TABLE OF CONTENTS

(Ctrl + Click to follow links)

SECTION Page

2. SCOPE, PURPOSE AND GENERAL REQUIREMENTS

2.1. Primary Purpose

The primary purpose of this Design Criteria (DC) is to establish minimum design requirements for laboratory furniture, chemical fume hoods, HVAC, and closely related safety devices to provide a safe work environment and prevent undesirable exposures to laboratory hazards among students, faculty, and staff in University System of Georgia (USG) laboratories. This document is to provide guidance to architects, institutional staff designers, and safety professional. Institutions are encouraged to thoughtfully look at all aspects of design and are encouraged to balance energy savings, ease of maintenance, safety and recurring cost in design decisions.

2.2. Scope

This document is to be used for the design and renovation of teaching and research laboratories as well as science support spaces. For the purpose of this document a teaching laboratory is deemed to have structured occupancy and set experiments, as outlined by the course syllabus and course subject matter. A research laboratory has sporadic occupancy and the hazards are varied by experimentation being conducted. This document is not intended to include BSL3, BSL4, Vivaria, and other high hazard laboratories.

2.3. Minimum Standards

These design criteria are minimum design standards required for all new construction and renovation projects involving laboratory furniture, chemical fume hoods

Chapter 120-3-26 Ga State Rules and Regulations for Boiler and pressure vessels

Compresses Gas Association Standards

The primary procedural reference for minor or major capital projects that exceed

Building Project Procedures Manual
http://www.usg.edu/building_project_procedures/.

2.6. Drawings

2.6.1. Working drawings.

During the preliminary design phase of the project,
representative shall develop and submit a draft set of working drawings to the appropriate representatives at the institution (Facilities, Construction/Engineering, Environmental Health and Safety, and involved academic units) for review and comment.

Upon institution approval of minor or major projects that exceed the

presented to the Board of Regents of the University System of Georgia, Office of Real Estate & Facilities, 270 Washington St., S.W., Atlanta, GA 30334, for review and comment by the Board of Regents Facilities office staff. The Board of Regents Program Manager for the institution shall coordinate this meeting. Working drawings shall include floor plans and elevations of all laboratory casework, fixed installations, and other equipment. The Vice Chancellor for Real Estate & Facilities shall be the approving authority for preliminary design documents.

2.6.2. Shop drawings.

The (s) shall submit shop drawings to the architect showing rough-in and installation drawings. or

hop drawings to hop drawings to

biosafety cabinet, heat generating equipment, autoclaves) along with recommended ductwork seam connection methods and materials (if not welded).

2.6.4. Samples.

All prospective bidders shall, upon request, submit samples.

2.6.5. Final drawings.

After changes are made, representative(s) shall develop a final set of working

3.1.3. Cabinet and shelf locations.

Cabinets and shelving shall not be located to allow for storage above 18 inches from the ceiling or directly under sprinkler heads to prevent stacked materials

4. GENERAL INFORMATION AND SPECIFICATIONS

4.1. Specification Criteria

This section shall be followed in preparing the technical specifications for laboratory furniture and chemical fume hoods. The format may be altered to same.

4.2. Accessible Design

Laboratory furniture and eq0 /P 16ction 8BTn 8B377c0.0000097300573(N)4(F)4(OR)4(M)4(A

5.1.

a. Wall cases shall be in accordance with the plans and elevation drawings as to size and location. Consideration should be given to selection with regard to use and door style.
b. Bypass stops shall be included on all sliding doors.

5.1.4. Storage cases.

a. Storage cases shall have doors and shall be in accordance with the plans and elevation drawings as to size and location.
b. Bypass stops shall be included on all sliding doors.

5.1.5. Reagent racks and shelving.

Reagent racks and shelving shall be constructed of the man
materials for reagent shelving and be of the size and location as per construction documents.

Reagent racks, coated with a chemical-resistant finish, and of the size, configuration and location per contract documents.

a.

