

### PART VII: RESEARCH LABORATORY DESIGN

#### 1. SCOPE:

- 1.1. This part outlines the minimum requirements for the design procedures for research laboratories in new buildings and for repair and alteration projects for research laboratories in existing buildings on the UMB campus.

#### 2. UMB OVERVIEW:

- 2.1. The mandate for cost-effective construction within public sector budgets necessitates prudent selection of materials and systems which can service the needs of the University. Further, the on-going maintenance of over four million square feet of space recommends the use of those items which have proven durable and maintainable over time, and the standardization of these materials to minimize stocking of replacements and training in their use and maintenance.

#### 3. CODES AND STANDARDS:

- 3.1. All laboratory designs shall comply with the codes and standards included in Section 2 of these Design Standards.

#### 4. GENERAL REQUIREMENTS:

- 4.1. **General:** The following requirements have been developed from experience in the design, operation, and maintenance of research laboratories on campus. These requirements do not apply to other spaces described as “laboratory”, such as computer labs or “simulation labs”, etc. These requirements are intended to provide a “check list” of customary needs that are provided according to the practices and means of the University, and are to supplement, or be coordinated with, other specific criteria in these Design Standards. These requirements shall apply to both new and renovated laboratories, as well as accommodate any special needs as directed by the responsible school or institute.

- 4.2. **Environmental Health and Safety Department (EHS):** The University’s EHS Department is responsible for the safety and health design aspects for laboratories and supporting spaces and is the primary contact for laboratory design issues related to safety and health. EHS shall be included in all phases of the laboratory design process as an active member of the design team throughout the design and construction process. This is particularly important in the design of high level containment facilities such as Biological Safety Level 3 (BSL-3) and Animal Biological Safety Level 3 (ABSL-3) facilities. Contact information for EHS is listed below, but coordination with EHS shall be through UMB.

- a. Environmental Health and Safety Department  
714 W. Lombard Street  
Baltimore, MD 21201  
Phone: 410-706-7055 / Fax: 410-706-8212 / 410-706-3494 (FM)

**4.3. Regulatory Interpretations and Variance Requests:** The A/E shall submit requests for regulatory interpretations or variances to UMB, who will forward them to EHS for review. All requests and responses shall be in writing.

**4.4. Animal Facilities:** Animal facilities shall be designed in accordance with the requirements of the American Association for the Accreditation of Laboratory Animal Care (AAALAC) and shall be reviewed and coordinated with the University Director of Veterinary Resources as directed by UMB.

### 5. **CAMPUS LABORATORIES:**

**5.1.** Common types of laboratories present on campus have been categorized as:

- a. Standard Laboratory
- b. Biological Safety Level 2 (BSL-2)
- c. Biological Safety Level 3 (BSL-3)
- d. Animal Biological Safety Level 3 (ABSL-3)
- e. Surgery: Survival
- f. Surgery: Non-Survival
- g. Animal Holding Rooms
- h. Photo Dark Room
- i. Laser
- j. Electron Microscope
- k. Prosthetics (dental)

### 6. **GENERAL LABORATORY REQUIREMENTS:**

**6.1. Structural:** See Section 3 AD: Structural Design of these Design Standards for requirements.

#### **6.2. Architectural:**

- a. **Doors:** Doors to laboratories shall be thirty six (36) inch to forty four (44) inch, single leaf type doors. Larger doors or multiple leaf doors shall only be used when necessary to accommodate special equipment and/or furniture. Multiple leaf doors shall be used only when necessary to accommodate special equipment and/or function. Provide a “half door” tempered glass view window (retrofit on renovations) at doors to labs. Hardware shall include removable cylinder, entrance function (lock/unlock

jamb selection) lever, heavy-duty stainless hinges, brushed stainless kick plates both sides, and a closer.

