

# News to Use

## Design Requirements Manual

*The formulae  $\frac{\partial U_i}{\partial x_j} + \frac{\partial}{\partial x_j}(\mu U_i) = -\frac{\partial p}{\partial x_j} + \frac{\partial}{\partial x_j}(\mu \frac{\partial U_i}{\partial x_j}) + g_i(\rho - \rho_s)$  for building  $\frac{\partial}{\partial x_j}(\rho U_i U_j) = -\frac{\partial p}{\partial x_j} + \frac{\partial}{\partial x_j}(\mu \frac{\partial U_i}{\partial x_j} - \rho u_i u_j) + g_i(\rho - \rho_s)$  state of the art  $\frac{\partial}{\partial x_j}(\mu U_i U_j) = \frac{\partial}{\partial x_j}(\mu \frac{\partial U_i}{\partial x_j} - \rho u_i u_j)$  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: [ms252u@nih.gov](mailto:ms252u@nih.gov)

### Piping Systems - Design and Materials

The DRM specifies piping materials for use in systems within and outside of the laboratory that are intended to provide uniformity of design, be cost effective, and promote compatibility with other building materials and building systems. Hydronic plumbing and process piping systems in NIH facilities shall be designed for ease of system maintenance and component replacement, system reliability, and extended service life.

Piping systems consisting of different hydronic zones shall be provided with interconnecting means to be used when serving critical areas. Each piece of equipment shall be provided with a means to determine balance and control water flow. Balancing valve and flow meter fittings shall be provided at each floor for every riser. Hydronic equipment and systems shall not be installed inside BSL-3 containment.

NIH has researched and made recommendations regarding the use of specific pipe materials and quality. For example, the use of stainless steel traps is described in <http://orf.od.nih.gov/PoliciesAndGuidelines/Bioenvironmental/>. It is incumbent upon the A/E to consult the available resources to determine piping material compatibility with the specific program requirements. Construction documents shall include specifications for testing procedures and commissioning of all systems installed in the project.

Selection of pipe materials and installation methods shall incorporate special requirements unique to individual program areas, such as consideration of magnetic fields, special materials, shielding, and chemical exposure, etc. Piping/plumbing (p/p) systems may differ in animal facilities versus in a laboratory. Animal facility p/p systems may include cage wash, waste drainage, animal drinking water, and vivarium gas systems. These systems require close review with an animal care specialist to determine the exact requirements for specialized equipment, drainage, steam, and corrosive criteria.

BSL-3 and ABSL-3 p/p criteria are specified in the DRM in Section 8-11: BSL3 & ABSL3 Biocontainment. Piping systems not serving BSL-3 spaces shall not be routed in containment areas. Penetrations into the containment barrier of BSL-3 spaces shall be fully detailed in the construction documents, and shall require mock-ups to be constructed and tested prior to installation. All penetrations shall be durable, sealed, and tested to meet the room tightness criteria for BSL-3 containment. Insulation shall terminate at the back face of the penetrated material, prior to the containment barrier. Escutcheons shall not be utilized. Special attention shall be given to sealing, caulking and corrosion resistance criteria as described in the DRM Chapter 2, "BSL-3 Testing, Validation, and Calibration"

and Chapter 4 Architectural Exhibit X4-7-A "BSL3 Caulking and Sealants."

General requirements for p/p are the same for all facility types. Adequate fluid temperature, pressure, and volume shall be delivered to meet laboratory functions through conservatively sized pipe mains. Future capacity (20%) allowances shall include building design calculations, utility services, main risers and major branch lines, equipment room space planning and interdisciplinary coordination of projected future requirements. To the extent possible, **equipment should be sized to provide an additional 20% capacity above the calculated system requirements to offset aging and wear and tear performance losses.**

The DRM specifies piping design criteria for steam and steam condensate piping (Sec.6-3.D.4). Regardless of steam and condensate pressure classification, all pipe and fittings shall be rated for a minimum pressure of 2,067 kPa (300 psi). Steam piping shall be a minimum Schedule 40 and condensate piping, a minimum Schedule 80.

Heating water systems in NIH buildings shall serve preheat coils, reheat coils, perimeter radiation fan coil units, etc. These systems can be constant or variable flow and include heat exchangers, duplex distribution pumps, expansion tank(s), makeup water provisions, air separator and two or three way terminal device control valves. Heating water systems shall be designed to offer N+1 reliability and maintain 100% capacity in the event a lead component fails.

Cooling in NIH facilities is to be provided by the use of chilled water. Chilled-water cooling coils shall be selected to ensure that the interior space relative humidity is maintained at full and part-load conditions. Chilled water coils shall be selected for an entering water temperature of 7.2°C (45°F) and leaving water temperature of 15.6°C (60°F) at peak demand.

Water piping installation at the NIH Bethesda campus and Poolesville facilities shall utilize Type K (hard-drawn) tubing. Extramural projects located outside of the metropolitan Washington DC area may use Type L (hard-drawn) copper piping for above ground water piping installations if prevailing practices and water supply conditions are compatible with Type L (hard-drawn) copper tubing.

Materials and application of pipe hangers, supports, joint welding, brazing and soldering shall conform to the latest requirements of ANSI/ASME B31.1 or ANSI/ASME B31.9 and MSS Standard Practice SP-58, SP-69, and SP-89, and other applicable specifications. All p/p systems shall be provided with a complete identification system that conforms to the requirements published in ANSI/ASME Standard 13.1 and NFPA 99.