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Date	Section	Description of Change

THE FOLLOWING INFORMATION IS SPECIFIC TO A 'LABORATORY' SPACE TYPE AND IS IN ADDITION TO ALL PREVIOUSLY STATED STANDARDS LISTED IN DIVISIONS 01 – 33 AND APPENDICES.

The codes and standards referenced within UO design standard shall be considered part of the project requirements. In cases where there is a conflict between the adopted or selected code/standard and UO design standards, the most stringent, technically appropriate, and conservative criteria shall apply.

Where it is unclear which set of requirements governs, the design team shall consult with the UO Owner Representative.

Numerous industry guidelines and standards must be followed. The Architect/Engineer (A/E) shall be familiar with all applicable requirements and reference documents. The most current edition of each referenced code and standard shall apply.

DEFINITION AND PURPOSE

1. The higher education laboratory space type is broadly composed of specialty facilities designed to support engineering and scientific research and development, inclusive of specialty facilities designed to support hands-on instruction with engineering and science.
   a. Laboratories conduct work on a non-production basis and at a scale of operations designed to be safely carried out by individuals who are either working alone or working in small independent clusters.
   b. Laboratories may be "dry": lacking significant use of hazardous materials but potentially including high physical hazards such high-energy equipment or other hazardous operations.
   c. Laboratories may be "wet": using diverse types of hazardous materials inclusive of solids, liquids, and gases.
   d. Laboratories may be "theoretical", "computational", or "nonbiomedical clinical": lacking significant health or physical hazards.
2. This section's purpose is to specify design requirements that are in addition to consensus codes, regulations, and standards, and to provide clarification on implementing health and safety or building services requirements applicable to new or renovated university laboratories.

UO LABORATORY TYPES

1. Individual labs may vary from these models in level of risk, materials and systems, and other respects. Labs are expected to be generic within categories to allow flexibility of future assignment with minimal redesign of building mechanical systems:
   a. **Bioscience/Biomedical**: moderate chemical use; moderate solvent use moderate radioactivity use; moderate to high use of carcinogens, controlled substances, toxics, mutagens, and infectious materials. These labs are designated as either Biosafety Level 1, Biosafety Level 1+ or Biosafety Level 2 (BSL1, BSL1+ or BSL2). BSL1 and BSL2 are defined by CDC/NIH standards. Labs at UO designated as BSL1+ are similar to the BSL2 designation except for differing training requirements by lab staff that are co-occupying the lab space. The UO does not permit laboratory work requiring BSL3 nor BSL4 containment and practices.

b. **Engineering & Device Fabrication**: moderate to high chemical, corrosives, cryogen, compressed gas & solvents use; moderate to high electrical or physical energy hazards.
c. **Synthesis chemistry**: high chemical use; high flammable solvent use; high corrosive liquids use; high gas use.
d. **Analytical chemistry**: low to moderate chemical use; moderate solvent use; moderate to high gas use.
e. **Optics**: low chemical use; moderate solvent use; moderate cryogen and compressed gas use; high electrical or physical energy hazards.
f. **Physics**: low chemical use; high cryogen use; high electrical or physical energy hazards.
g. **Clinical, including Human Physiology**: low to moderate chemical use; moderate to high use of inert and oxidizing compressed gases; BSL1 or BSL2 materials; x-ray diagnostic equipment.
h. **Animal Research**: low to moderate chemical use; significant use of carcinogens, toxics, mutagens, and infectious materials; x-ray diagnostic equipment.
i. **Geological sciences**: low to moderate chemical use; moderate corrosive use; moderate flammable gas use; moderate to high physical energy hazards.
j. **Anthropology**: low to moderate chemical use; low to moderate infectious materials use.
k. **Fine arts studios and maker spaces**: moderate to high chemical use (low diversity and high volumes); moderate to high flammable and corrosive liquids use; moderate aerosols use.