- b. **Walls:** Five eighth (5/8) inch gypsum board.
- c. **Windows (if applicable):** Non-operating, sealed. Light control: one (1) inch horizontal blinds. For renovations in existing buildings, the already established window treatment shall be used.
- d. **Laboratory Furniture:** Laboratory furniture must be capable of supporting anticipated loads and uses. Spaces between benches, cabinets, and equipment should be accessible for cleaning.
  - (1) Bench tops must be impervious to water and resistant to heat, organic solvents, acids, alkalis, and other chemicals.
  - (2) Chairs used in laboratory work must be covered with a non-porous material that can be easily cleaned and decontaminated with appropriate disinfectant.
- e. **Casework:** See Section 3 AD: Interior Finish, Accessory and Specialty Design of these Design Standards.
- f. **Architectural Finishes, Except as Noted in Special Laboratory Use:**
  - (1) **Floors:** Twelve (12) inch x twelve (12) inch commercial grade vinyl composition tile in up to three colors. Leave one carton of each color in laboratory as attic stock. Carpets and rugs in laboratories are not permitted.
  - (2) **Base:** Four (4) inch vinyl cove.
  - (3) **Walls:** Three (3) coat acrylic latex egg shell, semi-gloss or satin finish paint.
  - (4) **Ceiling:** Twenty four (24) inch x forty eight (48) inch x fifteen sixteenths (15/16) inch, painted suspended grid with lay-in fissured acoustical tile. Provide one carton in laboratory as attic stock.

6.3. **Mechanical:** See Section 3 MD of these Design Standards for requirements.

6.4. **Electrical:** See Section 3 ED of these Design Standards for requirements.

### 7. SPECIAL LABORATORY REQUIREMENTS:

7.1. **Minimum Standards:** In addition to the general laboratory requirements above, the minimum standards for special laboratories shall be included in the design as follows:

- a. **Standard Laboratories:** Standard laboratories should be designed so that they can be easily cleaned and should include the following:
- (1) **Floor:** Welded seam vinyl sheet.
  - (2) **Base:** Four (4) inch integral seamless vinyl.
  - (3) **Walls:** Extend studs and gypsum board on laboratory side to deck above to seal room.
  - (4) **General Purpose Low Flow Fume Hoods:** General purpose low flow fume hoods with a lockable ventilated storage cabinet.
  - (5) **Special Purpose Fume Hoods:** Special purpose fume hoods are radio isotope and/or perchloric acid hoods with lockable storage cabinets.
- b. **Biological Safety Level 2 Laboratories (BSL-2):** The BSL-2 laboratories should be designed so that it can be easily cleaned and decontaminated.
- (1) **Floor:** Welded seam vinyl sheet.
  - (2) **Base:** Four (4) inch integral seamless vinyl.
  - (3) **Walls:** Extend studs and gypsum board on laboratory side to deck above to seal room.
  - (4) **Doors:** Provide perimeter gasket seal, closer.
  - (5) **Ceiling:** Lay-in panels shall be mylar faced, with hold down clips and perimeter sealant.
  - (6) **Incubator with Tanked Gas:** Provide space for equipment and secure blocking for tanks as directed. External location of tanks is preferred with sealed supply through wall.
  - (7) **Biological Safety Cabinets (BSC):** Biological safety cabinets must be installed so that fluctuations of the room air supply and exhaust do not interfere with the proper operations of the BSC.
  - (8) **Room Temperature:** Constant room temperature may be required. If so, provide wall insulation with a taped vapor barrier, possible batt insulation in ceiling as directed.
  - (9) **Decontamination:** A method for decontaminating all laboratory wastes should be available in the facility (e.g., autoclave, chemical disinfection, incineration, or other validated decontamination method).

- c. Biological Safety Level 3 Laboratories (BSL-3):**
- (1) **Biological Safety Level 3 (BSL-3) Facilities:** EHS maintains a design specification for BSL-3 facilities that is periodically updated. At the inception of a project involving a BSL-3 facility, UMB will contact EHS to obtain the current version of the design specification, and forward it to the consultant.
  - (2) A/E design team must coordinate the designs for biological safety level areas with UMB.
- d. Animal Biological Safety Level 3 Laboratories (ABSL-3):**
- (1) **Animal Biological Safety Level 3 (ABSL-3) Facilities:** EHS maintains a design specification for ABSL-3 facilities that is periodically updated. At the inception of a project involving an ABSL-3 facility, UMB will contact EHS to obtain the current version of the design specification, and forward it to the consultant.
  - (2) A/E design team must coordinate the designs for biological safety level areas with UMB.
- e. Surgery Laboratories, Survival:** Laboratories designed as survival operating room suite also shall include:
- (1) **Prep Areas:** Prep room, recovery room, gown room, ante room and area for monitoring equipment as directed by UMB.
  - (2) **Floor:** Epoxy membrane or seamless vinyl equal to “Armstrong Medintech”
  - (3) **Base:** Integral coved six (6) inch high epoxy membrane with stainless steel termination molding and sealant
  - (4) **Walls:** 5/8 inch “Dens-shield” or equal. Fiberglass tape seal; over (tapered) joints. Skim coat with “Sto Industries Flexyl” or equal polymer-based Portland cement coating system and a water reducible epoxy coating system for wet areas.
  - (5) **Ceiling:** Five eighth (5/8) inch M.R.Gypsum board with epoxy paint same finish as walls. All penetrations must be sealed.
  - (6) **Doors and Frames:** Epoxy paint finished galvanized steel with “hospital” sanitary stops. Provide vision panels. Stainless steel armor plates on both sides. Side of door in direction of travel shall have flush hardware. Perimeter seals.
  - (7) **Protection:** Same as animal holding rooms.