. 4wiTm0 d with a chemical

a. Composition stone with a chemical-resistant finish or low-gloss vinyl sealer.
b. Natural quarry stone with a chemical resistant finish.
c. Solid resin compounded solid resin throughout.

damage in the event of a major water release or spill and to allow for the testing of safety showers.

b. The drains maybe equipped with flush-mounted caps so that inadvertently spilled chemicals or other undesirable materials will not enter the sanitary sewer system.

c.

6.1. Fume Hood Selection

6.1.1. Hood design.

a. Laboratory hoods are to be considered an integral part of the overall building HVAC system, should provide adequate safety for all users and be included in overall energy efficiency planning. Locations, abundance, size and design should be a collaborative effort between users, Environmental Health and Safety, Facilities Operations and design teams.

b. All new laboratory buildings constructed after July 2019 shall use high performance hoods and the associated integrated building infrastructure for general teaching and research laboratories. For significant renovation projects, the use of High performance hoods should also be considered. The use of radiological materials may require a higher volumetric flow-rate , Environmental Coordinator, Radiation Safety Officer, and/or Radiation Safety Committee should be consulted.

c. The Design Team shall do a pre-project analysis of fume hood safety and energy conservation strategies and present recommendations during the initial project-planning phase. Strategies to be considered should include such things as: modes of hood operation during work activity and after hours; use of heat recovery systems; automatic sash closures; use of horizontal sliding sashes, etc.

d. Recirculation of any laboratory fume hood exhaust air is prohibited.

e. Certain specific applications (i.e. Rad hoods) may require combination high efficiency particulate air (HEPA) and/or organic vapor (OV) filters (Bag in and Bag out) for laboratory chemical fume hoods. These hoods must be on individual exhaust duct systems.

f. All fume hood exhaust ductwork from chemical fume hoods will be constructed of stainless 316 or 304. All joints will be welded and ground smooth (interior), except for maintenance points and the initial connections to each fume hood. Any deviations from 316 will require an approved variance. Galvanized or 304 maybe considered for ductwork in manifold exhaust duct sections of systems where the air is well diluted.

g. Chemical polyvinyl chlorinated (CPVC) or combustible duct materials are prohibited for fume hood duct systems.

h. Manifold materials will be based on good safety and engineering principles and a risk assessment.

i. During schematic design, the institution user group(s) shall provide the designer with a completed risk assessment of the chemicals

programmed to be used to assist in the selection of appropriate exhaust duct materials.

j. Ductless chemical fume hoods are generally prohibited, however, an exception may be considered on a case-by-case basis by the Office of Facilities, in addition to the approval of and the institution.

k. Low airflow safety alarm consoles shall be factory and field-tested and furnished with each fume hood. Airflow measuring devices shall be capable of indicating design flow-rates +/- 20% of the design. Airflow monitoring devices can consist of thermoanemometers, static pressure sensors, and/or suitable industry accepted devices.

6.1.2. Recommended fume hood size.

a. Fume hood sizes shall be selected according to intended use and available space.

b. Three-foot and four-foot width hoods shall be selected when the intended use is for one person and when large apparatus set-ups are not anticipated.

c. Five-foot width hoods shall be selected when the intended use is for one or two people and where large apparatus may be set up some of the time.

d. Six-foot width general-purpose hoods shall be selected when the intended use is for two or more people, in teaching labs, or when unusually large apparatus may be set up a majority of the time.

e. Chemical fume hoods longer than six-feet are not permitted in any laboratory, since the hoods cannot exhaust effectively into a single duct chamber. Variances to this requirement may be considered on a case-by-case basis with proper justification and should be submitted to the Board of Regents Vice Chancellor for Facilities prior to beginning the project.

6.2. Fume Hood Airflow Requirements

6.2.1. Airflow rate.

a. High Performance (low flow), CAV chemical fume hoods and VAV chemical fume hoods shall be designed to maintain a minimum average face velocity of 60-79 FPM with the sash open 18 inches, +/- 10%. Operating ranges 80-100 FPM shall be +/- 20%. The operating range of these hoods should be 60

materials may require higher air flow rates, as required by regulation and/or the institution.

b. Standard bypass, VAV (with or without set-backs), or CAV (with frequency drive) shall be designed to maintain an average face velocity of 100 FPM +/- 20% while occupied and as low as 60 FPM

b. Gas, air, vacuum service fixtures shall be located inside the hood within 12 inches of the hood sash.

