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Loss Mitigation Action Plans: Preparations for the Loss of Essential Services and Guidelines for Restarting Equipment

By Robert F. Weir, P. E.

Editor's Note: The Gulf Coast hurricanes in 2005 caused devastating losses of life and property. These disasters focused renewed attention on emergency planning and recovery procedures. That includes equipment operation, which is vital to the protection and recovery of a business and the public in the event of an unexpected calamity. The information in this article has been updated and expanded since it was originally published in The Locomotive. With today's economic pressures and security concerns, a loss mitigation action plan is more important than ever.

Your business can lose critical services when you least expect it. Are you ready for the sudden loss of electric power and other utilities? How about the disruption of equipment controlled by electrical devices? In your haste to restart equipment after a flood, will you take the necessary steps to protect and prepare equipment before energizing, so you can prevent damage and even longer delay? Now is the time to review and reinforce your business contingency plans. Thoughtful planning for events that may put your business at risk can pay large dividends when these events occur.

<u>Some things to do when your business is threatened by:</u>

Loss of Electric Power

The loss of electric power will stop most machinery. Depending on the time of the year and your climate, it will also raise the possibility of freeze losses, loss of perishables due to inadequate refrigeration, and the possibility of severe damage to piping and processes through freezing, overheating and loss of control.

If loss of electric power represents a serious threat to your business, and particularly if you know when a loss of power is likely to occur, effective preparations can be made to mitigate damage.

- Prepare generators. If engine generators are available, perform monthly pre-operational checks and test them by starting. If possible, run them under load. Training operations personnel in the procedures necessary for safe transition to on-site power generation is a top priority if backup generators are to be used successfully. A written procedure is necessary, and it should cover all power loss scenarios.

- Top off fuel tanks. If an engine-generator set is supplied by fuel stored on site, make sure that the fuel is **fresh**. Many instances of failure to start and/or failure to carry load are caused by aged fuel. Never use fuel which has been in storage for more than 12 months. This is just as true for diesel as for any other liquid fuel. In addition to degradation of fuel quality, stored fuel can also accumulate algae, which can quickly plug fuel strainers and filters, stopping the engine.
- Anticipate power surges. Power interruptions from any cause are frequently accompanied by voltage surges. Surge protection is always recommended for protection of sensitive circuits, especially those serving electronic power supplies associated with computers and automation controls. If you have such equipment which is not adequately protected from surge damage, consider shutting it down when power outages are expected. Better yet, consult your electrical engineer or contractor about installing power quality hardware and an effective grounding system in your facilities. See the information under the “Prevent Freeze Damage” section below for precautions to be taken in the event of power loss during cold weather.

Loss of Telephone Service

Telephone service interruptions affecting a significant geographical area usually do not result in property damage. However, if interruption of communications would affect your business adversely, alternative communications should be considered. Cellular service is sometimes more resistant to local line interruption than your telephone wiring. Having a pre-planned configuration which will permit the use of cellular or satellite handsets as a substitute for vital business communication, including data and facsimile, might be an effective, low cost backup capability. Here is another area where a written plan will be an invaluable tool.

If interruption of telephone service could be a serious hardship, then other communication backup facilities should be evaluated, including commercial radio transceivers and satellite links. Computer data links are becoming available via cable services. This represents a redundant communications link to the extent that the cable service does not share facilities with telephone carriers.

Telecommunications may represent a vital part of your business. For some, even short duration equipment failure could cause significant lost revenue. If so, permanent decentralization of service to two or more geographically separated redundant telephone service locations should be considered.

In such a scheme, each of the sites has inherent capability to assume the call volume of the other for at least short periods. This is the domain of telecommunications experts and is beyond the scope of this article. Decentralized service impacts the entire business enterprise, including the computer systems (order entry and inventory checking are examples) which support telephone operations.

Whatever the nature of your telecommunications needs, power quality plays an important role. The risk of damage to vital telecommunications hardware posed by power and telephone line voltage irregularities makes the use of proper surge suppression and arresting equipment a necessity, given today’s heavy reliance on telecommunications.

Flood Damage to Equipment

We all know that flood can occur as a result of weather phenomena. But it can also occur as a result of power interruption or machinery failure which interferes with continuous dewatering (pumping) necessary in some types of property located at or below the local water table. It can also occur as a result of bursting of frozen pipes. The following recommended action steps are designed to address flooding from any cause.

Before the Flood

If flooding is expected, the following steps should be taken to minimize damage to equipment and to make post flood recovery as rapid as possible:

- Make sure all personnel are evacuated from the property before rise of floodwater.
- Remove as much property and equipment as possible to high ground storage, if available, move the highest value property first.
- If time permits, construct flood barriers with sandbags or other materials. Even if these do not hold back flood waters, they may resist flood currents sufficiently to prevent destruction of structures.
- When flooding is imminent, shut down all fuel burning equipment which is subject to flooding. In the case of steam boilers, it is best if these can be allowed to cool prior to immersion.
- De-energize all electrical circuits prior to immersion in flood water.
- Get all vehicles to high ground.

The Risk Does Not Recede with the Water

If your equipment, machinery or electrical systems have been exposed to flood waters, you risk their loss even when the water level has dropped. Equipment and machinery may have water, silt or other contaminants within them. Your equipment could be damaged or destroyed if you attempt to start or test it without adequate cleaning and preparation for operation. **Do not attempt to operate or test your equipment without properly restoring it.** Even when your equipment's exterior appears normal, residual moisture and contaminants can lead to permanent damage.