SPACE PLANNING & GENERAL ITEMS

10. Academic research and teaching laboratories: B-occupancy design per OFC Higher Education Laboratories. Specialty laboratories and hazardous materials storage rooms may require H-occupancy design per OFC.
11. For research spaces allocate 150 ft² per occupant.
12. For equipment spaces allocate 20-25/ ft² per occupant.
13. For teaching labs allocate 50 ft² per occupant
14. Locations of chemically intensive spaces are to be determined with discussion between EHS, D&C Engineering, CPFM Facilities Services, and Science department requesting the space. Locations shall be designed to comply with Oregon Fire Code hazardous materials storage and use requirements.
15. Design teams should assume laboratory settings will store a minimum of 4 Liters of flammable liquids or 75 cubic feet of flammable gas and have a minimum unoccupied ventilation rate of four room air changes per hour.
16. Double-sided aisle widths should be no less than 5ft-0in. Any reduction requires UO consultation and approval.
17. Single-sided aisle widths should be no less than 4ft-0in. Any reduction requires UO consultation and approval.
18. Lab benches should be planned for a minimum of 30 inches in depth without obstructions. Reduced depth requires UO consultation and approval.
19. **Gas Cylinders:**
    a. Provide open wall space for cylinder storage and chain restraints. If cylinders are not required upon occupancy, reserve wall space and provide backing for future cylinder storage and restraints.
    b. Primary restraints must be chain style to withstand a fire event. Secondary strap style is permitted in addition to chain style but not in place of.
    c. Restraints for gas cylinders must comply with various safety codes and regulations, including NFPA, OSHA, and the IBC.
20. **Lab entrance:**
    a. Lab entries shall be a minimum of 36” to accommodate equipment and accessibility. Special cases

may require larger openings or door pairs determined as part of a project design.

b. For the purpose of safety, provide transparency at door with relight or glass panel in a door to corridor, when possible.
c. Doors leading to and from labs will have automatic closure hardware.
    - Closers adjusted to a slow close for safety during chemical transportation.
d. Lab casework and equipment along egress paths require earthquake restraints.

21. Provide user desk and write-up space outside of the laboratory.
22. The exit path shall be from greater hazard to lesser hazard.
23. Kitchenettes, human food storage, etc. should be in separate spaces than the lab, and such that path of travel from kitchenette to the office does not move through lab space.
24. Provide storage space for: (1) Hazardous (and non-hazardous) waste containers and secondary containment devices (for liquid wastes), (2) miscellaneous equipment such as carts, and other mobile equipment.
25. Serviceable building components shall be concentrated in accessible locations. For example, lab utility shutoff valves should be concentrated and located at the lab entry vs. over an active research bench.
26. No operable windows.
27. The lab design shall feature adaptable work areas that can be easily modified to accommodate future changes.
28. Local alarms will be implemented in high volume use/storage areas of simple asphyxiants and shall not connect to building fire alarm.

CHEMICAL EVALUATION AND STORAGE

1. The Owner's Rep. will facilitate coordination with Design Team and EHS to evaluate:
    a. Chemical types, usage, and storage.
    b. Central hazardous waste accumulation areas for lab building.
2. Satellite hazardous waste accumulation areas for individual labs. Whenever possible, H-occupancy hazard spaces are to be located on ground floors.
3. No custom fabricated chemical or acid storage units; manufactured units only. Confirm with lab users chemical storage size and weight of containers.
4. Chemical and solvents shelf storage shall incorporate edge restraint system to mitigate non-structural earthquake hazard.
5. **Flammable, Corrosive & Acid Cabinets:**
    a. All cabinet types should have self-closing doors with coordinators.
    b. Basis of Design (BOD) for exhaust systems in laboratory building is to be two separate systems, one for lab exhaust and one for general building exhaust.
    c. Manufactured flammable, corrosive, and acid storage cabinets only. Cabinets may not be field altered such that fire ratings are jeopardized in any way.
    d. All fixed cabinet types below fume hoods to be vented with fume hood unless otherwise approved. This includes flammable cabinets.

CASEWORK & FURNITURE

1. **Load Requirements**:
   a. Wall construction and shelving hardware must support a minimum of 20 lbs per linear foot of shelving.
   b. 440-pound load rating for 16-inch-deep shelf.
   c. 520-pound load rating for 12-inch-deep shelf.
   d. Drawer slides must have a minimum of 100-pound capacity.
2. **Drawer and Door Pulls:**
   a. Steel wire, 1-3/8 x 4-inch pull.
   b. US10D finish.
5. **Wire shelf guards required:**
   a. Minimum of 1/4 inch diameter.
   b. Lengths not to exceed 24in without intermediate supports.
6. **Lab Services Access:**
   a. Valves, controls, and shut-offs are required to be accessible. No junction boxes in or under casework.
   b. Automatic emergency shutoffs for lab services to meet code minimum only unless otherwise reviewed and approved by CPFM and EHS.
   c. Access must be by quarter-turn hardware per Section 08 30 00; access is NOT to include removal of screws.
7. **Counter tops:**
   a. High chemical exposure: cast epoxy, stone, or stainless steel. No phenolic-resin.
   b. Moderate or low chemical exposure: Acid-resistant plastic laminate, stainless steel, and phenolic resin are allowable if appropriate with chemical exposure.
   c. Grommets shall be provided in countertops when utilities below the countertop are intended to be used at the worksurface.

