Criteria for Research Lab Planning and Design

This document intends to provide a standardized set of laboratory planning and design guidelines to ensure uniform program development across all university segments, whether conducted by university professionals or outside consultants.

The current version of these guidelines supports laboratories that utilize chemicals, flammable gases, or toxic gases, i.e. "wet" laboratories. Other laboratory types: dry, computational, clean class, teaching, and specialty environments will be addressed in future versions.

I. Planning Terms

(A) *Laboratory*

A controlled built environment with specialty equipment used for experimentation, research, instruction, teaching, measurement, or manufacture.

(B) *Wet Lab*

A laboratory that utilizes, processes, stores, or distributes chemicals or flammable gases. Wet labs can range in intensity of use and require fixed equipment and building systems infrastructure dependent on use type. Wet labs include damp, wet, and heavy wet labs.

(C) *Dry Lab*

A laboratory that cannot utilize, process, store, or distribute chemicals or flammable gases. Specialty electrical or ventilation may be required depending on use and equipment requirements.

(D) *Computational Lab*

A laboratory used primarily for computer simulation, the use of electronic equipment, or robotics that does not have the capability to utilize, process, store, or distribute chemicals or flammable gases. Specialty electrical or ventilation may be required depending on use and equipment requirements.

(E) *Maximum Allowable Quantities (MAQs)*

The maximum allowable quantity of hazardous materials within a prescribed control area as defined by applicable building and fire and life safety codes.

(F) *Control Area*

A defined area within a building that is separated from the rest of the building by fire-rated construction.

(G) *Adaptability*

Adaptability is the capability of a research environment to adjust to changing needs in research, equipment, and quantity of research positions. For new construction or renovation, the ability of a lab

to adapt to future needs will be defined in the programming phase. Adaptability is achieved through clear building systems design strategies and laboratory layout considerations.

II. Planning Considerations

(A) Code Compliance, Accessibility, and Campus Standards

Compliance with applicable state, local, accessibility, and fire safety building codes and adherence to American National Standards and University standards defined in the Design and Construction Guidelines are required.

(1) All biology labs should meet design requirements in the most recent version of the Biosafety in Microbiological and Biomedical Laboratories (BMBL) manual, which is currently in the 6th edition.

(2) Please note that 'biosafety level' design requirements differ from 'animal biosafety level' design requirements, and biological laboratories where vertebrate animal research is performed should also meet design requirements in the most recent version of the Guide for the Care and Use of Laboratory Animals, also known as 'the Guide', which is currently in the 8th edition.

(B) Laboratory Programming

(1) Designers should request a copy of FAMA's completed Laboratory Planning Questionnaire.

(2) The Laboratory Planning Questionnaire is designed to document the research environment's requirements including the use, anticipated equipment, hazards, and required building systems infrastructure. The questionnaire allows FAMA to advise on facility capability, building, location, space, scope, and budget of any proposed renovation, alteration, or change in use. This document is also used by Environmental Health and Safety (EHS) as the primary means to understand proposed hazards and communicate requirements and recommendations for registration, compliance, and laboratory operations. Laboratories are required to comply with MAQs within an identified control area.

(3) Proposed laboratory equipment shall be reviewed with FAMA to confirm the proposed location has the building systems infrastructure necessary. FAMA may propose alternate locations where building systems infrastructure can support equipment requirements.

(4) Requests should include equipment cut sheets, the manufacturer's specifications, and installation guides when available.

(C) Research Laboratory Space Planning

(1) Laboratory space planning should be modular, adaptable, and organized using generally accepted laboratory design best practices.

(a) Existing building systems' capacities and capabilities will be reviewed from a structural, space, control area, HVAC, electrical, and plumbing perspective determining the limits achieved through typical lab layouts defined by research type.

(b) When possible, lab spaces should be located on the top floor of the building to facilitate equipment exhaust through the roof.

(2) Lab Bays

(a) A typical preferred research lab planning module is 11′ wide to accommodate; 36″ deep fume hoods, 60″ aisle, and 30″ deep bench. 10′-6″ is the minimum width.
(b) Length of lab planning modules may vary but is typically 30′-35′. The University considers two 11′ wide lab modules to be a lab bay, ideally, 22′w x 30′+ d, yielding approximately 660 net assignable square feet.
(c) Walls separating lab bays should be avoided when security protocols allow, and environmental pressurization is maintained.