Dry and Clean Before Using

The following summarizes the steps to prepare your equipment for operation. Most actions involve careful draining, drying, cleaning or lubricating of equipment before attempting to start or energize it. Taking these precautions now can help you to avoid a major equipment failure and enable you to restore vital operations sooner.

Electrical Equipment

- **Do not energize** equipment that has been flooded until properly cleaned, dried out, and until insulation has been tested. This includes enclosures, bus ducts, conduit, and cables. Application of power to wet circuits will usually result in serious damage that will require repair or replacement. This is especially to be observed if the equipment is vitally needed and obtaining a replacement could be difficult. It is usually better to spend the necessary drying time than to risk destruction of the equipment.

- Windings in electric machinery should not be dried at temperatures exceeding the rating of its insulation system. In general, a maximum temperature of 194 degrees F or 90 degrees C may be used. Check with the manufacturer for equipment specific information and recommendations.

- Dry type transformers should be cleaned and thoroughly dried as described for windings.

- Oil filled transformers should be thoroughly inspected for damage including the insulation bushing and oil samples should be drawn from the tank's top and bottom for analysis. Examine the sample for free moisture in the form of moisture droplets or a cloudy appearance. The laboratory should be instructed to include a Karl Fischer test for dissolved water content. Maximum water content for equipment rated >= 69kv is 25 ppm and equipment rated at <69kv is 35 ppm. If water is found in the oil, the oil charge must be dehydrated by a competent service firm.

- Circuit boards that have been immersed can sometimes be salvaged, provided that they were not energized at the time of immersion, and further provided that water sensitive components are not mounted to them. This can be done by carefully washing the individual boards in pure water and thoroughly drying before energizing.

Before Operating Machinery

- Contact the manufacturer for its recommendations.
- Inspect foundations for cracking, weakness, or settlement. If settlement is suspected, check and correct alignment of all shafting, and check all stationary components for level.
- Inspect all machine internals for silt accumulations and clean as needed.
- Open the cylinders of all reciprocating engines or compressors that have been immersed and remove foreign material or water.
- Drain and clean lubrication systems. Wipe oil containing elements with lint-free rags and refill with new lubricants as required. Monitor the lubricant charge during the initial hours after resuming operation for indications of water contamination and change lubricant if necessary.
- Ball and roller bearings suspected of being contaminated by water and debris should be opened, solvent cleaned, and then re-lubricated in accordance with the manufacturer's instructions. When cleaning, be especially careful to remove solid debris such as stone particles or metal chips.
- Carefully clean and **test** governors and controls. Many control systems are electric. Refer to recommendations for electrical equipment above.

Boilers

- Carefully inspect foundations and settings of boilers for settlement. **Do not operate** a boiler if there is any evidence that the foundation has been undermined.
- Make sure the setting (brickwork, refractory, and insulation materials) is thoroughly dry. Use portable heaters where necessary. If the boiler has been immersed in salt or brackish water, the casing and insulation should be removed at least in wetted areas and the pressure parts should be washed with fresh water. After such washing, new dry insulation material should be applied and the casing re-installed.
- All safety appliances, such as safety and relief valves, steam gage, water column, low-water cutouts, and blow down systems must be cleaned and repaired as needed.
- All controls must be inspected and tested before operation, especially the water level control and low-water fuel cutoffs.
- Burners should not be fired until checked by a burner technician. **An explosion may occur** if the combustion controls do not function properly.
- Boilers should not be operated if proper feed water is not available. If operation is essential, and the boiler is to be run on untreated potable water, it will be necessary to blow down the boiler every eight hours and to open and clean the boiler internals at least once per week until proper water quality is re-established. In addition to frequent blow-down, and provided that clean make up water is available, it is also helpful to run with maximum makeup flow while diverting as much condensate as possible to sewer or drain until the boiler water quality returns to normal.

Freeze Damage

Any interruption of power during cold weather is a freeze hazard. Taking proactive steps like those listed below will help you reduce and avoid damage.

- Building closures. Make sure all doors, windows, shutters, and dampers that can be closed are in place and secured to minimize heat loss.
- Snow and ice removal. Check equipment and snow removal contractors. Remember that the roof may need to be cleared.
- Anticipate flooding. If the premises may be flooded as a result of severe cold weather, take precautions and plan for this eventuality now. Move susceptible equipment or stock to an alternate location if feasible. Check operation of pumps or other dewatering equipment.
- Collect and circulate a list of emergency telephone numbers. Distribute them to everyone in the organization who may need them.
- Heating systems. If backup electric power is not available, make arrangements to obtain portable heating units which do not require electric power.
- Protect piping. Piping systems which could freeze must be checked. Be sure that heat tracing is energized. Be prepared to supply backup power to heat tracing systems or drain the piping. Pay particular attention to sprinkler systems. Any change in the readiness status of your sprinkler systems should be reviewed by your local fire department.

For more maintenance and loss prevention information, visit the Equipment Care section of Hartford Steam Boiler's Web site.

[Editors Note: These recommendations are general guidelines and are not intended to be exhaustive or complete nor are they designed to replace information or instructions from the manufacturer of your equipment.]

Robert Weir joined Hartford Steam Boiler in 1993 and was appointed Director in 1995. He has an extensive background in the design and construction of power generation and industrial equipment and systems. A graduate of the U.S. Naval Academy, he holds a Master's Degree in mechanical engineering from Worcester Polytechnic Institute and is a graduate of Suffolk University Law School . He is a member of the American Society of Mechanical Engineers (ASME), a permanent committee member of the National Fire Protection Association (NFPA 37), and is admitted to Massachusetts and federal courts, including the U.S. Supreme Court.