STRATEGIC OUTCOMES PRACTICE

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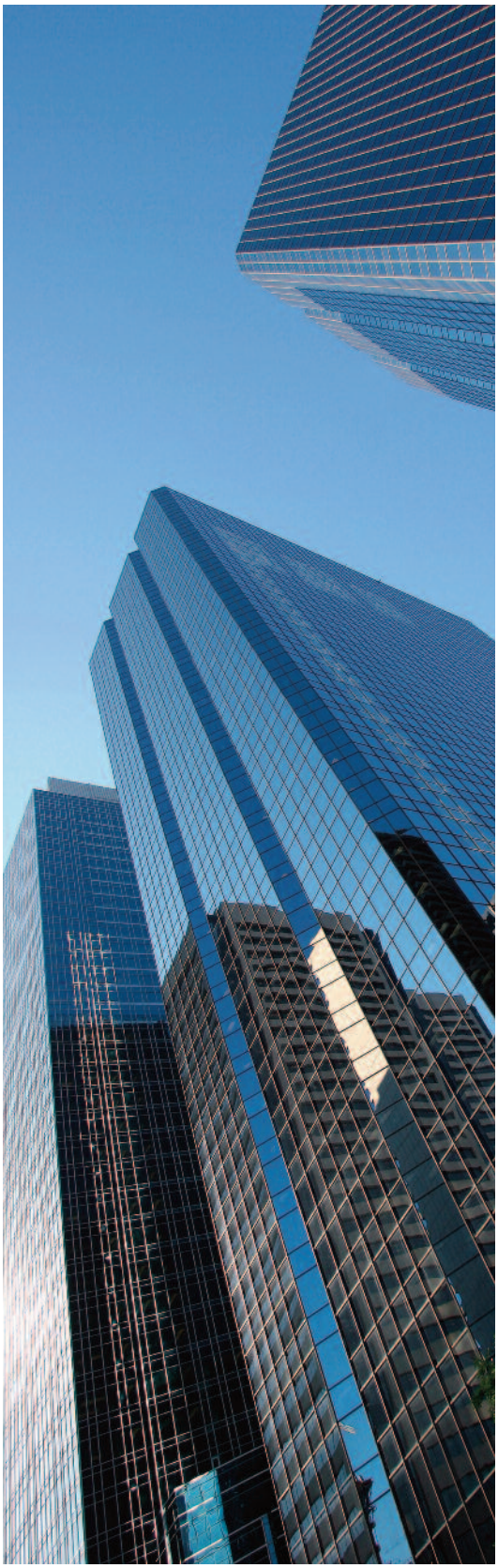
HIGH RISE EMERGENCY POWER SYSTEMS: A CATASTROPHIC FIRE EXPOSURE?

Burgers and sodas aren't the only things that have been supersized in the past decade. Electrical requirements for critical building systems have burgeoned, often as much as 400%.



The increasing burden on the power grid has been accompanied by a parallel demand on emergency and back-up generating systems, spotlighting a crucial risk management issue: As the demand for these generator systems grows, more facility operators must face the complex risks of large-volume, combustible liquid-fueled systems. One common example is a diesel fueled system.

Electricity has long been necessary for even the most basic business functions, and the ever-growing reliance on computing power and massive data storage has only added to our dependence. At the same time, evolving building codes require emergency power for more building systems in more building types and more occupancy classifications – and they require it for longer durations. Always an issue in medical facilities, where life safety is critical, the back-up demand is escalating for high-rise residential and commercial buildings. Life safety must be supported when public electrical power is interrupted.

Risks associated with small interim back-up power systems have historically been moderate. Facilities relying on limited-duration, back-up battery systems, such as a UPS (uninterruptible power supply), do not face any unusual property risk if the UPS is properly installed and maintained. For facilities with higher demands for back-up or fire safety systems, such as emergency exit lighting, a modest fuel-powered, engine-driven emergency generator will often suffice. The electrical demands on these types of Emergency Power Supply (EPS) are relatively moderate, involving an electrical rating of a few hundred kilowatts (kw). The fuel supply for these smaller generators is limited and presents an easily managed property exposure. However, larger fuel-powered systems present significantly greater challenges.