FINISHES

1. **Floors:**
   a. The following space types should use poured resinous flooring with integral covedbase:
      - wet spaces, such as autoclave rooms
      - high-volume liquid chemical storage
      - animal facilities
   b. All other lab spaces require a seamless and continuous sheet rubber with welded seams and cove base.
      - Manufacturers known to be acceptable: nora, Mondo, and Tarkett.
   c. Flooring should continue under casework, fume hoods, etc.
   d. All manufacturer recommendations and directions must be followed and performed for the initial cleaning of all flooring systems.
2. **Ceilings:**
   a. Ceilings are not required in general lab spaces.

b. Ceiling required in chemical storage rooms.

c. If ceiling is not provided, DO NOT paint overhead Mechanical, electrical and plumbing. Structure and fire protection piping can be painted.

d. Protect sprinkler heads from paint.

LAB EQUIPMENT

1. **Biological Safety Cabinets:**
   a. EHS approval of type and placement required.
   b. Design and placement standard per NIH DRM Appendix A: Biological Safety Cabinet (BSC) placement Requirements for New Buildings and Renovations.
   c. Biological safety cabinets shall not be plumbed for flammable gas.
2. **Emergency Fixtures:**
   a. Emergency fixtures known to be acceptable: WaterSaver and Haws.
   b. Every lab suite must have a minimum of one safety shower and one eye wash, located as close as possible to an exit, within an exit route, and over a drain. Shall not be located near electrical panels.
   c. The path of travel to emergency stations should be clear of obstructions and as straight as possible. If a hazard is separated from the emergency station by a door, additional fixtures or operational controls reviewed by EHS should be added.
   d. Emergency fixtures with local thermostatic mixing valves shall have a temperature gauge.
   e. Isolation or shut-off valve for each emergency fixture is required.
   f. When possible, provide an additional emergency shower fixture and floor drain in a gender-neutral restroom or accessible stall for modest use.
   g. Sink mounted eyewashes located under drying racks and/or storage shall be protected from contamination.
   h. All fixture drains to be hard-piped.
3. **Vacuum pumps:**
   a. Housing vacuum pumps within acoustical enclosures is preferred.
   b. Vacuum pump cabinets located below fume hoods:
      i. Should be exhausted in combination with the fume hood exhaust.
      ii. Vacuum tubing pathway from the cabinet, through the fume hood work surface, and into the fume hood may not have any bends.
      iii. The vacuum tubing pathway penetration through the fume hood work surface must extend above the work surface to provide spill prevention.
   c. Stand-alone vacuum pump cabinets do not require an exhaust connection unless odors need to be eliminated from the space

MECHANICAL

1. Snorkels and spot exhausts require a balancing damper at a minimum.
2. Lab spaces should address room envelope integrity to ensure proper balancing and pressurization; special attention needed in renovations.
3. Occupancy sensor types in animal areas should be reviewed by animal facility operators prior to use. Ultrasonic sensors can be stressful to animals and use of infrared only devices may be required.

FUME HOODS

1. All fume hoods are to be certified by the ASHRAE 110 standard.
2. Epoxy based sealants only.
3. Service valves, switches, etc. are to be front-mounted for serviceability.
4. Interior light must be accessible from outside of the hood for replacement and service.
5. Duplex 120v grounded GFI outlet on both left and right face of hood.
6. One fume hood per lab complex is to be adaptable for ADA use. Exceptions require approval of CPFM and EHS.
7. Explosion-proof and any special-use hood interiors shall be reviewed and approved by EHS.