- f. **Surgery Laboratory, Non-Survival:** Non-survival operating room may be within the laboratory, but may require a prep room/area, scrub room, and gown room as directed.
- (1) **Ceiling:** Twenty four (24) inch x forty eight (48) inch x fifteen sixteenths (15/16) inch baked-on enamel aluminum grid with mylar or vinyl faced lay in panels with hold-down clips and perimeter sealant.
  - (2) **Doors and Frames:** Standard doors with vision panels, stainless steel armor plates on both sides and flush hardware.
  - (3) **Protection:** Same as animal holding rooms.
- g. **Animal Holding Rooms:**
- (1) **Floor:** Slope to floor drains. Epoxy membrane waterproofing with non-slip surface, impact and dynamic loading resistant
  - (2) **Base:** Eight (8) inch high integral coved epoxy membrane with sealed metal termination strip.
  - (3) **Walls:** inch “Dens-shield” or equal over metal studs with fiberglass tape five eighth (5/8) seal over tapered joints. Skim coat with “Sto Industries Flexyl” or equal polymer-based Portland cement coating system and water reducible epoxy coating system specified for wet areas.
  - (4) **Ceiling:** Twenty four (24) inch x forty eight (48) inch x fifteen sixteenths (15/16) inch wide baked-on enamel finished aluminum grid for damp area. Mylar-faced cleanable tiles with hold down clips
  - (5) **Doors and Frames:** Sealed, epoxy painted galvanized steel with “hospital” sanitary stops and stainless steel armor plates on both sides. Rooms shall have doors with floor sweeps, vision panels with light sealed doors, full open or swing away hinges and flush hardware on side in the direction of travel.
  - (6) **Protection:** Vinyl, aluminum or stainless steel guard rails and brackets at thirty six (36) inch rail height within cage areas. At stud line provide either 16 gauge x twelve (12) inch galvanized steel backer plate with stud stiffeners, or six (6) inch x 16 gauge continuous track stud.
- h. **Photo Dark Rooms:**
- (1) Commonly, traditional wet photo dark rooms are used; however, prefabricated modular units may be used as approved by the responsible school.

- (2) General laboratory standards shall be modified as follows:
  - a) **Light Lock:** Provide a light-lock vestibule or circular light-lock dark room door with appropriate light seals.
  - b) **Ceiling:** Twenty four (24) inch x forty eight (48) inch x fifteen sixteenths (15/16) inch grid, Mylar or washable vinyl faced lay-in panels with hold down clips and perimeter sealant.
  - c) **Bench Tops:** Traditional black acid-resistant laboratory grade HPDL with drip edge, back and side splashes, and shelving.

**i. Laser Laboratories:**

- (1) **Location:** Space may be located in the center of the building and should be free of vibration transmitted from generator rooms, mechanical equipment, etc. Room may require raised vibration isolated floor system.
- (2) **Floors:** Anti-static, VCT.
- (3) **Ceiling:** Twenty four (24) inch x forty eight (48) inch x fifteen sixteenths (15/16) inch suspension system with mylar or vinyl faced acoustical tile, hold down clips with sealant. Some labs may require acoustical batt insulation above ceiling.
- (4) **Other Considerations:** Some labs may require provisions for connection to the building process cooling water system water. See Section 3 MD of these Design Standards for additional requirements.

