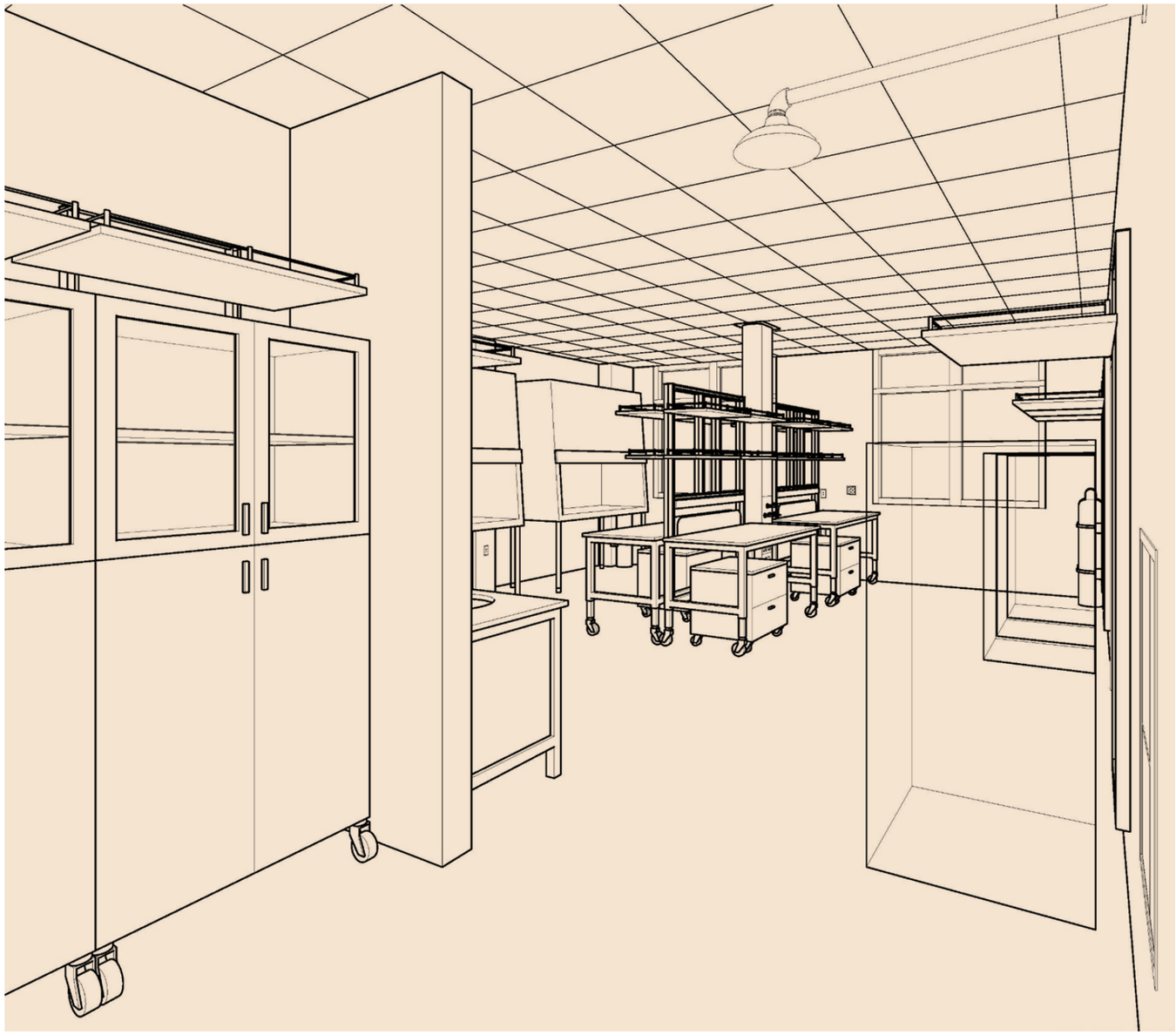


TECHNICAL FEASIBILITY STUDY

Laboratory Schematic Design
Hong Kong Science Park
Expansion Stage 2 (SPX2)
Progress Draft #4
2021 February 04