MORE FUEL = MORE RISK

Both the new, larger power demands and longer duration parameters have increased the size of diesel fuel-fired EPS generators to meet these requirements. The size of the tanks used to store the greater amounts of fuel (sometimes thousands of gallons) needed to supply these higher capacity systems has increased significantly. Furthermore, locating these larger tanks in areas separate from the EPS has introduced the additional property risk of fuel-filled transfer lines running through the building area.

This increased fuel-supply requirement has heightened both the potential risk of fire and the extent of a property loss.

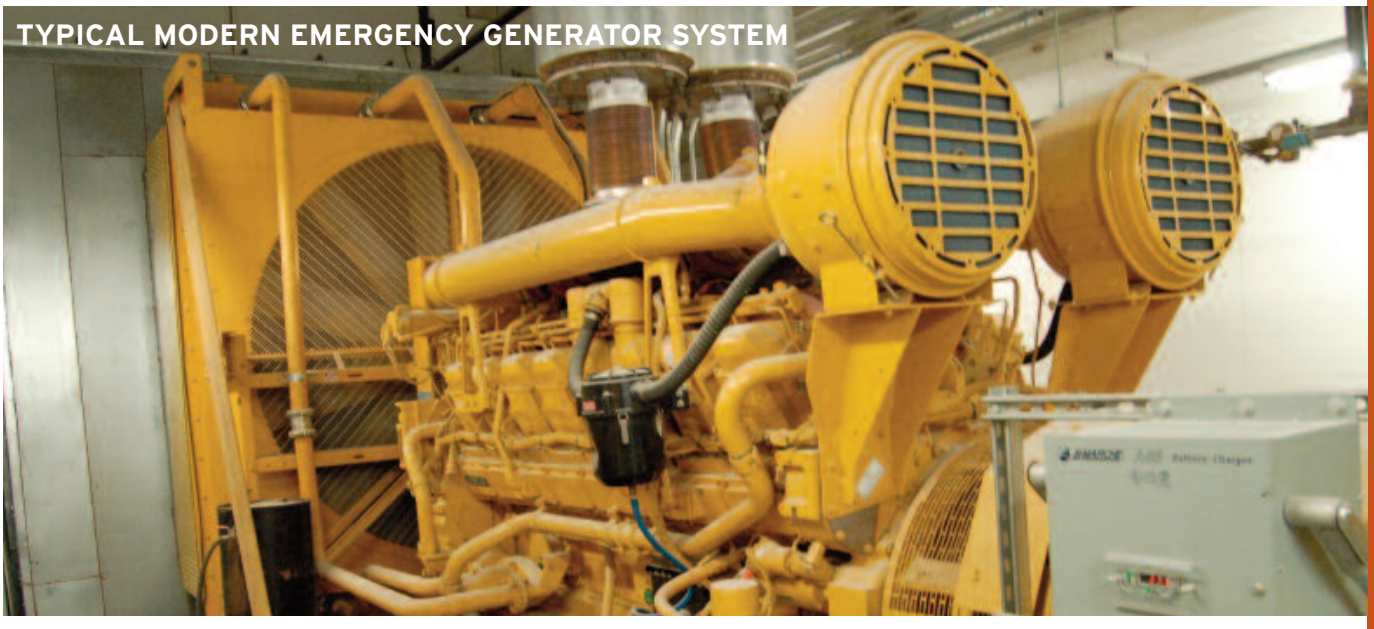
To help limit the fire and property loss exposure, a number of equipment design features, operational safety controls and fire protection systems are recommended. These equipment design and protection parameters should be applied to the main EPS system room, fuel storage room and any internal fuel supply pipe system. (See Emergency Generator System Protection illustration, page 4.)

(Note: Local building and fire codes and insurance company requirements should also be reviewed, and any additional code or insurability requirements might supersede these suggestions.)

GENERATOR ROOM

Standard fire protection design considerations for the generator room include:

1. The room enclosure should have a minimum fire rating of one hour.
2. The generator and any in-room fuel storage (i.e., day tank) should be provided with a separate leak and spill control and containment curb. Newer tanks may be designed to be self-contained (double-wall construction).
3. Leak detection alarm devices should be installed in these curbed areas along with an emergency drain directed to a safe location.
4. The day tank size should be no larger than needed (275 gallon maximum is suggested).
5. The generator room should be provided with automatic sprinkler protection designed to protect the room and fuel storage occupancies. (Local building and fire codes or nationally recognized standards, such as NFPA, should be used as applicable.) If room drainage cannot be provided, then foam type (AFFF) sprinklers may be employed for quicker fire control and to limit fire spread.


