EHS Involvement in Laboratory Renovation and New Laboratory Construction

Rev 04-2021
Checklist I

Programming and Pre-Design: Assessing equipment and materials list

- Obtain equipment list if available
  - Assess what utility or gas hook-ups are required
  - Assess materials being used with equipment (hazardous chemicals, cryogens, gases, etc)
  - Assess for highly specialized equipment (such as irradiators)
  - Assess physical hazards (UV, laser, heat, mechanical, electrical, etc)
  - Assess structural load needs for heavy equipment
  - Assess whether magnetic or other shielding will be needed
- Obtain chemical list and quantities if available
  - Informs engineering controls and storage requirements
  - Flammable and corrosive storage requirements
    - Amount needed for anticipated chemical use
    - Will existing equipment be re-used?
  - Fire protection/Sprinkler requirements
  - Hazardous building designation
- Laser use
  - Vibration isolation
  - Temperature control
  - Process chilled water?
- Hazardous gas use?
  - Toxic Gas Monitoring System (TGMS) required?
  - Ventilated Cabinets Required
  - Thresholds for code requirements
- Cryogenic liquid use?
- Animal use?
- CFATs thresholds
- Select Agent use?
- Funding agency requirements (i.e. NIH Design Guidelines)
- Electrical requirements
  - Type of power required
  - Voltage requirements
  - Emergency back-up power
  - Number and type of outlets
  - GFCIs
Gas supply needs
- House gas vs. tank farms
- CO₂ liquid carboy manifold for >20 incubators
- Natural gas needs
- Oxygen monitoring for inert gases?
- Specialty gases at hoods? (lines must be copper and cleaned for O₂ use)
- House vacuum requirements

Lighting requirements

Anticipated types of waste production

Assess fume hood and other exhaust requirements including point exhausts and pump exhausts

Assess existing building HVAC system for exhaust and supply capacity if increasing exhaust demand

Plumbing needs
- Drains
- Acid neutralization system?
- Emergency irrigation supply and drainage

Will major abatement be required?
- Asbestos
- Perchloric acid hoods
- Heavily contaminated spaces and equipment
- History of mercury use in an area?
Checklist II

Schematic Design (SD): Building checklist

☐ HVAC
  o Energy conservation considerations
  o Fume hoods
    ▪ Variable volume vs. constant volume
    ▪ Zone presence sensors
  o Need for ventilation monitoring system? (CHIPS)
  o 100% outside air supply in labs and no recirculation of air from labs
  o Labs negative pressure to exterior spaces
  o Direct drive or double pulley and belts for fume hood exhausts
  o Determine air changes per hour (ACH) based on relative hazard
  o Location of supply/exhaust ducts relative to hoods and biosafety cabinets

☐ New building considerations and codes
  o Building codes – high rise flammable storage limitations
    ▪ High rise?
    ▪ Adequate number of “control zones”? 
    ▪ Variances needed?
  o Engage emergency responders in discussions
  o Knox/Lock box placement
  o Fire suppression
  o Fire alarms/location of annunciator panel
  o Emergency irrigation placement
  o Emergency egress
  o Location of Emergency Response Room
  o Building Security
  o Securing loading dock and access control
  o Managing receipt of hazardous materials to building
  o Room signage
  o Wayfaring
  o Equipment corridors
    ▪ Define permitted chemical storage, transport, dispensing and equipment
  o Autoclave size and proximity to labs it serves
  o Controlled centralized infectious waste storage
  o Building entryway flooring material
- Slip resistance?
- Coefficient of friction?
- Use of mats?

☐ Loading dock
  - Chemical/gas delivery and storage
  - Security
  - EH&S support/Emergency Response room
  - Secured infectious waste storage
  - Refrigeration for infectious waste storage
  - Chemical stockroom?
    - Flammable liquids or denatured alcohol satellite storage?

☐ Plumbing needs
  - Drains
  - Acid neutralization system?
  - Emergency irrigation supply and drainage

☐ Break room provided?
☐ Lockers provided?

Laboratory-Level “Building” considerations

☐ Room numbering change? Updates to fire panel needed?
☐ Need to seal/tub floors to contain floods?
☐ Determine where hazardous materials/equipment will be stored/used with egress in mind
☐ Where will waste be stored?
  - Radioactive waste
  - Chemical waste
  - Infectious waste

☐ Emergency power needs?
☐ Emergency shut-off needs?
☐ Lab Floor plan and orientation considerations
  - Egress
  - Door swings in direction of egress?
  - Windows provided in doors and/or interior walls?
  - Adjacencies considered?
  - Flood potential
  - Electrical panels placed where they won’t be blocked
  - Eyewash and safety shower placed where they won’t be blocked
  - Fume hoods and biosafety cabinets placed appropriately? (Away from doors, walkways and supply air vents)
- Separation of office space from wet lab space
- Path for material transport
  - Freight elevator location and openings, avoid passenger elevator use
- Consider possible future use of space and plan generically for potential chemical use and desk space needs
- Plumbing needs
  - Drains provided?
  - Corrosion resistant drain lines?
  - Emergency irrigation supply and drainage
  - Need for sinks in hoods?
  - DI water requirements?
  - Traps
Checklist III

Schematic Design (SD): Within the Lab: Furniture, Fixtures and Equipment

Specifications for:

- Ventilation controls
  - Fume hoods
    - Sash type
    - Alarms
    - Air foil
    - Sash lock
    - Materials of construction
    - Utility valves/switches located in hood
    - Need for built-in variable-voltage rheostat?
    - Sufficient number of receptacles on face without overloading circuits
    - Power to alarm? Outlet on top of hood for AC adapter
  - Biosafety Cabinet Type
  - Assess turbulence potential due to supply air and doorways and/or windows
    - Laminar or low-flow supply in small square footage or high hood density areas
  - Need for point-exhausts?
    - Flow confirmation or alarm if independent of fume hood exhaust
  - Glove boxes

