

News to Use

Design Requirements Manual

The formulae $\frac{\partial U_i}{\partial x_j} + \frac{\partial (\rho U_i)}{\partial x_j} = -\frac{\partial p}{\partial x_j} + \frac{\partial (\rho \sigma_{ij})}{\partial x_j} + s_i(\rho - \rho_0)$ for building $\frac{\partial (\rho U_i U_j)}{\partial x_k} = -\frac{\partial \tau_{ijk}}{\partial x_k} + \frac{\partial (\rho \sigma_{ij})}{\partial x_k} - \rho \omega_{ijk}$ state of the art $\frac{\partial (\rho U_i U_j)}{\partial x_k} = \frac{\partial (\rho \sigma_{ij})}{\partial x_k} - \rho \omega_{ijk}$ 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: shawm@mail.nih.gov

Floors in Vivariums

Vivarium floors, like all other vivarium assemblies, have stringent performance requirements. The Guide for the Care and Use of Laboratory Animals requires that floors be "...moisture resistant, non-absorbent, impact resistant and relatively smooth..." "...have a minimal number of joints". The DRM requires that floors be "resistant to the adverse effects of disinfectants, high-temperature water, and detergent cleaning... continuous movement of cages and equipment... permits the easy wheeling of cages or other equipment through the animal facility".

Due to the requirements for moisture resistance and disinfection, monolithic flooring is required in all areas within a vivarium perimeter. The tried-and-true flooring of choice is epoxy resin.

Alternatives to Epoxy

In area subject to more moderate wear (entry and administration, behavioral studies, surgery, imaging), seamless vinyl or seamless rubber terrazzo with integral covered base may be appropriate and should be considered as alternates to epoxy. Although less durable than epoxy, these floors have superior cushioning and acoustic properties, are less expensive to install, and are easier to repair. Standard Operating Procedures (SOPs) and the institutional experience of maintenance and animal care staff will determine whether these floors are appropriate.

Epoxy

The primary working area of a vivarium (holding rooms, cage wash, primary corridors, and procedure rooms), however, are subject to extreme abuse on a daily basis, including:

- Heavy wheeled traffic
- Impacts
- Harsh chemical cleaning
- Thermal shock from steam cleaning
- Pressure washing

For these conditions, the durability of epoxy is required. Although an ideal material with a long history of success, epoxy floors can fail if not detailed properly and installed under the right conditions. A key element for a successful installation is planning from early in the design phase:

Concrete Slab Design: Epoxy is chemically bond to the concrete, which makes it more durable than surface-applied sheet flooring like vinyl and rubber. However, if the bond is not strong delamination and failure can occur. One source of failure is vapor transmission through the slab. To reduce vapor transmission, the slab must be designed appropriately for the specific conditions, and typically includes a vapor barrier, a granular drainage layer and an underslab drainage system.

Installation of floor drains and sloped floors should be carefully considered, since they have major impact facility operations.

Drains and sloped floors (at 1/8" per foot) are generally appropriate for rooms with the most extensive use of water and subject to wash-down, like large animal holding rooms and cage wash areas. Drains and sloped floors are generally not used in corridors, small animal holding rooms and procedure rooms.

Slabs must be designed for high floor loading, which is in excess of standard laboratory floor loading.

Product Selection: Epoxy flooring systems are produced by many manufacturers, and vary in their composition and characteristics. It is important to identify a specific flooring system compatible with the intended use and conditions, and with a successful track record. Once identified, the selected system will be used as a basis for making decisions throughout the design process. Vivarium floors have many unusual conditions, including pits, trench drains, gratings, curbs and sloped floors, which must be finished in epoxy. It is ideal to use an epoxy manufacturer's tested and recommended details to ensure compatibility with their system. A manufacturer can also supply specification requirements for concrete (including chemical composition, pH, vapor transmission, moisture content) to ensure compatibility with their system

Mock-up: It is highly recommended that an on-site mock-up be used as a basis for performance for the actual floor installation. The mock-up should be installed in close proximity to the actual installation, under conditions as close to the actual installation as possible. The mock-up should include as many typical conditions as possible (base and wall termination, inside and outside corners, floor drain, pit, curb, etc.). Upon completion, the mock-up should be tested for thickness, hardness and adhesion, and reviewed by the users and design team for color and slip-resistance. Upon acceptance, the mock-up should be retained and used as a reference basis for performance and acceptance.

Testing: It is imperative that the epoxy installer visit the site and test the concrete slab to confirm that conditions meet their requirements. The installer must be authorized by the manufacturer, and be a certified Society of Protective Coatings Application Specialist. Installation should not commence until all required conditions are met. The installer may have to pre-treat or prepare the slab.

Installation: Due to its critical nature, it is important that the installation of the epoxy floor is not rushed. As a finish trade, flooring installation should be as late as possible in the construction sequence to ensure that the floor is not damaged by subsequent activities. Installation should not begin until the HVAC system is running, the environment has stabilized and the concrete floor has cured and dried to within manufacturer's recommendations.

Post Installation: The epoxy should be given adequate time to cure under recommended conditions. When allowed, the floor should be covered and protected until occupancy. After occupancy it is important to follow manufacture's recommendations for maintenance and repair.