hazards such as industrial and raw sewage and sodium chlorides form the salt water content) this water contains heavy chloride residues, sulfide and sodium residues, other heavy trace metals, hydrocarbons and other various biological inhibitors and environmental waste chemicals that are unhealthy, toxic and very corrosive are present. As the water recedes the stainless, copper, aluminum and plain steel substrates of the micro-circuitry and electrical components which have been covered in contaminated water continue to readily oxidize from the contaminates in the water as the oxygen hits the contaminated metallic surfaces which increases corrosion exponentially. Painted finish surfaces can bubble, pop and peel. All metals that are exposed start to corrode and the resulting oxidation even stainless steel and aluminum will surface pit. Damage to base metals occurs to micro-circuitry especially when energized and deflection of metallic materials occur causing cracks, waves, fissures and pitting that is often only microscopically detachable. Advanced corrosion is also microscopic and is hard to remove if energy is on for long periods of time.

Flash rusting and corrosion enhanced by flooding and drying can be averted with proper mitigation protocols. Of course de-energizing the device is also a factor in damage reversal. These metals left untreated almost always call for replacement- typical insurance allows for mitigation steps including corrosion control inhibitors, dewatering, gross contamination removal and moisture displacement agents. Fast action is the key to being able to restore sensitive electronics, equipment and electrical gear. Some items may corrode from the secondary effects of the flooding just by being in non-climate controlled conditions and being exposed to high moisture meaning relative humidity has reached condensing levels or the dew point has been exceeded meaning these items have been exposed much higher levels of humidity than designed and energizing them without a thorough analysis of the effects of corrosion may result in premature failure.

**Equipment is only a valid restoration candidate if de-energized and proper de-watering process is followed along with corrosion control inhibitors and moisture displacement agents. This must be done promptly and properly applied as soon as possible. If the electrical component substrates are left untreated the loss of base metals and the structural design intended for microprocessors, electrical conductors, contact strips, buss bars and switch gear is compromised often beyond repair, requiring additional parts replacement costs or total replacement and of course adding to the time for the completion of the project.**

## **Types of Equipment Serviced:**

### **Electrical Gear-**

Certain transformers, controllers, electrical cabinets, breakers, switch gear & cabinets, wiring and distribution equipment can be effectively restored and tested. Certain small controllers, case molded circuit breakers and dry transformers may need replaced. Secondary moisture corrosion is readily controlled and removed.

### **IT Equipment, Computers and Servers-**

Hard drives that have been immersed in flood water should be stabilized and processed for data recover. Computers, routers, servers and switches that are subject to high moisture may be restored effectively.

### **Boilers, HVAC and Fire Pump Systems-**

Are possible candidates for restoration. Certain devices such as limit switches, burner management control, motor controllers and motors may need repaired or replaced. Pressure vessels, coils and pumps will need preservation to ensure they may be restored.

### **Equipment and Machinery and Controls of all Types**

Including Restaurant and Food Processing, Commercial Laundries, Bio-medical, Elevators, Security Systems, Automated Access Systems, Machine Shop Equipment and PLC and Relay Logic Control Panels can be effectively restored but small sensitive items may need to be replaced.

## **Mitigation Protocol Steps:**

- De-energize and Lock out/Tag out Power Sources
- Barrier/Security and Caution Tape Off all Open Access Hazards and Open Panels, Install Temporary Barriers for Drying Purposes
- Inspect for Hazards and Mitigation Needs
- Remove Standing Water from Equipment Areas- Extract or Pump Standing Water and Air wash All Equipment Interior and Exterior Surfaces
- Open all control and cabinets to expose the components and Install Temporary Barriers for Drying Purposes
- Rough Clean and Rinse All Gross Contamination Areas with D-Ionized Water
- Air wash Clean all Surfaces
- Apply Contact Cleaner to Circuit Boards and Low Voltage Electrical Devices
- Apply Corrosion Control Inhibitors to all Electronics and Structural Components and Cabinets

These mitigation steps must be employed as soon as safely possible after the site is cleared for entry. These are the critical steps if restoration is to be attempted on valuable equipment and machinery. These assets take time to order and install. In today's economy insurance companies and clients want back in business as soon as possible. Electro-Mechanical Recertifiers Inc. works with OEM's to accomplish sound recovery protocols and fastest path to recovery.