HERA laboratory planners

CONTENTS

Summary 3

Purpose 4

Section 1- Lab Planning Derivation 5

Section 2- Lab Programme Room Data Pages . . . 10

Section 3- Schematic Design Lab Floor Plans . . . 44

Section 4- Lab Lease Options 66

Section 5- Schematic Design BSL2 Lab 68

Section 6- Schematic Design BSL3 Lab 78

Section 7- Schematic Design Engineering Lab . . . 88

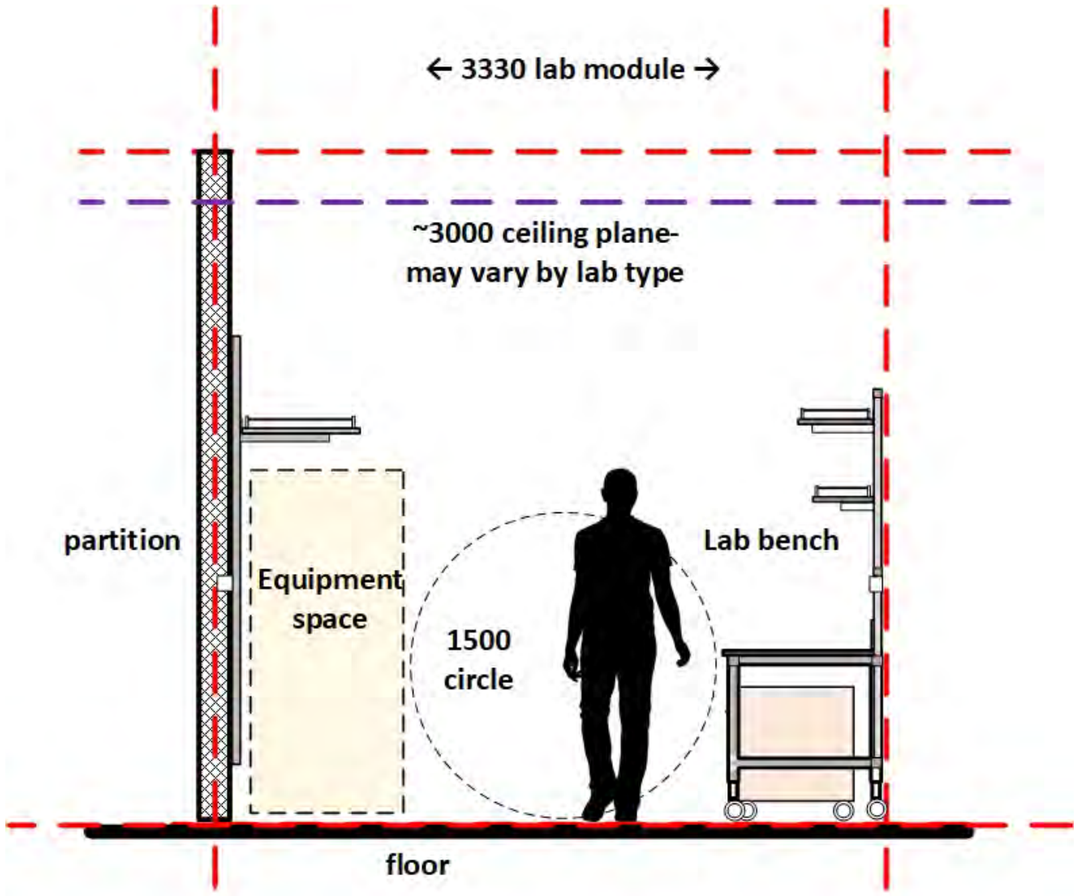
Section 8- SD Lab Concept Sections 97

Section 9- Protean Lab Concepts 101

Section 10- Equipment Cut Sheets 108

Section 11- Design Criteria 117

Life Science Research Laboratory
University of California, Irvine



Section

SUMMARY

This document provides a lab design programme, concept design summary, and Laboratory Schematic Design for the new Hong Kong Science Park Expansion Stage 2 (SPX2). The information contained herein provides a basis of design for the following lab buildings: Tower 12W-A; Tower 16E-A; and podium buildings 20/22E-A.