   Unless otherwise specified, one set of each located on one interior side is sufficient for 3-foot and 4-foot width hoods.

   5-foot and 6-foot width hoods require two sets of these supply fixtures, one set on each side.

   Recommended vertical order of installation: gas at lowest position, air at mid-position, vacuum at highest position.

c. Vertical-discharge water service fixture(s), with vacuum breaker, shall be provided

Environmental Health and Safety department approves.

c. Console shall have plate-mounted or plastic-adhering operating instructions applied on or next to the console. Digital instructions displayed from the console are also acceptable.
d. Console shall have a digital device calibrated to read average face velocity (applies to conventional air velocity monitors).

a. The front face of the hood shall have a sash frame constructed of the same material as the fume hood with its window made of flame and shatter-resistant (and non-splintering) transparent material.
b. The sash shall be capable of vertical or horizontal movement to close off the entire front opening.
c. Vertical sashes are the preferred configuration shall move throughout their travel by applying no more than 5 lbs. of force. They must remain stationary when force is removed.
d. Horizontal sashes, if used, shall consist of at least two panels, movable throughout their travel by applying no more than 5 lbs. of force and be 12 to 14 inches in width. They must remain stationary when force is removed.
e. Combination sashes vertical and horizontal), if used, shall meet the requirements for each as noted above.
f. Factory-installed sash stops shall be provided and installed 18 inches above the working surface, with easy release to open the sash further for set-up work.
g. Automatic sash closures

6.9.1. Hood superstructure.

Chemical fume hoods shall be installed in accordance with requirements in this section, with hood superstructures secured to countertops.

Equipment.

a. Factory-installed permanent sash stops shall be incorporated into all new laboratory chemical fume hoods, incorporated with a low airflow alarm system as detailed elsewhere in this document.
b. Lighting fixtures within the hood shall be furnished and installed. General and special purpose and radiation hoods shall have fluorescent or LED lamp fixtures (2 lamps per fixture) rated to provide at least 60-foot candles lighting intensity measured across the base of the hood. Perchloric acid hoods shall have an explosion-proof rated lamp fixture provided with a 150-watt bulb (or equivalent lower wattage providing specified illumination).
c. Static pressure sensors for the low airflow safety alarm console (if used), shall be provided, attached to the alarm console and pre-set into the interface connection.

6.9.3. Fume hood exhaust ducts.

a. Exhaust duct materials shall be selected, sized, and installed based on sound engineering principles. Selected duct materials shall be compatible with the intended uses for the hoods, compliant with existing building/fire code, and appropriately durable. All standard fume hood exhaust ducts shall be constructed with 316 at a minimum up to the manifold if in a manifolded system.
b. Roof penetrations for ductwork shall be water-proof and weather-tight.
c. Exhaust duct seams shall be welded and ground smooth, or otherwise joined using methods and materials providing equivalent leak-proof containment. If duct seams are not to be welded, submittals shall be provided explaining the method and materials to be used. Spiral ductwork is prohibited on all chemical fume hoods.
d. A minimum of two (2) duct diameters (length) of straight ductwork shall be provided ahead of the exhaust fan inlet to minimize system air turbulence.
e. Ducting from individual chemical fume hoods shall be installed vertically whenever possible. When horizontal runs are required runs shall not

exceed 10ft in total length and shall be sloped back to the fume hood at a minimum of ¼-inch per foot.

f. Duct turns from fume hood to exhaust fan may be smooth radius or gored, limited to 3 turns. Sharp-angle changes of direction are prohibited.

g. For hoods installed on exterior laboratory walls, offsets are permitted at the smallest angle possible (not to exceed 45º) to connect the duct to the roof fan or manifold system.

h. Duct damper and valve units shall be located for safe access, in accordance with regulatory standards, for adjustments and maintenance.

i. The duct interface section furnished as an extension above the hood

placed to conceal the stack for aesthetic reasons may be acceptable, provided the exhaust flow is not impeded.