(3) Circulation

(a) Ante rooms or ante areas should be provided for the donning of PPE.
(b) Labs shall have a minimum circulation clearance of 44″ and a minimum aisle clearance between benches and fixed equipment of 57″ (4′-9″), 60″ (5′) is strongly preferred.
(c) A closed aisle where fixed benches meet a perpendicular wall (dead-end T-shape) allowing only single-direction circulation is not acceptable.
(d) Secondary egress routes should be considered in hazardous settings.
(e) Adequate clearance should be provided for all controls, switches, filters, dampers, valves, and serviced components.

(4) Fume hoods are to be located away from primary parallel circulation routes and all doors accessing the space. Fume hoods should not be in corners or within the path of a single means of exit. Fume hoods should not face each other across an aisle.

(5) Fixed equipment such as fume hoods, sinks, eye washes, emergency showers, tank farms, manifold systems, vented gas cabinets, etc. should be carefully located to maximize future adaptability.

(6) Fixed casework is ideally placed at the perimeter of labs adjacent to other fixed equipment.

(7) Mobile casework with overhead services is encouraged to provide future adaptability and flexibility for evolving research and equipment needs.

(8) Space within the lab must be provided for loose equipment such as flammable and combustible cabinets, hazardous waste storage, refrigerators, specialty equipment, and tank farms (quantity dependent upon research type).

(a) Tank restraint systems are required.
(b) Toxic and highly toxic compressed gases, as per EHS, require a ventilated gas cabinet.

(9) Designated storage space should be provided for lab carts. The location must not reduce the width of corridors or aisles to less than code-required widths.

(10) Chemical storage shelves shall not be placed above laboratory sinks.

(11) Provide a storage room or Janitorial Cabinet, 36"W x 18"D x 72"H, for lab-specific cleaning supplies and equipment (mops, mop buckets, etc.)

(12) Provide a break area, collaboration area, or study lounge adjacent to the research lab. The area should have ample power for charging personal devices, a refrigerator, and a microwave. Consumables shall not be stored in lab areas.

(13) Provide lockers or storage areas outside the research lab for personal effects (coats, purses, etc.).

III. Finishes and Fixtures

(A) Flooring

(1) Flooring shall be chemically resistive resilient flooring with an integral cove base unless otherwise instructed.

(B) Doors and Door Hardware

(1) Door openings providing access to wet labs should be a minimum of 42″ wide, preferred 48″, achieved through a 36″ active leaf and 12″ inactive leaf.

(2) Provide segmented access control for new or fully renovated labs unless otherwise instructed.

(3) Provide vision lites, latches, door closers, and hardware as required by code. Where possible, lab doors should swing (out) in the direction of egress.

(C) Windows

(1) Interior communication or observation windows should be reviewed with FAMA and Research & Innovation to ensure security requirements are met.

(2) Windows in wet laboratories shall not be operable. If existing windows are operable, they should be secured to maintain pressurization and prevent turbulence.

(3) Exterior windows should be reviewed with FAMA as lighting and temperature controls may affect research activities.

(D) Ceilings

(1) The preferred ceiling height is within an 8′-6″ to 10′ AFF range to provide efficient air changes. Laboratory design documents shall include acoustical design best practice measures.

(E) Fume Hoods

(1) Ductless fume hoods are not permitted. University minimum fume hood size is 36″ deep x 72″ wide unless otherwise instructed.

(2) Fume hood acid storage/flammable base cabinet shall be integrated with fume hood. Do not use general-purpose cabinetry under the hood.

(3) The fume hood shall have airflow monitors and provide an audible and visual alarm if the velocity drops below a set level, indicating potentially unsafe conditions.

(4) ADA requirements should be discussed with FAMA during schematic design.

(F) Casework

(1) All laboratory casework shall reference, adhere to, and comply with recommended practices by the Scientific Equipment and Furniture Association (SEFA) when considering casework specifications, materials, detailing, and finishes. Reference; SEFA 2.3, SEFA 8.