- Chemical storage
  - Refrigerators and freezers
    - Household vs. UL-listed for flammable liquids vs. explosion proof
    - Temperature range requirements
  - Chemical segregation provisions
  - Maximum height of chemical storage
  - Storage cabinet labeling (i.e. “corrosives” vs. “acids” vs. “bases”, etc)
  - Acid cabinets
    - Appropriate type of cabinet for strong acids
    - Spill containment
    - Capacity
      - Biomedical: 1 gal per bench/8 gal per lab minimum
      - Physical Sciences: 3 gal per bench/15 gal per lab minimum
  - Flammable liquids storage cabinets (FLSC)
    - Meet NFPA 45, UL listed, and FM approved?
- Cabinet grounding
- Venting
  - “Stench cabinet” needed?
    - Must vent minimum of 2-4 cfm per cubic foot of cabinet space

☐ Casework
  - Distance of shelves from ceiling/sprinklers
  - Doors and/or locks on chemical and supply cabinets needed or preferred?
  - Back stops and lips on shelving
  - Materials of construction of cabinets and work surfaces
  - Adequate storage for chemicals, glassware, supplies, drying racks, books, notebooks, etc.
  - Available knee spaces for sitting/storage of waste carboys
  - Slanted tops on wall cabinets or extend to ceiling to prevent storage on top of cabinets
  - Under-hood vacuum pump cabinet needed?
    - Electrical provided?
    - Active exhaust for cabinet interior or pass-through to hood or exhaust duct provided to vent pump?
    - Cooling fan and louvers to remove heat from cabinet?

☐ Emergency irrigation equipment
  - EH&S approved eyewash/shower equipment selected?
    - Combination eyewash/shower installed where possible
    - Deck-mounted model when sink-placement is required
    - Hands-free operation
  - Discharge to drain for eyewashes
    - Trap primer
  - Signage or decals
  - 10-second travel distance and no passage through door needed
  - Clearance around shower location

☐ Lab furniture (ergonomic issues, no cloth upholstered furniture, lab coat hooks, etc.)

☐ General floor plan issues inside of lab
  - Allotment for free-standing chemical cabinets and waste collection areas
  - Gas cylinder and cryogen dewar locations identified
  - Electrical receptacle placement (outlet drop-downs, columns, hanging multi-outlet assemblies over optical tables or large equipment, etc)
  - Placement of fume hoods and BSCs out of traffic flow and away from doors
  - Location of spill kits and safety glasses holders

Specialty Laboratories:
Cell/Tissue Culture Rooms
- Sink located at door
- Emergency irrigation inside room
- Laminar air flow supply diffusers
- Negative pressure to adjoining spaces
- Seamless floor
- CO₂ central manifold for incubators (preferred) or compressed gas restraints
- Biosafety cabinets (BSC)
  - Verify type: A-2, B-2
  - Dedicated exhaust for B-2
  - Gas-tight valve in exhaust duct of B2 cabinets for decontamination
  - Stagger placement so workers are not back-to-back (preferred) or 8 foot minimum spacing
  - Discourage natural gas installation, provide external shut-off if gas is provided
  - House vacuum or pumps
  - Emergency power to cabinets

Autoclave rooms
- Preferred in separate room designated for autoclave only
- Confirm adequate autoclave size
- Minimum set-down space of 5x5 feet
- Canopy exhaust hood with condensate drain
- Seamless flooring or epoxied concrete
- Floor drain
- Negative pressure to adjoining space
- Minimum 6 ACH

Darkrooms
- Verify use (wet chemical vs. optical imaging)
- Emergency irrigation needed?
- Silver recovery processes?

Laser Lab
- Lighted warning sign
- Need for process cooling?
- Room temperature tolerance issues?
- Gas requirements?
- Gas cabinet needs?
- Hazardous gas use?
- Electrical receptacle placement
- Point exhaust for laser generated air contaminants?
- Fume hood needed for laser dyes or other chemicals?
- FR laser curtains for Class 3B or 4 laser fire hazard?
- Compressed air or inert gas supply for optical tables

Animal Facilities and Animal Labs
- Anesthetic gas scavenging or hoods/cabinets for animal surgery
- Large autoclave ergonomics for cart-loading
- Room pressurization
- Glass wash areas
  - Storage and secondary containment for bulk quantities of corrosive cleaning chemicals
  - Delivery of cleaning chemicals to glass wash equipment
  - Emergency irrigation in glass wash room

Radiation Use
- Position hoods on exterior wall or provide shielding on back
- Filtration in fume hood needed?
- Shielding for X-ray work
Checklist IV

Construction/Construction Administration (CA): Commissioning Plan

- Abatement of existing space
  - Hoods
  - Corrosives cabinets
  - Asbestos
    - Floor tiles
    - Ceiling tiles
    - Lab benches
    - Transite panels in fume hoods and acid cabinet lining
    - Pipes and duct work
  - Old equipment to be decontaminated
    - RAM contamination
    - Lead
    - PCB oils in transformers
    - Mercury
    - Heavy metals
    - Infectious materials
  - Mercury in sink traps or under floor tiles
  - Chemical clean-out prior to vacancy
  - Tritium-powered exit signs
  - Bulbs and ballasts
  - EHS clearance before demolition begins

- Contractor safety concerns
- Emergency Response Plan
- Emergency Contacts
- Room signage
- Emergency responder tour
- Training new faculty or lab members
- Testing and commissioning of fume hoods and biosafety cabinets
- Review air balance reports
- Testing of emergency irrigation equipment
  - Verify type and proper installation with drainage
  - Flow tested and tagged as described in ANSI Z358.1