SECTION 13 00 26 – LABORATORY ELECTRICAL DESIGN CRITERIA

1. INTENT AND USE

A. This section details some of the most common issues affecting the appropriate, safe and effective installation of electrical systems for research laboratories and lab spaces. It is not intended to include all electrical installation requirements or good engineering and installation practices. As such, it does not include comprehensive guidance on standard architectural practices or all building code requirements.

B. In addition to good practice and Brown's past experience, these guidelines are based upon:
   1. National Electrical Code
   2. Applicable NFPA and ASHRAE Standards
   3. Applicable Brown Design Standards

2. GENERAL LAB ELECTRICAL DESIGN CONSIDERATIONS

A. The project team shall carefully review and design the lab electrical systems to suit the expected lab use. Lab areas and spaces that require special construction means and methods shall be clearly noted and identified on the project drawings. Considerations include, but are not limited to the following:

   1. Corrosives: Certain lab chemicals and processes are corrosive to normal metal electrical devices and enclosures. Evaluate the need for non-ferrous, plastic or nonmetallic wiring devices, device covers, lighting fixtures, etc. in these locations.

   2. Combustible gas and dust: In labs and spaces where combustible and flammable gasses are utilized or combustible dust may be present, provide proper area classification per NEC requirements and detail each of the classified areas on the project drawings. Utilize properly rated electrical devices in these areas.

   3. Wet Locations: Areas subject to washdown, sterilization, steam, wet lab spaces subject to washdown, and all Vivaria spaces shall be designed utilizing water resistant, corrosion-resistant wiring methods, materials and products that generally conform to NEMA 4X/ IP54 rated use.

   4. Dusty and dirty locations. In labs and spaces where dirt and dust may be present, utilize cast, weatherproof electrical device boxes with gasketed covers. Use compression, hub or threaded conduits and connectors in these areas.

B. The project team and engineer shall provide a "basis of design" statement for the lab electrical system designs that clearly defines all system criteria and assumptions made during the project design process.

3. LAB POWER DISTRIBUTION PANELS

A. Laboratories and lab equipment, both 120/208 and 480/277 Volts, shall be served from dedicated lab panels that are separate from distribution panels serving building MEP loads.

B. Evaluate the benefit of providing dedicated lab panels for both 480/277-volt and 120/208-volt electrical loads for each individual lab.

C. Avoid locating distribution panels serving other than dedicated lab circuits within lab spaces.

D. Lab distribution panels shall be individually served via dedicated circuits from upstream distribution panels, switchboards or bus ducts; "daisy-chained" distribution panel feeders are not acceptable.

E. Dedicated electrical power distribution panels for larger labs and lab spaces with a high concentration of branch circuits shall be provided.

F. Care shall be taken to avoid locating panels within locked labs or areas that may be inaccessible due to spills or other hazards; preference is to locate lab panels in alcoves or closets adjacent to the lab, accessible from the main building corridor.

G. Where distribution panels are installed within labs, locate them such that code-required clearances for access and service may be readily maintained and configured to allow for the ready installation and reconfiguration of their branch circuits.

H. Do not serve lab electrical loads from panels located on alternate floors from the lab floor.

I. Preference is for panels in lab spaces to be flush-mounted in walls.

J. Provide distribution panels with 20-40% spare load capacity and spaces for future circuits.

4. CIRCUITS SERVING DEDICATED LAB EQUIPMENT

A. Provide lockable, local disconnect switches for all hard-wired, dedicated circuit lab equipment. Avoid the use of circuit breaker lock-outs. Exceptions for local disconnect switches are for cord-and-plug connected equipment.

5. RECEPTACLES

A. Locate electrical receptacles and switches to minimize their exposure to spilled liquids, i.e. avoid locating receptacles across the front of a chemical fume hood below the work surface.

B. Lab Walls: Locate sufficient 120-volt receptacles on all open walls to eliminate the need for extension cords.

C. Lab benches:
   1. Provide lab bench areas with surface metal raceway with integral receptacles with receptacles spaced on 12-24 inch centers, or similar continuous "plugmold" receptacles, located on equipment racks above the benches.
      a. Do not use "tombstone" receptacles mounted on the lab benches.
   2. Confirm location of receptacles for equipment under benches and above. Ensure proper placement receptacles for the planned equipment locations.

D. Ceiling-mounted, pendant drop receptacles shall be provided as needed for laboratories where equipment will be located away from walls. Avoid the use of floor-mounted receptacles in labs to reduce the chance of device failure and shock from liquid spills.

E. Avoid locating switches, wiring devices, receptacles and electrical equipment within 6 feet of eye wash /showers.

F. Provide Ground Fault Circuit Interrupter (GFCI) protection for receptacles located within 6 feet of a sink or other wet location, including fume hoods.
   1. GFCI receptacles shall not be used for critical equipment such as refrigeration, sump pumps, or gas detectors; use dedicated single receptacle outlets for such equipment.

G. Laboratory convenience receptacle circuits shall be sized as 20-amp circuits, with no more than 10 duplex devices per circuit; avoid use of 15-amp circuits.

H. Provide dedicated receptacles, of the proper voltage and current ratings, for dedicated cord-and-plug connected lab equipment, in addition to the general convenience receptacles noted above.

6. LIGHTING

A. Provide area and task lighting to provide illumination levels per IES (Illumination Engineering Society) guidelines.

B. In lab spaces and other areas where hazardous materials are in continuous use or stored, provide an unswitched light fixture(s) to reduce the possibility of the area accidently going completely dark.

