The National Institutes of Health | Division of Technical Resources | Office of Research Facilities

Design Requirements Manual **News to Use**

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The formulae $\frac{\partial \rho U_i}{\partial t}+\frac{\partial}{\partial x_j}(\rho U U_j)=-\frac{\partial P}{\partial x_i}+\frac{\partial}{\partial x_j}\left(\mu\frac{\partial U_i}{\partial x_j}\right)+g_i(\rho-\rho_0)$ for building $\frac{\partial}{\partial x_j}(\rho\overline{U}\overline{U}_j)=-\frac{\partial \overline{P}}{\partial x_i}+\frac{\partial}{\partial x_j}\left(\mu\frac{\partial \overline{U}_i}{\partial x_j}-\rho\overline{u_i'u_j'}\right)+g_i(\rho-\rho_0)$ state of the art $\frac{\partial}{\partial x_i}(\rho\overline{U}\overline{H})=\frac{\partial}{\partial x_i}\left(\lambda\frac{\partial \overline{T}}{\partial x_i}-\rho\overline{u_i'h'}\right)$ biomedical research facilities.

Risk Assessment and Disaster Planning

NIH facilities and the work contained therein are extremely valuable, and loss due to a facility failure are potentially incalculable. This is addressed in the NIH DRM Section 1.15.6 *Risk Assessment, Systems Failure & Disaster Mitigation.* The need and purpose for Section 1.15.6 is summarized in the Rationale:

Failures in systems can cause substantial impact to facility operations and loss of research. Many catastrophic utility failures can be prevented or controlled by provision of redundant equipment and appropriate standby power supplies, commissioning activities, automated monitoring and response plans. These specific additional precautions should be addressed in the architectural and engineering design of systems for research and vivaria along with an evaluation of additional risks in conjunction with the program to ensure appropriate plans are maintained and to mitigate risks. The rapid restoration of services and minimization of damage is critical in any emergency and is best accommodated through careful planning and installation quality control. The requirements of this section are not all-inclusive, and are not intended to address all provisions necessary for safety or to prevent and mitigate failures. System designers/engineers must appropriately consider each system and the inherent risks and features to ensure proper design, operation, and failure response on a project specific basis.

Risk Assessment

Risk assessments should be conducted early in project planning to identify potential hazards. A properly conducted risk assessment measures the criticality of each architectural and engineering system, its potential for failure, and the consequences of a failure. Once the risk assessment has been conducted appropriate mitigation plans should be developed.

The degree of formality of risk assessments will vary by application, however formal risk assessment is required for hazardous systems, high containment facilities, aseptic production facilities, patient safety and other critical systems and facilities. NIH risk assessments must be prepared by, or in consultation with, subject matter experts and then reviewed and approved by appropriate representatives of all organizations with applicable expertise and authority, which may include impacted institutes and centers, DOHS, DRS, ORF, DFM, DPSM and others.

Disaster Planning

Disaster planning is of utmost importance in research facilities as the unplanned loss of critical infrastructure and system failures can lead to the loss of research and risks to safety. The A/E should work with research personnel to determine the courses of action that should be taken if failure of one or more systems occurs and evaluate potential risks and preventative and mitigating actions.

Considerations

Every facility presents unique risk assessment and disaster planning challenges. Considerations should be tailored to the parameters of the project but should include:

Logistics: Plan for disruption in the delivery of critical supplies due to weather or other events. This directly influences how much area needs to be set aside to accommodate reasonable reserves.

System Design: Systems shall be designed and materials selected to minimize potential for loss of service, to avoid or minimize impact on research and facility operations in the event of disaster or malfunction. Mitigations may include appropriate redundancies, quality of system components, planning for access, maintenance and repair of downed equipment in a safe and minimally disruptive manner. Monitoring and alarming of critical systems should be included for the notification of personnel.

Site and Project-Specific Risks: The A/E should consider the site and project-specific risks associated with each system, both in terms of regular maintenance and operations activities and disaster response.

Disaster Response Plan Coordination: Provisions to address disaster response in regard to engineering systems shall be coordinated with facility disaster response plans.

Requirements: Disaster planning scenarios may include:

- Loss of power (failure of primary, or in critical applications failure of backup power)
- Loss of heating/cooling/supply air capacity
- Loss of exhaust air capacity
- Loss of HVAC (environmental) controls
- Delay/disruption of scheduled deliveries (minimum on hand stock of critical supplies)
- Loss of critical equipment (process or storage equipment)
- Loss of containment/isolation
- Other potential scenarios, including a list provided in DRM 1.15.6E.

Disaster After Action: After a failure or repetitive failures has occurred, the need for root cause analysis and mitigating action shall be considered and shall be reported to ORF.

'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:** shawm@nih.gov

Further details on this month's topic are available on the DRM website DRM Section 1.15 Common Engineering Systems' Requirements
https://www.orf.od.nih.gov/PoliciesAndGuidelines/BiomedicalandAnimalResearchFacilitiesDesignPoliciesandGuidelines/Pages/DesignRequirementsManual2016