Carlos Perez-Rubio, AIA
Principal-in-Charge
carlosp@herainc.com

Glen Berry, AIA
Senior Laboratory Architect
glenb@herainc.com

Monica Moore-Zigo, AIA
Laboratory Architect
Project Manager
monicam@herainc.com

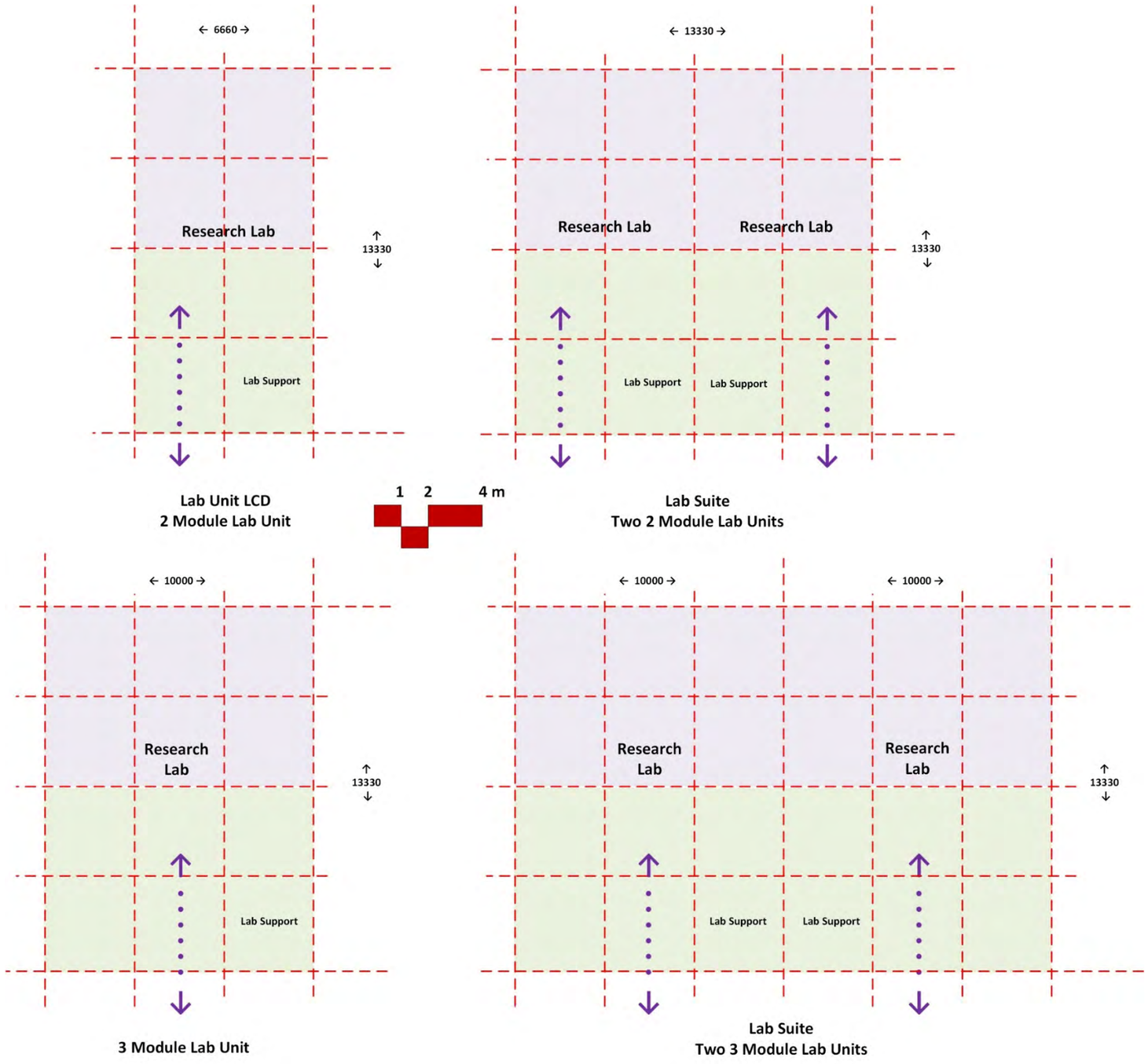
Jennifer Kim
Laboratory Planner
BIM & Revit Design
jenniferk@herainc.com

Rainey Hufstelter, AIA
Laboratory Architect
Biocontainment Design
raineyh@herainc.com

Jeff Owens
Senior Laboratory Planner
Biosafety Level Design
jeffo@herainc.com

Clay Stafford
Senior Laboratory Planner
clays@herainc.com

HERA laboratory planners



PURPOSE

The purpose of this 4th draft Technical Feasibility Study (TFS) Lab Programme document is to show various options and possibilities for lab planning and design.

Updates from the Draft #3 report, issued on 2020 July 31 include Schematic Design Laboratory concepts and illustrations.

