

Evaluating Your Plant's Vulnerability to a Power Outage

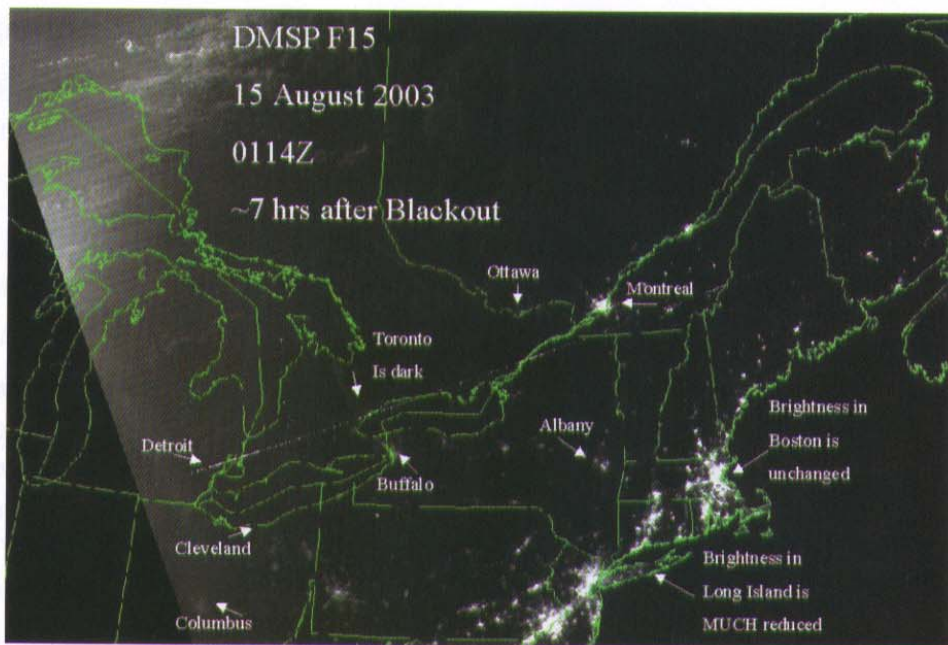
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Electrical-power issues come in many forms, but can have the same combustion-system impact.

The recent power blackout that hit parts of the Midwest and Northeast (U.S.) affected many plants with process combustion equipment like boilers, ovens and furnaces. Unexpected power outages can occur in many forms (e.g., brownout and/or voltage sag or momentary blip) with the same affect on combustion systems. Examples include interrupting fan system airflow, and hampering the ability to ignite and control combustion processes. Preparing for such an event depends on the specific situation and plant needs. There is no simple answer.

Having back-up power generation for critical processes is a possibility. Factors to consider for back-up power generation include loads, fuel type, engine size and rating (continuous duty or standby). NFPA 110 (Life Safety Code) classifies generator systems as Level I and Level II. Each requires significantly different design and maintenance criteria. Level I generators are considered life-safety generators, and require items such as fuel availability even when the facility's main fuel is shut off during an emergency. (Remember that emergency generators require routine maintenance and "exercise" so that they can be reliable and effective when called into duty.) Another option is to have uninterrupted power supply (UPS) for critical control systems. These systems provide the ability to force your controls to certain positions for an orderly, safe shutdown.

In some instances, very important control systems are operated using compressed air, which can buy time in case of a power outage. The additional time can allow you to make a controlled shut-



August 2003 power blackout affected areas

down while the air receiver that stores compressed air slowly drains down.

Listed below are 12 combustion equipment/electrical power-related issues that must be taken into consideration when it comes to maintaining the integrity and safety of equipment.

Burner management systems (BMSs) can be destroyed from a brownout or voltage sag. Loss of a BMS can mean a few hours of nonfunctioning equipment even if you have a spare, or many days out of service if the system is an older electromechanical style (Fig. 1). Obsolete BMS systems must be upgraded when changed out, which often means completely rewiring the control panel. The Combustion Safety website (see below) contains a list of BMS systems no longer supported by manufacturers. Having a spare BMS sys-

tem in house or ready access to one is highly recommended.

Loss of cooling water for oven doors and fan bearings, such as those on forced-draft and induced-draft fans on boilers, can have severe consequences. Plants sometimes recirculate water and

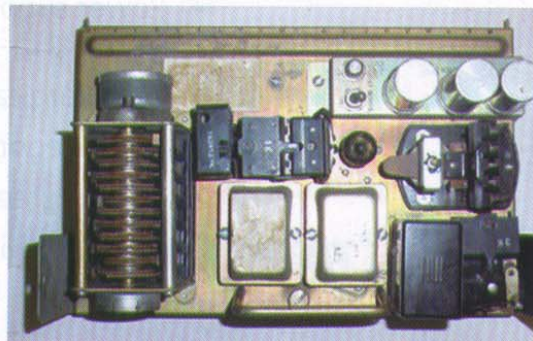


Fig 1 Older style electromechanical burner management system



Fig 2 Open cooling system that supplies water to door seals. A furnace cooling system is critical to safe operation.



Fig 3 Example of refractory failure resulting from thermal shock due to unexpected fast shutdown

have city water as a back up, but even the back-up water system might be unavailable. Recirculating water pumps (Fig. 2) on back-up generators could avoid this situation. Cooling water must have a backup system and/or some type of flow or temperature alarm. Alarms and backups should be tested regularly.