(2) Typical floor-mounted closed base cabinets may be specified in metal or approved hardwood. If hardwood, follow AWI recommended quality standards.

(3) Mobile casework shall be height adjustable and consider integral lighting, power, and data.

(4) Cabinets for solvent or flammable liquid storage shall be listed and labeled as complying with requirements in NFPA 30, and cabinets shall be properly grounded and vented.

(5) Glass front cabinets are preferred.

(6) Clearly define performance criteria in specifications and submittals.

(G) Countertops

(1) Laboratory work surfaces shall comply with recommended practices by the Scientific Equipment and Furniture Association (SEFA) when considering work surface specifications, materials, detailing, and finishes. Reference; SEFA 3.

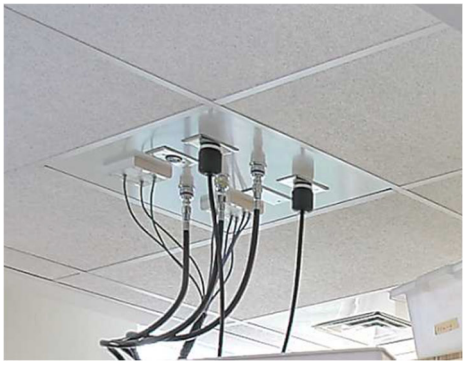
(2) Countertops shall be chemical and abuse-resistant. Plastic laminate or wood are not acceptable within wet labs.

(3) Clearly define performance criteria in specifications and submittals.

(H) Overhead Service Carriers

(1) Utilize Overhead Service Carriers to maximize flexibility and allow for future expansion with minimum effort. Carriers should accommodate standard laboratory gases, air, vacuum, specialty services, power with twist lock connection, and data

(2) Ceiling panels are ideally located flush with a finished ceiling if suspended for access, or in a lab with no finished ceiling, maintain a minimum of 7′-0″ AFF (Above Finish Floor) clearance to the bottom of the manifold.



(I) Process Piping

(1) Compressed air may be available is certain locations from the central utility plant.

(2) Vacuum, Distilled Water, and neutralizing tanks, and gas storage shall all be addressed at the Building System or Point of Use as needed.

(3) Provide all available building systems services to fume hoods, benchtops, and tank farm manifold systems to overhead service carriers. Extend branch piping to all fixed equipment and service chases with valve taps.

(4) Confirm requirements for coaxial tubing with EHS.

(J) HVAC

- See Division 23.00.00 HEATING, VENTILATING, AND AIR CONDITIONING (HVAC)

(1) See Division 23 for Fast acting venturi valves

(2) Design HVAC per code with the design minimum air change rate of 6 air changes per hour.

(3) Lab air pressures shall be specified and called out on the plans and control sequence.

(K) Plumbing

- See SECTION 22 40 00 PLUMBING FIXTURES for information on emergency flushing equipment.

(1) All biology labs, regardless of biosafety level, shall have a handwash sink and eyewash inside the laboratory. It is essential that hands are washed before leaving the laboratory. Therefore, the sink should be located close to the egress. !

(L) Power

- See Division 26.00.00 ELECTRICAL

(1) Provide dedicated panels to support each lab bay fed by normal power. Provide a panel serving multiple labs to provide standby power. Provide a room UPS and distribution panel for equipment rooms that serve sensitive laboratory equipment including refrigerators and freezers.

(2) Supply should be sufficient to support 30% growth.

(3) Designers shall work with FAMA to identify the appropriate power distribution plan.

(a) Reliance on surge protectors as "permanent" power sources should be avoided.
(b) Reliance on floor boxes is discouraged.

IV. References

(1) Research Laboratory – Planning Fundamentals (nih.gov)
(2) Laboratory Door Design Considerations (nih.gov)
(1) https://orf.od.nih.gov/TechnicalResources/Pages/DesignRequirementsManual2016.aspx
(2) Content sourced from the University of Syracuse; https://answers.syr.edu/display/ecs/Laboratory+Planning+and+Design+Guidelines