

News to Use

Design Requirements Manual

The formulae $\frac{\partial \mu_i}{\partial \alpha_i} + \frac{\partial \mu_i}{\partial \beta_i} (\rho_i \mu_i) = -\frac{\partial \rho_i}{\partial \alpha_i} + \frac{\partial \rho_i}{\partial \beta_i} (\mu_i \frac{\partial \mu_i}{\partial \alpha_i}) + \rho_i (\rho_i - \rho_i)$ for building $\frac{\partial}{\partial \alpha_i} (\rho_i \mu_i) = -\frac{\partial \rho_i}{\partial \alpha_i} + \frac{\partial \rho_i}{\partial \beta_i} (\mu_i \frac{\partial \mu_i}{\partial \alpha_i} - \rho_i \mu_i) + \rho_i (\rho_i - \rho_i)$ state of the art $\frac{\partial}{\partial \alpha_i} (\rho_i \mu_i) = -\frac{\partial \rho_i}{\partial \alpha_i} + \frac{\partial \rho_i}{\partial \beta_i} (\mu_i \frac{\partial \mu_i}{\partial \alpha_i} - \rho_i \mu_i)$ biomedical research facilities.

'Design Requirements Manual (DRM) News to Use' is a monthly ORF publication featuring salient technical information that should be applied to the design of NIH biomedical research laboratories and animal facilities. NIH Project Officers, A/E's and other consultants to the NIH, who develop intramural, extramural and American Recovery and Reinvestment Act (ARRA) projects will benefit from 'News to Use'. Please address questions or comments to: shawn@mail.nih.gov

Generator Fuel Supply

Generators typically support critical electrical loads in many National Institutes of Health (NIH) facilities in case of loss of normal electrical power. Generator fuel supply reliability and security of installation are critical for supporting the NIH mission to health and research. Generators and fuel supply systems shall be located in a secured area to protect the installation. The fuel oil system shall be engineered and installed to industry standards. The design of the fuel supply and storage system shall comply with the following requirements:

- Locate the fuel oil supply tank as close as possible to the emergency generators.
- Supply the emergency generator with a safe and uninterrupted source of #2 fuel oil. Onsite fuel storage capacity shall be adequate for a minimum of 24 hours run time at 100% generator nameplate. For locations other than the NIH Bethesda campus, minimum fuel storage capacity of 48 hours run time at 100% generator nameplate load is recommended. Tank sizing calculation shall consider the duration of expected power outages versus the availability of fuel deliveries and the shelf life (The shelf life of #2 fuel oil is 1.5 to 2 years) of the fuel oil. Where fuel storage capacity is large or may be stored for prolonged periods, evaluate the need for a fuel polishing system.
- Emergency generator(s) fuel oil shall not be used for any other purpose and shall not be shared with any other equipment.
- Locate day tanks as close as practical to the generator's engine and locate at an elevation where the highest fuel level in the day tank is lower than the diesel fuel injectors. Vent day tanks installed indoors to the outside.
- The fuel supply line from the storage tank to the day tank shall have redundant automatic transfer pump. The overflow line from the engine shall be returned to the storage tank, not the day tank. In gravity situations where the main fuel tank is higher than the generator, a "reverse day tank" (return storage tank) shall pump excess fuel back to the main tank. Fuel lines shall not be routed on the surface of the floor or anywhere subject to wear or physical damage.
- Underground fuel oil piping shall be double wall fiberglass and shall be provided with a leak detection and monitoring system. Above ground fuel oil lines shall be black steel.

Compatible metal fuel oil pipes and fittings shall be used to avoid electrolysis.

- Size fuel oil supply pipes and pumps to handle a fuel oil flow rate three times greater than the full-load fuel oil consumption rate specified by the generator manufacturer. In multiple day tanks applications, size the main fuel oil pump system for three times the total fuel oil flow with all generators running at full load simultaneously. Size fuel oil return pipes for twice the total fuel oil flow rate. Pipe engine return-fuel oil back to the fuel oil supply tank.
- Provide an electric solenoid shutoff valve for fuel oil supply line to each generator. Connect the solenoid valve to the engine starter circuit to open the valve prior to energizing the generator.
- Provide a flexible code approved tubing between the engine and the fuel supply line to isolate vibration from the generator's engine.
- Provide Building Automation System (BAS) monitoring of main storage and generator day tank high level and critical high level alarms as well as fuel tank rupture alarm.
- The design specifications of the fuel oil system shall include all tank specialties such as fuel level alarms, filling accessories, control devices and all monitoring and testing devices.
- Fill piping shall be a minimum 2 inches in diameter, shall terminate above grade and shall be designed to minimize spilling when the filling hose is disconnected.
- For fill pipes serving tanks larger than 660 Gallons, an overflow/spill containment device shall be provided pipes.
- Fuel tanks shall be adequately vented to prevent pressurization.

The above mentioned paragraphs highlighted some of the important guidelines of the DRM regarding generator fuel supply systems. Refer to the DRM, NFPA 110, IMC and NFPA 37 for additional requirements on generator fuel systems installations. As the reliability of generator fuel supply is critical, installation of the fuel systems must comply with above mentioned guidelines and ensure ease of maintenance of all fuel system components including fuel quality check.