8. **Hood Sashes:**
   a. Vertical sashes ONLY.
   b. Use of any automatic sash positioner requires UO review and approval. UO review includes EHS, CPFM, and the occupying research group to ensure that all parties understand, and agree to, all benefits and impacts. If used, factory installation is required by the fume hood manufacturer.
   c. All removeable access panels are to remain free and clear for removal to perform maintenance.
   d. The use of Ductless fume hoods is discouraged. To consider purchase and installation ductless fume hoods requires the Owner's Rep facilitated coordination of review and approval by EHS.
   e. Constant volume fume hoods shall have bypass grills of adequate size to maintain an acceptable face velocity over the entire range of sash movement.
   f. Auxiliary air fume hoods shall not be used.
   g. No fume hood installations are allowed in rooms with return air to other spaces. All rooms with hoods shall have 100% exhaust.
   h. Perchloric acid and radioactive iodination hoods shall not be exhausted via a manifolded lab exhaust system. Independent ducting is required.
   i. Owner's Rep will facilitate the review of all manifold lab exhaust systems with EHS and Design Team.
   j. In new construction, fume hoods shall be selected and balanced to operate with 80 FPM at an 18-inch sash height. The fume exhaust system should be sized such that fume hoods can operate with 100 FPM at an 18-inch sash height. This includes sizing of central system equipment such as exhaust fans, as well as local components at an individual hood such as a terminal unit. The lab designer shall specify on the drawings both full open and operating design face velocities and areas. For each hood installed with variable flow controls minimum flows and response times shall also be specified.
   k. When the lab area is in the unoccupied mode it is encouraged to provide control systems that will reduce the fume hood face velocity within parameters of health and safety.
   l. Variable Air Volume (VAV) hoods should be the basis of design. Renovations may consider Constant Air Volume (CAV) as required.
   m. Drawings shall specify minimum flows, and response times. Minimum exhaust volume shall conform with ANSI Z9.5.
   n. VAV hoods should be provided with an emergency switch that allows the exhaust volume to go to maximum flow velocity with a closed sash or for a set time; ANSI Z9.5.

9. **Hood placement:**
    a. The location of fume hoods shall encourage horizontal, laminar flow of supply air into the hood, perpendicular to the hood opening.
    b. Hoods shall be placed at least 10ft from any doors; except doors that are only for use in emergency conditions.
    c. Corner locations shall be avoided unless two paths of egress are available.
    d. Hoods shall be placed to avoid pedestrian traffic immediately in front of the hood.
    e. Biological Safety Cabinets shall not be placed directly opposite a fume hood as this will cause turbulence at the face of both the fume hood and Biological Safety Cabinet.
    f. Access for cleaning at top of fume hood is required.
10. **Fume Hood Testing & Commissioning:**
    a. Proper operation of fume hood must be demonstrated by the contractor installing the fume hood prior to project closeout. Demonstration includes successful ASHRAE 110 testing, and completed testing and balancing services with no unresolved issues.
    b. All new and renovated fume hood installations shall be properly commissioned with a balance performed of the total exhaust flow using a duct traverse followed by face velocity measurements. If the hood is equipped with VAV or two position controls, these shall be exercised in all modes of the intended operation.
        - Hood testing shall be in accordance with current methods outlines in ASHRAE standard 110.
    c. Where possible the recommended containment performance test is ANSI / ASHRAE 110. All center points of a uniform nine-point grid at the full open face of a hood shall have velocity readings within +/- 15 FPM of each other.
11. **Controls and Alarms:**
    a. All new hoods must be equipped with minimum alarm points:
        - Visible and audible alarms for high and low face velocity.
        - Local alarm reset and calibration.
    b. Fume hoods shall be equipped with an operational display panel that is compatible with both the hood manufacturer's fume hood controller and the building's Building Automation System (BAS). The design team is responsible for ensuring full compatibility between these systems. The preferred approach is for the display panels to be provided by the BAS vendor and specified under Division 25.VAV hoods shall be equipped with indicators of airflow (CFM) and/or energy use.
    c. VAV hoods control systems shall have a minimum acceptable response time of 10 seconds.
    d. Within design discussions, determination of need for optional user over-ride on VAV shall be accommodated for full exhaust with a DDC system reset to VAV after 2 hours with a digital display of remaining time until VAV reset.
12. **Supply Air Criteria:**
    a. Supply air delivery must be designed to ensure hood performance and safety.
    b. Perforated duct diffusers may be used. Discharge velocities may not exceed 200 FPM at the diffuser outlets or anywhere else within the lab room.
13. **Ducting Details:**
    a. Duct materials shall be compatible with vapors to be exhausted. No galvanized duct work in lab

exhaust stream.

b. All duct seams and joints shall be sealed. Stainless steel ductwork shall be welded. Solvent welding is acceptable for PVC and FRP ductwork.

c. Fume hood exhaust ducts shall not contain fire dampers.

d. Effluent discharge shall be a minimum of 8ft above the roof surface with velocity of 3000 FPM at full flow. Effluent dispersion modeling is required if building supply air intakes exist on project or nearby buildings.

e. Fans shall be as close to the discharge point as possible. If located in a mechanical penthouse, the penthouse shall be ventilated at a minimum rate of 1 air change per hour.

f. Duct chases shall be reasonably oversized for future additional ducts. Systems that require maintenance or inspection shall be accessible. Labs backed on utility corridors are encouraged.

