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News to Use

Design Requirements Manual

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

'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'.

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Equipment Planning

Scientific equipment is a crucial component of any laboratory, and must be planned as carefully as any other aspect of laboratory design. Each set of equipment is specific to the operation and function of the laboratory and must be a primary design consideration.

Equipment must be investigated by the equipment planner early in the project, based on the current use of the lab and anticipated upgrades and future changes. This often starts with an equipment survey, where details of existing equipment is recorded, including make and model, dimensions and required clearances, utility requirements, and photographs. This information is documented in an Existing Equipment Schedule.

The programming of the new facility will determine equipment requirements related to future occupancy and anticipated functional and programmatic changes. Discussions with laboratory user during planning and programming will determine immediate new equipment needs, and future needs to be planned for the facility, to be documented in a New Equipment Schedule.

The design of the new facility has to accommodate the needs of both existing and new equipment in configurations that are efficient and functional. Early documentation and coordination with all members of the design team is essential to develop an integrated solution that addresses all functional requirements.

Key considerations include:

Location

Before equipment can be located within a lab, the basic function, process and flows of the lab must be assessed. Individual items must be located in a rational adjacency with other items with the goal of enhancing the sequential workflow within a lab. A rule of thumb is to locate the most sensitive or potentially hazardous operations as far from the door as possible to limit interference and exposure.

Physical Space

Equipment can be built-in (e.g. environmental rooms, autoclaves), hard-connected (fume hoods, glass washers), loose floor mounted (freezers, centrifuges), under counter (refrigerators), or benchtop mounted (PCRs, mass spectrometers). Regardless of the configuration, equipment must be provided with sufficient space to be set up properly and comfortably with all peripherals, and with sufficient working and maintenance clearances. Equipment which is very sensitive, noisy or potentially hazardous should be located in a remote part of the lab, an alcove or a separate room. The installation and eventual removal of large equipment must be planned and may include oversized doors and a path (horizontal and vertical) from the lab to a loading dock or other access point.

Utilities

Equipment required connection to a range of utilities including power, data, water, drain, compressed air, vacuum, and a variety of specialty gasses. Power (normal or emergency) may be hard-wired or cord & plug connected, and may include multiple connections, plug configurations, voltages, and other variations. Gasses may be from central systems or local sources, and may need tank restraints, regulators, piping and other devices. Space may be needed for peripherals like uninterrupted power sources, power supplies and chillers.

Heat Load and Turbulence

Equipment may have characteristics which will require coordination with the air distribution system. Equipment generating a large amount of heat may require a dedicated exhaust. Equipment that is sensitive to turbulence may require laminar air diffusers, an enclosure or other device to minimize air movement.

Vibration

Some equipment, including precision imaging, optical and analytical equipment are sensitive to vibration. The performance of the building should be assessed, and these devices strategically located in areas with appropriate vibration performance, which may be slab on grade, shorter structural bays or adjacent to columns. Equipment may also need vibration isolation tables, vibration pads or other devices. Equipment with rotating or reciprocating elements may produce unwanted vibration. These items should be located as far as possible from vibration sensitive equipment, and may need vibration isolators or other control devices.

Other Considerations

Specialty equipment may have weight, shielding, security/access and other requirements which will determine location and other considerations.

Responsibilities

It is important to document which party (generally the contractor or the government) is responsible for providing and installing of each piece of equipment. As a rule of thumb, built-in equipment requires the earliest and most close coordination by the contractor, and is usually provided and installed by the contractor. Hard-connected equipment should be installed by the contractor, but can be provided by either the government or the contractor. Loose equipment is generally provided and installed by the government.

Further details on this month's topic are available on the DRM website
http://orf.od.nih.gov/PoliciesAndGuidelines/BiomedicalandAnimalResearchFacilitiesDesignPoliciesandGuidelines/Pages/DesignRequirementsManualPDF.aspx
DRM Chapter 4 Section 5 Casework and Equipment