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

Standard Operating Procedures and Lab Design

Standard Operating Procedures (SOPs) are required for the operation of all laboratories. An SOP is a set of written instructions that describes in detail how to perform a laboratory process or procedure safely and efficiently. SOPs are especially important when work involves the use of hazardous materials, aseptic or highly regulated conditions, hazardous conditions, or other situations where an error in procedures can have serious consequences.

In many sections of the DRM, it is a requirement to use SOPs in the process of laboratory design, meaning they must be available for reference during the design process. This does not require that the full operational SOP of the laboratory be complete, but that the function of the lab is defined in sufficient detail so that the designer can optimize the lab's configuration and features for its processes and procedures.

SOPs

Labs are very expensive to build and operate and often involve hazardous conditions, so failure to follow procedure can have serious consequences. For these reasons, labs should be designed rationally relative to the lab's SOPs so that procedures are as efficient, safe, and intuitive as possible.

A well-written SOP will provide the designer with a wealth of information that will enable them to properly address features that are essential for lab operations, including:

- **Decontamination**. The details of decontamination, including methods, chemicals used, and frequency, will provide information relative to finishes, sealants, penetrations, and HVAC design.
- **Personal Protective Equipment (PPE).** The definition of PPE requirements will ensure that adequate space is provided, including space for shelving, bins, benches and other features.
- **Sequence of Procedures.** Procedures in a laboratory often proceed in a specific sequence, so locating equipment and workstations in a rational order and adequately adjacent to each other will increase efficiency while limiting conflicts and potential errors.
- **Management of Hazardous Materials.** The identification of hazardous materials in a lab will ensure that provisions are made for their safe handling, storage, and disposal.
- **Services and Utilities.** The determination of the optimal sequence of procedures will determine where services and utilities are located so that equipment can be optimally placed for use.

An SOP should be developed early in the design process. If the lab functions currently exist, the SOP can be derived from the current SOP and modified to incorporate new functions. If the lab does not exist, the intended users should develop a preliminary SOP based on planned procedures or processes.

The lab designer should read the SOP with the goal of understanding the required spaces, features, equipment, and adjacencies necessary to optimize lab for its function and for safe, efficient, and effective operations. Bottlenecks, conflicts, and crossed paths should be eliminated to the extent possible; equipment and other items should be located where needed and most convenient; and hazards should be located to minimize risk and in appropriate proximity to required safety devices.

If a lab is designed without referring to an SOP, the configuration and features will not be optimized for the lab's procedures and processes. In this case, the lab SOP will have to be modified to fit the lab configuration, which may require additional steps and introduce compromises to efficiency and safety.

Conclusion

Using SOPs in lab design enables a laboratory's configuration and features to be optimized for a its procedures and processes, resulting in a safer, more efficient lab and simpler, more intuitive SOPs. If an SOP is not used as a design tool, the lab's procedures and processes must be modified to fit the lab configuration, which can result in compromised safety and efficiency and a more complex SOP.

'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 Chapter 2, Planning and Programming
https://www.orf.od.nih.gov/TechnicalResources/Pages/DesignRequirementsManual2016.aspx