## **Restoration Protocol Steps:**

### **Initial Assessment**

#### **Project manager and electrical engineer travel to site to meet with client**

- > Walk through assessment & surface testing, prepare initial inventory and prepare broad scope of Work
- > Navigate insurance adjuster and risk manager parameters
- > Review project parameters, site conditions, equipment needs and safety issues
- > Review applicable NEMA Guidelines, NFPA Standards, national and local electrical code or other applicable code
- > Build schedule
- > Determine initial T & M budgetary project estimate within OEM guidelines
- > Provide Site Project Manager with a Scope and Not to Exceed Estimate
- > Review by ER Project Manager and Electrical Engineer if necessary

### **Mobilization**

#### **Dispatch all necessary personnel, supplies and equipment to work site**

- > Move equipment and staff to site via air or auto
- > Site set up, services and security
- > Review by ER Project Manager and Electrical Engineer if necessary

### **Mitigation Services**

#### **Preservation to ensure against further component damage**

- > De energize equipment for mitigation services by qualified electrician or trained Personnel
- > Take off line power as required
- > Ensure Lock Out/Tag Out in place
- > Safety Officer to work with Client safety officer to confirm all items are safe with sign off
- > Apply Corrosion control inhibitors
- > Apply Moisture displacement contact cleaners

- > Dewater by compressed air and air washing to enhance drying
- > Clean gross contamination using DI water wash/rinse
- > Clean gross contamination using CO<sup>2</sup> dry ice blasting
- > Partial disassembly as needed to treat sub parts
- > Temporary power for work functions
- > Climate & humidity controls to dry out machinery
- > Detailed written inventory and photos of progress of the items and services
- > Engineering inspection & review with sign off on all mitigation steps

#### **Detach/Remove Equipment**

#### **Disassemble & remove necessary sub-components for restoration, cleaning and testing**

- > De-energize power
- > Thoroughly inspect all parts
- > Review by ER Project Manager and Electrical Engineer if necessary

#### **Restoration/Repair/Refinish**

#### **Refurbishment of equipment**

- > Decontaminate by restoration cleaning protocols
- > Disassemble/Reassemble to component level as required
- > Parts order/Parts replacement repairs
- > Refinish cabinets & items as required
- > Application of approved mechanical lubricants
- > Inspection & pretesting with sign off by Client
- > Review by ER Project Manager and Electrical Engineer if necessary
- > Review by OEM

#### **Testing & Validation**

#### **Testing to NETA specs third party testing company**

- > Component level load testing
- > Assembly bench & load testing
- > Continuity Testing
- > Branch circuit testing& Megger testing
- > Inspection pretesting with sign off by Client
- > Review by ER Project Manager and Electrical Engineer if necessary

## **Re-commission Equipment**

### **Equipment put back in-place, start up and bring on-line**

- > Re-install components
- > Component start up and testing in place
- > In place power testing by qualified electrician
- > Remove safety Lock Outs and energize equipment for mitigation services by qualified electrician
- > Start up assistance, IR monitoring & on-going site monitoring with complete OEM Team
- > Review by ER Project Manager, Electrical Engineer and Electrician

## **Final Documentation**

### **Provide daily/weekly and final reports**

- > Daily T & M Summary
- > Weekly Totals and Billings
- > Final Photo Journal
- > Final Job Package
- > Assist CRG Project Manager with the Insurance Company Audit and Review Process
- > Final Reports
- > Warranty and Service Period
- > Sign off on final process by ER Project Manager and Electrical Engineer

### ***Consulting Services:***

Predictive analysis monitoring  
Proactive preventative maintenance  
Insulation resistance testing  
Motor Analysis  
Decibel level and lumen level testing  
Flash Arc investigations and training  
Catastrophic Failure Analysis  
Cause and Origin Reports  
Replacement cost Versus Restoration (Refurbishment)Reports  
Salvage and Scrap Value Reports  
Lightning Damage Reports  
Power Surge Reports  
Equipment Reports

### ***Restoration Services:***

Ultrasonic Decontamination Process with Water Borne Cleaners  
Deionized Electronics and Small Parts Aqueous Spray Booth  
Baking Ovens  
Capture Waste Stream  
Overhead Crane  
Motor Repairs  
ESD Test Benches  
Mechanical Tools  
CO<sup>2</sup> Dry Ice Blasting Systems  
Pressure Washing

Desiccant Dehumidification Services  
De-watering Services  
Corrosion Control Inhibitors  
Moisture Displacement Agents  
Industrial Electricians  
**Mobile Lab and On-Site Capabilities**

### ***Rental Resources:***

Generators and Cabling  
Power Distribution and Cabling  
Compressors  
Air Movers/Axial Fans  
Mobile Trailer Storage  
Camping Equipment  
Porta Johns  
Portable Kitchens  
Sleeping trailers  
Mobile Command Centers  
Water truck  
Fuel Truck  
Car Carrier  
Vault Storage Facilities  
Lifts  
Excavators  
Pumps

ER Inc. provides project management expertise on disaster sites, understands insurance requirements of T & M daily tracking of expenses (using the Clerk of the Works Program) for ease of payment and auditability as well as and is able to navigate the insurance claim process dealing with adjusters, independent adjusters and experts, consultants while the restoration and rebuilding process is moving forward.

Independent lab evaluations provide scientific assessment and help determine presence and levels of contamination.

We are business interruption and recovery claims experts who become part of the complete recovery process of the client's business unit.

For a 24/7/365 Disaster Response..... Call Us

Toll Free at 877-378-4183 tell the operator "I have a disaster event" so patched me through



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