System failure mode issues: In the case of a power interruption, it is important to know where (e.g., fully open or closed) each part of your combustion system (e.g., damper linkages, fuel/process related valves and boiler feed water valves) will fail with a loss of power. The wrong position can be catastrophic. Control systems must be configured to allow a safe start-up after an unexpected equipment shutdown.

Another concern involves equipment that could restart automatically when power is restored. Some burner management systems do not provide a lockout circuit for key interlocks that require manual reset. This process requires a person physically pressing the reset button to restore operation. Without a manual reset feature, equipment can instantly restart without warning, which can be extremely dangerous after momentary outages and can damage some components.

Solid fuels in boilers can be a problem when unexpected outages occur. It is wise to have bypass valves around boiler feed water valves so city water can be manually fed in case of an emer-

gency. Also be aware of what happens if you lose a fan and plan for an emergency shut down procedure so you don't end up with smoke and ash throughout the boiler house.

More challenging start-ups: Instantaneous shutdown at high fire can result in a firebox containing enough fuel to be in the flammable range, which only requires a hot ignition source for an explosion to occur. Losing power at high fire could take four seconds for fuel valves to close while still operating within the time required by most codes, which could put a lot of unburned fuel into the firebox. Minimize the risk of an explosion by letting the firebox cool down. Air purging a firebox that contains fuel and a hot ignition source can create the right conditions for an explosion. Establish documented start-up/shutdown and other pre-start walk down procedures. The Combustion Safety website identifies other prestart walk around safety issues that you should make a part of your plant's culture.

Improper (too fast) shutdowns can prevent large diameter oven fans from cooling down as required. Many oven shutdown procedures require ventilation and recirculation fans to continue to operate after flame failures and/or during orderly shutdowns to protect them from overheating and warping. After a

forced shutdown, listen for noises and vibrations during start-up, which could indicate damaged fans, bearings and shafts that are not safe to operate.

Properly working safety switches and interlocks such as high- and low-gas pressure switches, airflow switches and flame detectors are relied on for safe operation, especially in case of a power outage. Test all safety interlocks at least once every year (a regular program should be in place) and ensure they operate at the correct set points and conditions.

Refractory damage vulnerability: Some equipment could be prone to refractory failures (Fig. 3) after an outage due to thermal cycling. Check for signs of failed refractory when you bring systems back up. Refractory failures usually are indicated by visible hot spots on equipment and/or burned paint or changed surface colors on the outside of equipment walls.

PLC issues: Systems with a PLC (programmable logic controller) in start up after a power outage will most likely recover what was recently stored in the EEPROM, or nonvolatile memory. Volatile memory, which relies on power to the equipment, would be lost during a shutdown from a power loss. Ensure that backup memory storage batteries are in good working order.

Special heat-treating atmospheres issues: Heat-treating operations using special combustible atmospheres are extremely vulnerable to a power loss. It is necessary to get the atmosphere out and safely burned off. Make sure all control systems are built and configured to get purging materials to the appropriate area even under a power outage, or have a manual burnout procedure in place.

Handling intermediate products: Processes that generate flammable dusts/vapors must be able to evacuate the combustibles for safe shutdown. Certain "Class A" ovens (such as paint-drying ovens that create flammable atmos-

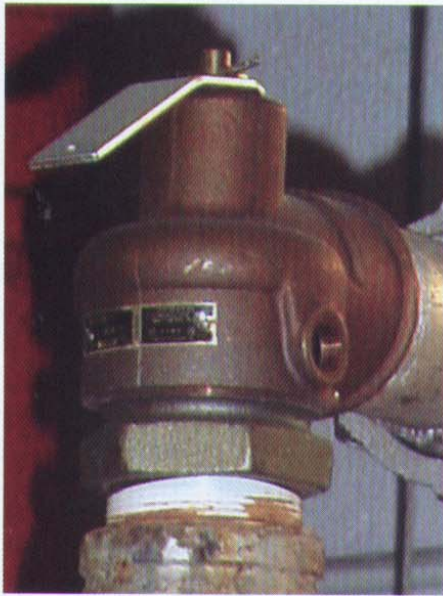


Fig 4 Representative safety relief valve. These valves should be lift tested or otherwise verified as operational at least once a year.

pheres) may require ventilation fans that run on emergency power to remove flammable atmospheres. Smelting and casting plants also need back-up power to get molten metal poured out and/or kept hot until it can be processed.

Loss of boiler auxiliaries: Earlier boiler facilities had steam-turbine auxiliaries (i.e., boiler feed-water pumps and forced and induced draft fans ran on steam power), which is rare today. If a shutdown can't be tolerated, consider having steam turbine drives for some auxiliary systems. Steam turbine drives also can be used to balance steam loads and may be more cost-effective than emergency generators.

Pressure surges and steam safety relief valves: A sudden loss of power could immediately shut off control valves

leaving steam in the system with no place to go. Steam also may continue to be generated for a short period, which may require safety relief valves to open to prevent a critical situation. Make sure a safety relief valve-testing program is in place. Safety relief valves (Fig.4) need to be lift tested, or otherwise verified as operating, at least once a year. To prevent damaging valves and preclude persons from getting hurt if the test is not performed correctly, only qualified personnel should conduct the tests. **IH**

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