r. Stacks shall be braced or guy-wired for stability.

s. Rain caps and other fixtures that may impede exhaust stack airflow are prohibited.

t. Each duct shall be permanently labeled, where accessible, above the laboratory ceiling, in a penthouse or on the roof, as to the location of the fume hood it serves (listing room number) for maintenance efficiency and to assure the correct hood is selected. Labels must be easily read from the access point.

u. Exhaust fan units shall be permanently labeled to identify the fume hood they serve.

    i. Exhaust fans and motors for each hood system shall be designed to accommodate at least 10% extra capacity to compensate for normal system loss.

    ii. Fan motors shall not operate at design capacity exceeding 90% of motor nameplate horsepower.

6.9.4. Hood exhaust fan system (non-manifold).

a. Fume hood exhaust fan and motor drive unit shall be located on the building rooftop or in a dedicated mechanical system penthouse, have a weather-protected exterior, and be designed and placed to be readily accessible for visual inspection and maintenance.

b. All moving parts shall be properly guarded.

6.9.5. Special controls for VAV hoods.

a. Airflow sensors and pressure independent quick response valves (less than 3 seconds) shall be installed in the exhaust duct, such that electronic controls are protected from the elements, to maintain face velocity and to

6.11. Laboratory HVAC and Fume Hood System Test and Balance

6.11.1. Installation coordination.

are responsible to coordinate required installation and testing of air handling equipment and fume hood systems.

6.11.2. Test and balance and fume hood certification requirements.

a. Each new or modified laboratory ventilation system and/or fume hood shall be tested and balanced based upon good engineering practices. Each fume hood shall be certified according to the latest ASHRAE 110 method to assure it was installed in accordance with manufacturer instructions and DC requirements.

Each USG Institution shall provide annual verification of all chemical fume hoods in use by suitable quantitative (e.g. airflow) and qualitative (e.g. visual challenge) testing in the as used (AU) condition, consistent with the latest ASHRAE 110 method. Some adaptation may be required depending on set-backs, sensing methods, etc. Institutions are encouraged to use third party testing firms that specialize in this type of commissioning/testing. Testing firms should be qualified and provide proof of competency, to be determined by the institution. As a general rule, these specialized testing firms should

Type A2

All primary emergency safety showers shall be properly installed and plumbed, within a 10-second walking time from the location of any hazard within the laboratory area. For general laboratories, emergency safety showers may be permitted in central locations (e.g. hallways).

7.4.2. Laboratory preparation rooms.

All preparation laboratory rooms with chemical storage in academic laboratories shall at least one permanently installed emergency shower and eyewash station.

7.4.3. Research laboratories.

Institutions can exercise individual discretion on whether or not to temper water for eyewash and emergency safety showers as required by the ANZI Z358.1-2014 standard.

7.5. Flammable Liquids Storage Cabinets

Flammable liquid storage cabinets shall be provided for laboratories where more than 10 gallons of flammable or combustible liquids are likely to be stored, handled, or used. An appropriate number of cabinets should be provided, of appropriate size, to meet the anticipated needs and allowable load of flammable and combustible liquids for the laboratory fire area.

7.5.1. Cabinet rating.

Installed or provided cabinets shall be properly labeled, and be Underwriters Laboratories (UL), and Factory Mutual (FM) approved.

7.5.2. Cabinet basin.

Cabinet shelf must have a retention basin in bottom of cabinet to contain leakages.

7.5.3. Cabinet doors.

Cabinets shall have positive-latching, self-closing doors.

7.5.4. Cabinet venting.

a. Un-vented cabinets may be installed/used. However, depending on the types and amounts of chemicals stored, laboratory air quality may be adversely impacted. Vent plugs provided by the manufacturer must be in place in all un-vented cabinets.

b.

7.6.1. Cabinet construction.

Cabinets shall be made of non-corroding materials.

7.6.2. Secondary containment.

Cabinets shall have catch pans or tubs to retain liquid spills.

7.6.3. Labeling.

Each cabinet shall be individually labeled for storage of either acids or bases (not both).