TYPICAL MODERN EMERGENCY GENERATOR SYSTEM

6. An automatic fire detection alarm system should also be installed.

7. The generator fuel supply lines should be rigid metallic pipe, rated for the maximum fuel pump pressure. The fuel line from generator day tank to the generator set should be a flexible metallic line. This will help limit potential stress or fatigue failure of the fuel line due to engine vibration.

8. Fusible link-operated Safety Shut-Off Valves (SSOV) should be provided on: a) lines from the remote tank to the generator room tank and b) the line from the tank to the generator set.

9. A manual Emergency Safety Shut-Off (E-Stop), which will shut down both the generator and any remote fuel supply pumps, should be located outside the generator room. On critical power systems, this E-Stop may need to be secured or protected against accidental activation.

REMOTE FUEL STORAGE TANK AND FUEL DELIVERY SYSTEM

1. If extended generator operation requires a bulk storage tank, this tank may be located in another area, such as in basements, mechanical rooms or outside the building. These remotely located fuel storage tanks can be relatively large (many thousands of gallons). This presents a large fire exposure, which needs to be evaluated.

2. Fuel transfer lines may run both vertically and horizontally from the storage tank outside or through the building. These fuel lines should be a) rigid, metallic type pipe, b) run as directly as possible to the EPS room and c) protected from potential internal building fire exposures, ignition sources or areas of high fire exposure (e.g., storage areas) and not pass through critical or sensitive areas.

3. The fuel transfer pipe to the generator room should be concentric (double walled). Concentric piping provides containment in the event of transfer piping failure. These fuel transfer lines should be located in a fire rated pipe chase or enclosure with a minimum one-hour fire rating.

4. The condition of the transfer pipe should be monitored via a leak detection system. This leak detection system should be located at either a) the base of the fuel system supply piping (for concentric pipe) or b) the bottom of the rated pipe enclosure.

5. A small capacity fuel pump is normally provided to transfer fuel from a remote storage tank, through the building (fuel transfer lines) to the day storage tank in the EPS room. The fuel transfer pump should be located in the same room as the remote fuel tank and both should be protected with sprinklers.