**j. Electron Microscope Laboratories:**

- (1) **Location:** Space should be free of vibration transmitted from elevators, generator rooms, mechanical equipment, etc.
- (2) **Floors:** Anti-static VCT.
- (3) **Ceiling:** Twenty four (24) inch x forty eight (48) inch x fifteen sixteenths (15/16) inch suspension system with mylar or vinyl faced acoustical tile, hold down clips with sealant. Some labs may require acoustical batt insulation above.
- (4) **Lighting:** Parabolic light supplement with recessed pin-hole or track-mounted incandescent lighting with dimming.

(5) **Other Considerations:** Some labs may require provisions for connection to the building process cooling water system water. See Section 3 MD of these Design Standards for additional requirements.

**k. Prosthetic Dental Laboratories:**

(1) **Floors:** Welded seam sheet vinyl in wet areas, VCT acceptable in dry areas. Light color without pattern.

(2) **Ceiling:** Twenty four (24) inch x forty eight (48) inch x fifteen sixteenths (15/16) inch suspension system with mylar or vinyl faced acoustical tile, hold down clips with sealant. Some labs may require acoustical batt insulation above.

**8. GENERAL PURPOSE LOW FLOW FUME HOODS, SPECIAL PURPOSE FUME HOODS AND BIOLOGICAL SAFETY CABINETS:**

**8.1. General Design Requirements:** The A/E design team must coordinate the designs for low flow chemical fume hoods and biological safety cabinets with UMB. All laboratory renovation and new construction must be in accordance with the most current version of National Fire Protection Standard (NFPA) 45 “Fire Protection for Laboratories Using Chemicals”.

**8.2. General Purpose Low Flow Fume Hoods:** The A/E shall specify that all general purpose fume hoods must be low flow hoods and must be installed in accordance with ANSI/AIHA Standard Z9.5-2003 “American National Standard for Laboratory Ventilation”. Specify that a wire mesh screen with openings no less than one quarter (1/4) inch x one quarter (1/4) inch be provided with all fume hoods. This screen shall be installed at the base of the baffle at the back wall of the fume hood.

**8.3. Special Purpose Fume Hoods:** The A/E shall specify that all special purpose fume hoods must be installed in accordance with ANSI/AIHA Standard Z9.5-2003 “American National Standard for Laboratory Ventilation”. Specify that a wire mesh screen with openings no less than one quarter (1/4) inch x one quarter (1/4) inch be provided with all fume hoods. This screen shall be installed at the base of the baffle at the back wall of the fume hood.

**8.4. Biological Safety Cabinets:** Biological safety cabinets must be selected and installed in accordance with CDC/NIH’s publication entitled “Primary Containment for Biohazards: Selection, Installation and Use of Biological Safety Cabinets”. In addition, all biological safety cabinets must be constructed and certified prior to use in accordance with National Sanitation Foundation Standard No. 49 (NSF, 2007) “Class II (Laminar Flow) Biohazard Cabinetry”.

**8.5. Audio and Visual Alarms:** All general purpose low flow fume hoods, special purpose fume hoods and biological safety cabinets shall be specified to have local audio and visual air flow alarms, as required by UMB and EHS. In addition,



specify that each alarm shall be tied in to the campus energy management and control system for remote monitoring.

- 8.6. Biological Safety Cabinets (BSC):** Biological safety cabinets must be installed so that fluctuations of the room air supply and exhaust do not interfere with the proper operations of the cabinet. BSCs should be located away from doors, windows that can be opened, heavily traveled laboratory areas, and other possible airflow disruptions. Biological safety cabinets exhaust to general laboratory exhaust, either indirect thimble or near the general room exhaust as directed. HEPA filtered exhaust air from a Class II BSC can be safely re-circulated back into the laboratory environment if the cabinet is tested and certified at least annually and operated according to manufacturer's recommendations.

### 9. CONTROLLED ENVIRONMENTAL ROOMS:

- 9.1. General:** Specify a complete prefabricated environmental room with all metal clad construction, furnished and installed as a complete self contained unit with all essential, plenums, controls, balanced air circulation, to maintain the specified environmental conditions as identified in the project program and/or as directed by UMB.
- 9.2. Refrigeration System:** Include in the specifications the requirements for the refrigerant system to come with water cooled compressors and air cooled back up systems. See UMB Master Specifications.
- 9.3. System Controls:** Include in the specifications the requirement for the system controls to include auxiliary contacts to send an alarm signal the BAS and connect the room to the building emergency power system.

**END OF SECTION 3 AD - PART VII**