7.7. Gas Cylinders Storage

7.7.1. Storage area requirements.

a. Cylinders storage rooms and closets shall be prominently identified as to the type gas contained.
b. Laboratories using compressed gases having an NFPA health hazard rating of 3 or 4 shall have a continuous mechanically-vented storage area for these gases. Continuous venting shall also be provided for pyrophoric gases and those (other than compressed air) having no physiological warning properties, regardless of health hazard rating.
c. Programmable oxygen level and toxic gas sensing devices shall be provided for each gas storage and use area as specified by code. These devices shall be capable of alarming to warn area occupants of a gas venting episode, or if the oxygen level in the area is diminished (e.g. cryogenic gas storage). The warning provided shall be visual and audibly distinguishable, to be heard over other noise sources. Where possible, the alarm should be centrally monitored at a remote location.

Fume hood low airflow alarm activates when sash opens784 Tm0.0902 0.212 0.365 rg

Exhaust from lab does not pass un-ducted through other areas		☐Yes ☐No ☐NA
Fume hood ducting is properly connected to an exhaust fan (if not manifold).	BOR	☐Yes ☐No ☐NA
Fume hood fan drive and motor units are properly guarded.	BOR	☐Yes ☐No ☐NA
Fume hood exhaust fans are permanently identified as to the hoods they serve.	BOR	☐Yes ☐No ☐NA
Fume hood exhaust stacks are oriented vertically and terminate at least 10 feet above the adjacent roof lines and air intakes.		☐Yes ☐No ☐NA

BIOLOGICAL SAFETY CABINETS

All biological safety cabinets (BSCs) meet the specifications of the most recent edition of the National Sanitation Standard 49 – Class II (Laminar Flow) Biohazard Cabinetry.	Best Practice	☐Yes ☐No ☐NA
At a minimum, Class II A1 or Class II A2 BSCs are provided for biohazard work.	CDC-NIH	☐Yes ☐No ☐NA
Type II A BSCs are not "hard-ducted" into the building exhaust system.		☐Yes ☐No ☐NA
BSCs provided have at least 6 inches side and 18 inches top clearance.	BOR	☐Yes ☐No ☐NA
The BSCs located away from doors and high-traffic areas, and such that air supply diffusers do not affect airflow at the BSC face.		☐Yes ☐No ☐NA
BSC wrappings are essentially left in place until dusty area work is completed.	BOR	☐Yes ☐No ☐NA
Required BSC service fixtures are installed and work properly.	BOR	☐Yes ☐No ☐NA
BSCs are certified by an accredited certifier.	BOR	☐Yes ☐No ☐NA

EMERGENCY EYEWASH & SAFETY SHOWERS

An emergency Eye-wash and Safety-shower is provided at all work areas where, during normal operations or emergencies situations, the body may come into contact with a hazardous substance	CFR 1910.151(c)	☐Yes ☐No ☐NA
Emergency eyewash and safety shower comply with the requirements of ANSI/ISEA Z358.1-2009 "Emergency Eye Wash and Shower Equipment"	ANSI/ISEA Z358.1	☐Yes ☐No ☐NA
Emergency eyewash facilities and safety showers are in unobstructed and accessible locations that require no more than 10 seconds for the injured person to reach along an unobstructed pathway.		

ELECTRICAL SAFETY

Adequate electrical receptors provided at an appropriate distribution in order to preclude future need for use of extension cords	Prudent Practices	☐Yes ☐No ☐NA
Receptacles of appropriate voltage and current ratings are provided for known equipment in order to avoid overloading.		☐Yes ☐No ☐NA
Electrical receptacles		