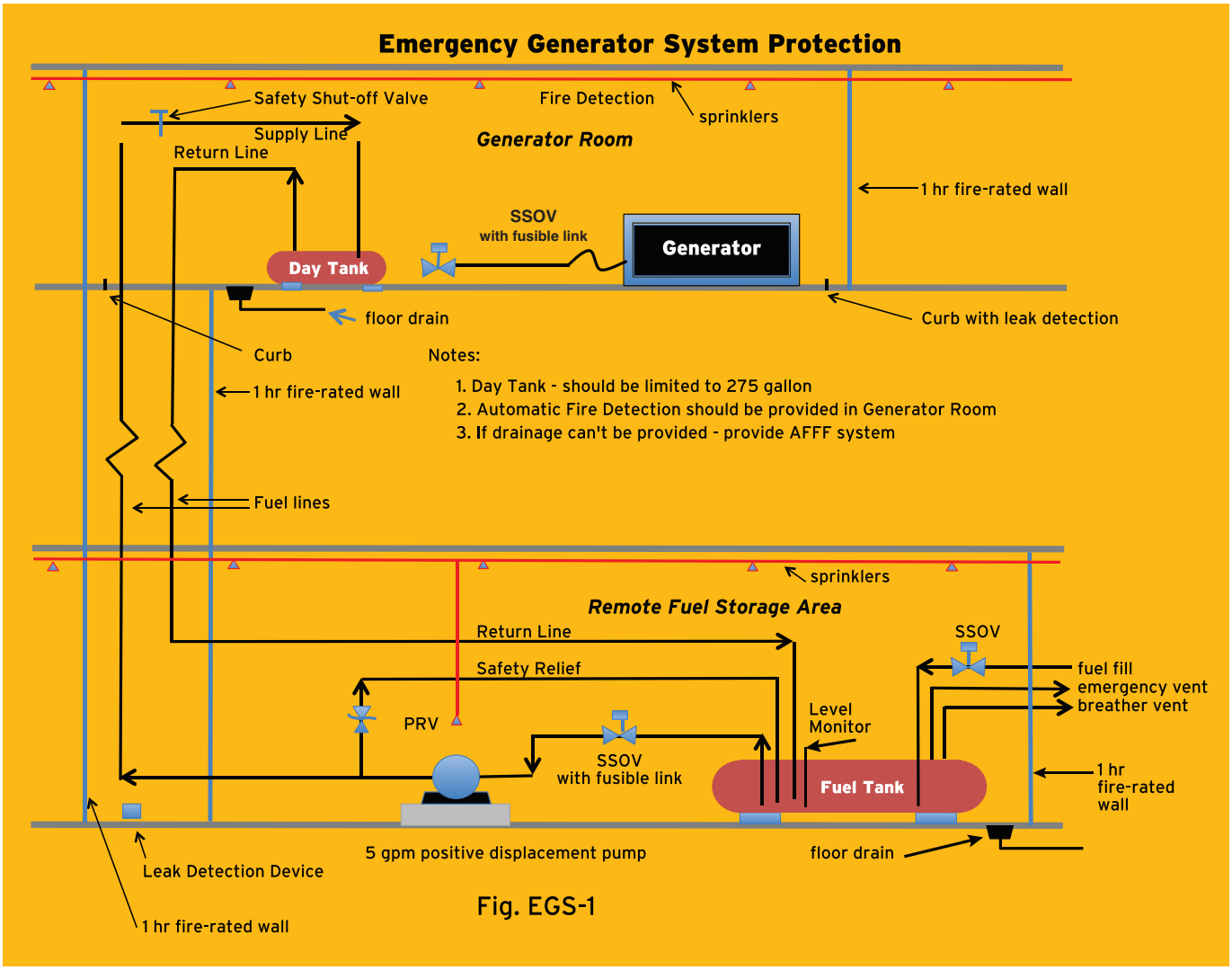


Fig. EGS-1

6. Ideally, to help limit the fire exposure, the remote fuel tank supply system should be located outside the building or in a separate fire rated vault.

7. The piping in the fuel storage tank room should meet the same design criteria as the EPS and transfer pipe connections.

8. Fusible link operated SSOVs should be installed on the fuel lines from the tank to the transfer pump and on the discharge side of the pump. A pressure relief valve, piped back to the fuel storage tank, should be provided on the discharge (pressurized) side of the transfer pump.

FUEL STORAGE TANK

The main fuel storage tank, preferably a dual-walled tank with internal leak detection, should be approved for fuel storage. If the tank is single-walled, the remote tank room should have a floor drain piped to a safe location.

An appropriately sized fill line, emergency vent line and breather vent line, which are designed according to the tank manufacture's specifications, should be provided. The tank should have a level indicator. To prevent accidental overfilling, the tank's level sensor should be connected to an overfill alarm that operates a shut-off valve on the tank fill pipe.

ADDITIONAL CONSIDERATIONS

1. Some EPS systems may be located in areas subject to earthquakes. Systems in buildings located in an earthquake zone should be reviewed and addressed according to the relative exposure and local code requirements. All equipment, piping and fuel tanks should be properly anchored to help prevent excessive movement during a seismic event.

2. For some specific building occupancies, the application of these property

protection suggestions may require futher review. In some situations, the effects of an automatic shut-down of the EPS equipment supplying Critical Health Care, Life Safety or Emergency Process Safety support should also be reviewed for acceptability.

SUMMARY

These installation design and protection guidelines are applicable in limiting property loss exposures associated with a fuel-powered emergency generator system. Limiting these property exposures will help guarantee that the emergency power systems will be safely and efficiently operational when called upon. This standby system will provide the operational or life safety electrical back-up it was designed for.

REFERENCES

NFPA Publications. National Fire Protection Association.
NFPA 110, *Emergency and Standby Power Systems, 2010 edition.*
NFPA 111, *Stored Electrical Energy Emergency and Standby Power Systems, 2010 edition.*

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