14. **Fume Exhaust Systems:**

a. The design must carefully consider acoustics and result in a lab noise level of NC 40 or lower. Proper acoustic design shall be accomplished by providing appropriate fan size and type. Sound attenuators are acceptable. When used, sound attenuators must be packless and constructed of 304 stainless steel.

Lab Chemical Exhaust		
Description	Construction	Design Criteria
Equipment, Grille, etc. to Air Terminal	304 Stainless Steel, fully welded Pressure class: -2"	(1)
Air Terminal to Main	304 Stainless Steel, fully welded Pressure class: -4"	(1)
Exhaust Air (EA) Mains to Shaft	304 Stainless Steel, fully welded Pressure class: -6"	(2)
EA Shaft	304 Stainless Steel, fully welded Pressure class: -6"	(2)
EA in Penthouse	304 Stainless Steel, fully welded Pressure class: -6"	(3)
(1) Max pressure drop: 0.08"/100ft and less than 1,200 fpm (2) Max pressure drop: 0.15"/100 ft and less than 1,500 fpm, except 1,200 fpm through fire dampers (3) Max pressure drop: 0.2"/100ft and less than 2,000 fpm for mains, except in mechanical room or other unoccupied spaces less than 2,500 fpm		

15. **Fume Hood Interior:**

a. Horizontal work surfaces are to be cast epoxy or stainless steel

- Radioisotope hoods are to have stainless steel horizontal surfaces.

b. Horizontal work surface must have a marine edge.

c. Penetrations in horizontal work surfaces must have a raised edge.

d. Cup sinks are discouraged but if required then they should have sink edge raised relative to work surface for surface small spills containment.

e. Existing hoods that are functional may be relined with EHS and CPFM approval.

PLUMBING

1. **Backflow prevention:**
   a. To be provided either building-wide, by floor, by zone, or by lab.
   b. If lab use calls for a sediment and plaster trap/interceptor; code compliant systems must be installed and must be easily serviced by the lab user.
2. **Piping material standards:**
   a. Cold water: copper type L, insulated.
   b. Hot water: copper type L, insulated.
   c. Compressed air: copper type L braised joint, or black iron schedule 40.
   d. Natural gas: black iron. Do not use threaded connectors; couplings must be used.
   e. Nitrogen: copper type L, braised joint, purge pipe per proper nitrogen installation procedure.
   f. Purified water: threaded PVC schedule 80 or stainless steel.
   g. Lab waste pipe shall be NSF listed sch40 polypropylene with mechanical joints.
      - Fusion welded joints are not allowed. Exception may be granted for buried below-grade piping.
      - Tie to main with cement solvent through lab bench or sink, threaded is preferred.
3. **Sinks:**
   a. Epoxy resin or stainless steel.
   b. Cup sinks with non-removable strainers preferred.
4. **Valves, controls, and shut-off valves:**
   a. Except for natural gas ALL utilities and services at each lab bench or overhead service carrier. May NOT be buried within casework.
   b. All valves shall be clearly labeled.
5. **Non-potable water:**
   a. All fixtures served by lab water and/or industrial water should be labeled ‘Non-Potable Water – Do Not Drink’ signage.
   b. Researcher provided water polisher equipment is allowed and requires a piped RO source.

ELECTRICAL

1. **Lighting:**
   a. Undershelf task lighting fixtures are to be switched only.
   b. Occupancy sensors should not control lighting in microscope rooms, laser rooms, or animal holding rooms.
   c. Occupancy sensor types in animal areas should be reviewed by animal facility operators prior to use. Ultrasonic sensors can be stressful to animals and use of infrared only devices may be required.

2. **Power:**
    a. Coordinate with Owner's Rep the panel locations at lab entries. Either exterior in the corridor prior to entry, or interior and immediately adjacent to entry.
    b. Electrical panel location shall not interfere with access to safety shower or room egress pathway.
3. **Wiremold:**
    a. Wiremold 4000 or 5000 series, depending on the application.