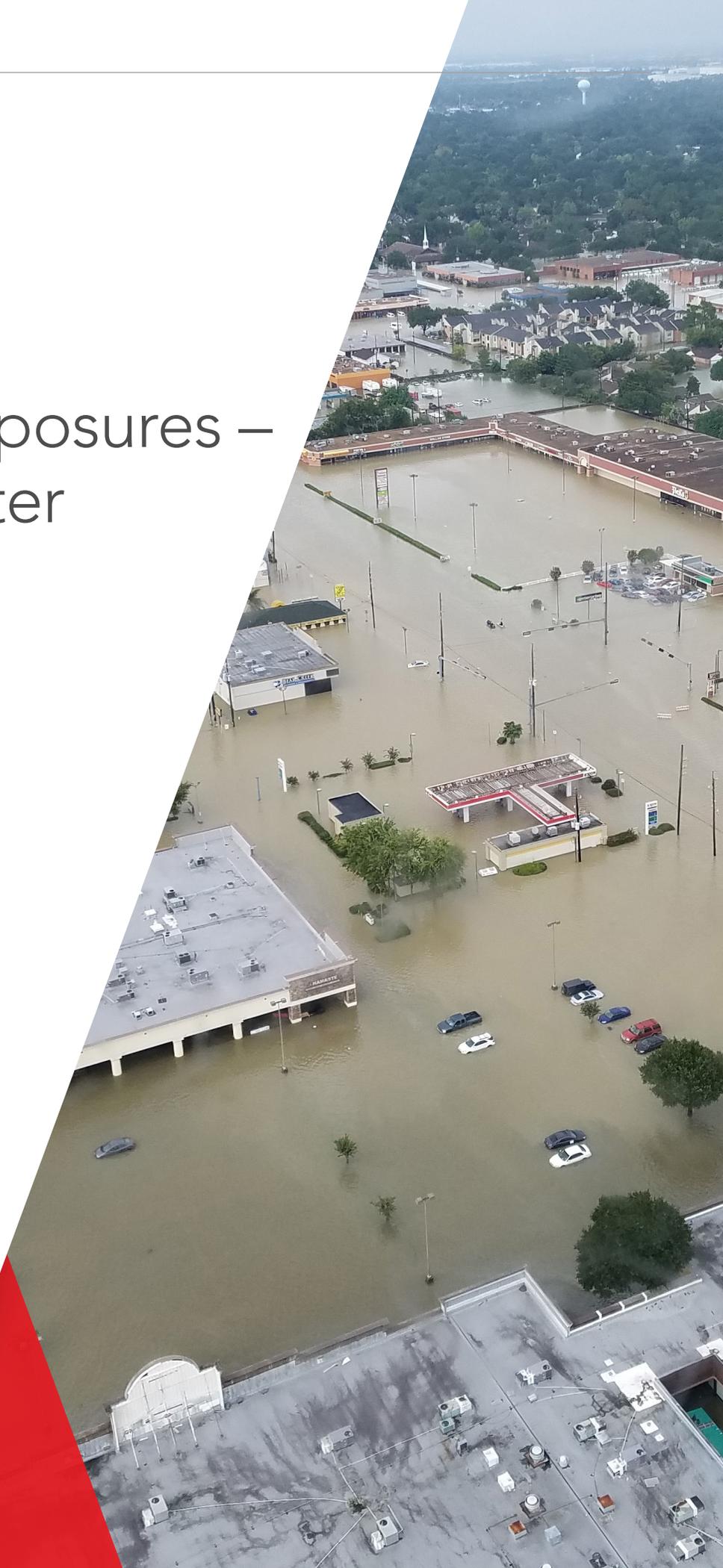




# Equipment Exposures – Before and After the Flood



Floods can put your facility equipment at risk in a variety of ways, causing moisture-related damage and foreign debris deposits, whether water has reached the basement, production floor or first floor.

Natural disaster pre-emergency planning and recovery are critical to preventing equipment exposure. Prior to flooding, critical resources should be catalogued. Critical vendor information should also be identified. Spare parts, lubricants, tools and OEM procedural manuals should be stored above high flood stage. Equipment should be secured and hazardous materials, oils and fuels should be moved to a safe location.

Where possible, moving critical equipment or processes out of flood zones or to higher elevations should be considered. Where this is impractical, steps should be considered to protect equipment from flooding. Every business needs a pre-emergency plan, and protecting equipment needs to be part of that plan.

When a flood is predicted, all equipment should be shut down. Turn off all electrical power to your equipment.

The following steps can help mitigate the risk of equipment failure upon startup after a flood.

- **Identify and inspect all equipment affected by the flood.** Everything from underground services to electrical circuit breakers above flood stage that may have tripped should be inspected. Equipment foundations should be inspected. Oil sumps and piping that are at or below flood stage will need to be stripped and cleaned, as well as fuel tanks. Ground-level emergency generators can have fuel and lubricating oil tanks/sumps that need to be inspected. Gear boxes and hydraulic equipment will also need to be inspected. Air tanks and other pressure vessels can shift during floods or be contaminated. Both dry and oil-cooled transformers must be inspected. Underground conduit can be filled with water or shift during floods. Conduit inspection should be conducted as conditions allow. Check fresh air intakes and flues for blockage or damage. Piping support should also be inspected as equipment and supports can shift during a flood. Some equipment will need to be opened. Lock-out/tag-out procedures must be followed. Avoid shortcuts to prevent further flood-related damage.
- **Clean and dry equipment.** In many cases, this will require trained personnel. Dry-type transformers and motors will require qualified electrical shops to properly clean and dry

windings. Improper drying of windings can lead to insulation failures. The same is true of switchgear and circuit breakers. Boiler refractory should be cleaned and dried properly. Boiler refractory with high moisture content can be ruined if subjected to high temperature. Insulation on boilers and piping should be thoroughly dried to prevent corrosion of the underlying metal. It can take several days for water tables to fall below underground services before cleaning and drying can take place. Underground condensate, steam or other medium systems should be flushed if breached.

- **Test electrical equipment and controls.** Both oil-cooled and dry-type transformers will be contaminated and must be tested. Testing the oil in the transformer and testing the insulation on all electrical equipment will prevent insulation failures from destroying equipment in the circuit. Grounding systems can be altered or damaged by flooding and should be tested. The same is true of underground electrical conduit. A shift in the conduit can stress cable insulation and cause a failure when re-energized. Simple testing can identify damaged insulation in need of repair. Boiler refractory moisture testing should be completed. Pressure testing of underground piping may be needed. All controls and safety devices, including relief valves that were contaminated, should be tested before returning to service.
- **Restore in increments, one system at a time.** Only trained personnel should restart equipment, and care should be taken to monitor parameters during startup. Only partial loads should be applied during the startup phase. Rushing equipment back to service may result in failures.

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