

EHS Involvement in Laboratory Renovation and New Laboratory Construction

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, cryogenics, 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
 - Energy conservation considerations
 - Fume hoods
 - Variable volume vs. constant volume
 - Zone presence sensors
 - Need for ventilation monitoring system? (CHIPS)
 - 100% outside air supply in labs and no recirculation of air from labs
 - Labs negative pressure to exterior spaces
 - Direct drive or double pulley and belts for fume hood exhausts
 - Determine air changes per hour (ACH) based on relative hazard
 - Location of supply/exhaust ducts relative to hoods and biosafety cabinets
- ❑ New building considerations and codes
 - Building codes – high rise flammable storage limitations
 - High rise?
 - Adequate number of “control zones”?
 - Variances needed?
 - Engage emergency responders in discussions
 - Knox/Lock box placement
 - Fire suppression
 - Fire alarms/location of annunciator panel
 - Emergency irrigation placement
 - Emergency egress
 - Location of Emergency Response Room
 - Building Security
 - Securing loading dock and access control
 - Managing receipt of hazardous materials to building
 - Room signage
 - Wayfaring
 - Equipment corridors
 - Define permitted chemical storage, transport, dispensing and equipment
 - Autoclave size and proximity to labs it serves
 - Controlled centralized infectious waste storage
 - 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
 - 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?
 - Pass-through to hood provided?
 - Ventilation provided?
- ☐ 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