C. Provide emergency lighting within all lab spaces and other areas where hazardous materials are used or stored.

D. Lab lighting sources shall be instant-on LED.

E. Lighting for fume hoods shall be provided by UL-listed fixtures external to the hood, or from dedicated fixtures provided as an integral part of the fume hood.

7. LIGHTING CONTROLS

F. Occupancy sensors for lighting control shall be designed and located to avoid the possibility of lights turning off within an occupied lab working zone due to a false reading.

G. Occupancy sensors for use in Vivaria areas shall be of the passive type (motion or IR type) only. Active and sonic type detectors are not allowed.

H. Integrate lab lighting control occupancy sensors with the lab Building Automation System (BAS) for lab HVAC occupancy control.

8. STANDBY POWER

A. During the design phase, carefully review the needs and expectations for standby power, which is typically provided by a local building generator, dedicated automatic transfer switch(es) and separate electrical distribution systems.

B. Standby power serving Lab and User equipment shall be fed from a dedicated automatic transfer switch and electrical distribution system, separate from the standby system serving the building

or lab HVAC systems.

C. Air handlers and exhaust fans and their BAS controls serving continuous research labs and vivaria shall be connected to a standby power source. Fume hood exhaust fans shall also be connected to a standby power source; fume hoods that are not used for the handling or storage of hazardous materials, such as in teaching labs, are not required to be connected to standby power.

D. Air handlers and exhaust fan equipment controls shall be configured to automatically restart upon restoration of a power failure or momentary power interruption, without affecting any of the control system's setpoints, calibration settings, or emergency status. After power returns, the system shall continue operation without the need for any manual intervention.

1. In lab environments with specialized chemicals or processes, review this provision in depth with the lab user, hygienist, design team and EH&S. Submit a standards waiver should lab use require deviation from this requirement.

E. Provide standby power for the following additional building and lab systems. Work with the PI, academic department and Facilities Operations to determine applicability.
1. Building heating system
2. Building Automation Systems (BAS)
3. Telecommunications closets and frame rooms
4. Domestic water pressure booster systems
5. Process cooling systems
6. Chilled water for Critical loads such as Vivaria (See Animal Care Facility Standards)
7. Dedicated lab equipment and user loads
8. Fume hood controls and lab ventilation control panels
9. Lab safety monitoring equipment (oxygen deprivation / chemical leak detection systems, lab equipment alarm monitoring systems, and lab design related systems requiring monitoring).

9. UNINTERRUPTIBLE POWER SUPPLIES (UPS)

A. Provide UPS where required to maintain power to loads that cannot tolerate poor power quality, momentary power interruptions or power loss. Strong preference is for local UPS to be provided for individual labs and lab equipment.

B. Type of UPS (on-line versus off-line style) and minimum battery run time requirements to be coordinated with lab user requirements.

C. UPS to be provided with factory bypass circuits to allow for operation of connected loads while UPS components are off-line for service /repair.

10. LASER LABS

A. Entryways to Class 3 and 4 laser-controlled areas shall have visible and/or audible signs indicating that the laser is energized and operating. Visible warning signs shall be of a color that may be seen when personnel are wearing laser safety glasses.

1. Provide additional signs inside the laser-controlled space as required, per consultation with PI's and EHS.

B. Where necessary, for example in high noise areas, audible warning horns may also be required. Considerations for the hearing and visually impaired shall also be made where required.

C. Provide clearly marked emergency "panic buttons" capable of deactivating the laser or reducing its output to a safe level at or below the MPE within the laser-controlled areas.

D. Provide appropriate grounding connections for laser power supplies and related electrical components.

11. X-RAY AND RADIATION FACILITIES

E. Entryways to permanently installed radiation-producing machines shall have visible signs indicating that the x-ray equipment is energized and operating.

1. Provide additional signs inside the x-ray-controlled space as required, per consultation with PI's and EHS.

F. Review the need for specialty RF mitigation, filters and shielding requirements for wiring entering x-ray spaces, and electrical equipment used within x-ray spaces. Review the need for supplemental grounding and bonding of electrical equipment, room shielding materials and building grounds. Clearly denote specialty requirements on the project drawings.

12. MISCELLANEOUS AND SPECIAL POWER REQUIREMENTS

G. Circuits serving sensitive Information Technology or data acquisition equipment may require the use of an isolated-ground conductor in addition to the required equipment safety grounding conductor. This isolated-ground conductor shall be terminated in a dedicated, identified isolated-ground receptacle or within the sensitive equipment.

H. Dedicated, isolated-ground conductors shall be run back to the separately-derived system source grounding conductor or ground bar (typically the upstream distribution transformer grounding connection, building service ground or dedicated isolated ground transformer), with no other connections to the equipment or electrical enclosure grounding conductor. Distribution panels serving isolated-ground circuits shall incorporate a separate, isolated ground bus that is clearly identified for this use.

I. Review the need for harmonic-rated distribution circuits and equipment serving electronic lab equipment loads.

J. Electrical equipment and controls within fume hoods shall be provided with a local disconnect service switch external to the hood, located within 15 feet, unless the equipment is plug-connected outside of the hood.

K. Provide rated bonding clamps and conductors to properly bond containers, gas cylinder racks, hoses, and other dispensing equipment to each other and the grounding system where flammable or combustible liquids are to be dispensed.

End Of Section