Shipping/receiving areas handling hazardous materials is equipped with fire extinguishers and an emergency eyewash and shower.	Prudent Practices	☐Yes ☐No ☐NA
Loading docks is designed to prevent the run-on of storm water and runoff of spills. – inward sloping, covered or use of berms/dikes	KSU Prudent Practices	☐Yes ☐No ☐NA
PLUMBING		
Water supply and drain connections are tested as correctly installed and working.	BOR	☐Yes ☐No ☐NA
Any plumbing leaks (water, drains, and gases) are repaired (all fixtures).	BOR	☐Yes ☐No ☐NA
Water service fixtures have vacuum breakers and cut-off valves.	BOR	☐Yes ☐No ☐NA
Water service fixture valves turn on/off in required direction.	BOR	☐Yes ☐No ☐NA
Special water service installations have self-closing valves.	BOR	☐Yes ☐No ☐NA
Cup sinks have strainers secured in place.	BOR	☐Yes ☐No ☐NA
GENERAL		
Laboratory wall, corner, and surface moldings are in place and secured.	BOR	☐Yes ☐No ☐NA
Laboratory aisles are at least 4 feet in width.	BOR	☐Yes ☐No ☐NA
Clear wall space at doors is at least 2 feet.	BOR	☐Yes ☐No ☐NA
Cabinets and shelving are not located to impede sprinkler head water flow.	BOR	☐Yes ☐No ☐NA
Air supply vents are not close to chemical fume hoods and biosafety cabinets.	BOR	☐Yes ☐No ☐NA
Disability (ADA) design considerations are taken into account.	BOR	☐Yes ☐No ☐NA
Cabinet, countertop, and fume hood materials are appropriate for uses.	BOR	☐Yes ☐No ☐NA
Cabinetry meets the size criteria.	BOR	☐Yes ☐No ☐NA
Sliding doors have required stops.	BOR	☐Yes ☐No ☐NA
Reagent shelving is 5 feet from the floor.	BOR	☐Yes ☐No ☐NA
Reagent shelving has ½ -inch retaining lips.	BOR	☐Yes ☐No ☐NA
Doors and drawers do not stick when opened and closed.	BOR	☐Yes ☐No ☐NA
Panels are all in place and properly secured.	BOR	☐Yes ☐No ☐NA
Service fixtures are properly positioned and secured in place.	BOR	☐Yes ☐No ☐NA
Service fixtures, lab and chemical fume hoods, are properly identified and color-coded.	BOR	☐Yes ☐No ☐NA

APPENDIX B: Glossary of Terms

Definitions

APPENDIX C: Acronyms

ADA	Americans with Disabilities Act	www.usdoj.gov/crt/ada
AIHA	American Industrial Hygiene Association	www.aiha.org/Content
ANSI	American National Standards Institute	www.ansi.org
ASHRAE	American Society of Heating, Refrigeration, and Air Conditioning Engineers	www.ashrae.org
BoR USG	Board of Regents University System of Georgia	www.usg.edu/ehs
BSC	Biological safety cabinet	
CAV	Constant air volume	
CDC	Centers for Disease Control and Prevention	www.cdc.gov
DC	Design criteria (this document)	
EMS	Energy management system	
FPM	Feet per minute (linear airflow rate)	
HEPA	High efficiency particulate air (filter)	
HVAC	Heating, ventilation, and air-conditioning	
LFB	Laminar flow bench	
NESHAP	National Emission Standards for Hazardous Air Pollutants	
NFPA	National Fire Prevention Associ	

1dem ocrt/ada

APPENDIX D: Institution Guidelines For Laboratory Safety Equipment

A. CHEMICAL FUME HOODS

A. Annual Verification (NEW GUIDANCE FOR INSTITUTIONS)

1. Each USG Institution shall provide annual verification of all chemical fume hoods in use by suitable quantitative (e.g. airflow) and qualitative (e.g. visual challenge) testing in the as used (AU) condition, consistent with the latest ASHRAE 110 method. Some adaptation may be required depending on set-backs, sensing methods, etc. Institutions are encouraged to use third party testing firms that specialize in this type of commissioning/testing. Testing firms should be qualified and provide proof of competency, to be determined by the institution. As a general rule, these specialized testing firms should have at least 50% gross revenue associated with testing chemical fume and/or biological safety cabinets.
2. Institutions should consider testing all high performance hood systems to

8. APPENDIX E: **Document History**

5th Revision November 2019

Major Changes

Scope
Hazard Assessments
Local Exhaust Ventilation (other than chemical fume hoods)
Relocation and Repair of BSCs
Lower Air Exchange Rates
Laminar Flow Hood