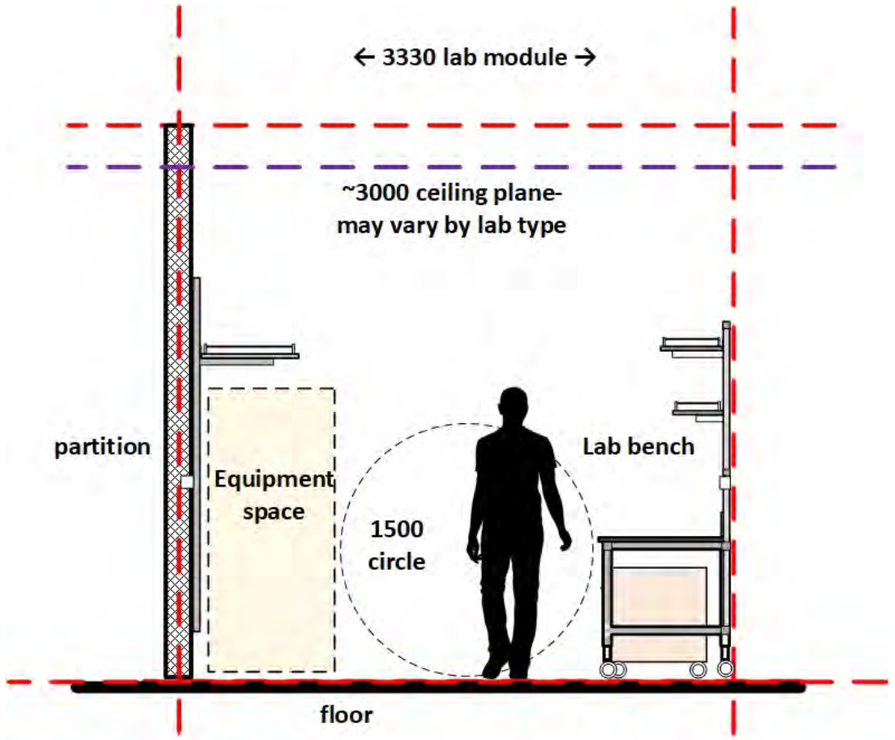
The keystone of science building design is Design for Change. Form does follow function, as architect Louis Sullivan stated. In science building design, the function is often not known, nor can it be accurately predicted. The challenge is to create a lab environment that can adapt and change as science adapts and changes.

"If there is one thing we know, it is that we do not know what we will be doing ten years from now."
Dr. H. H. Race
General Electric Research Laboratory

Ecology Research Laboratory
Carnegie Institution of Washington
Stanford, California

SECTION 1
LAB PLANNING DERIVATION

LAB MODULE CONCEPT



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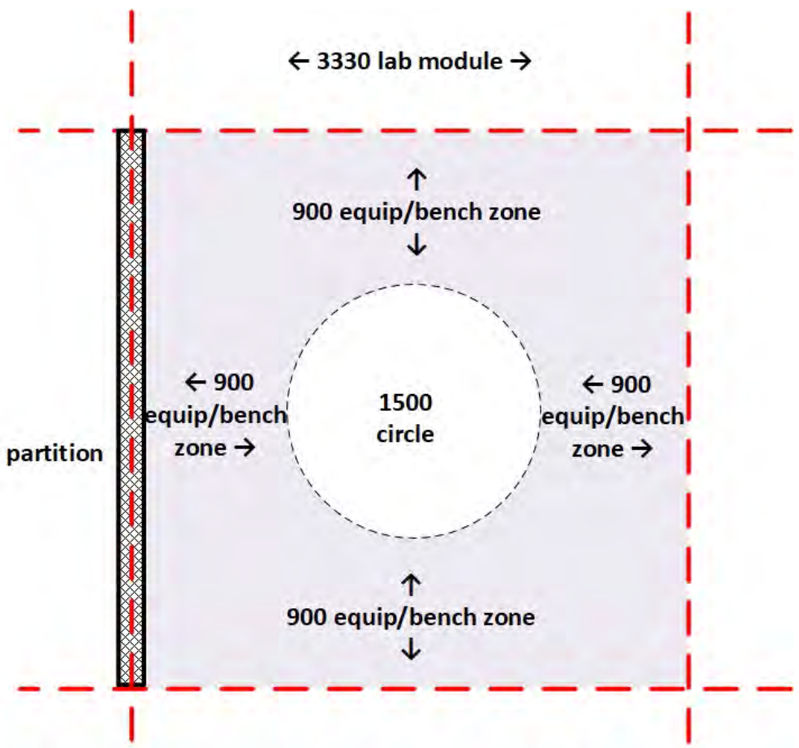
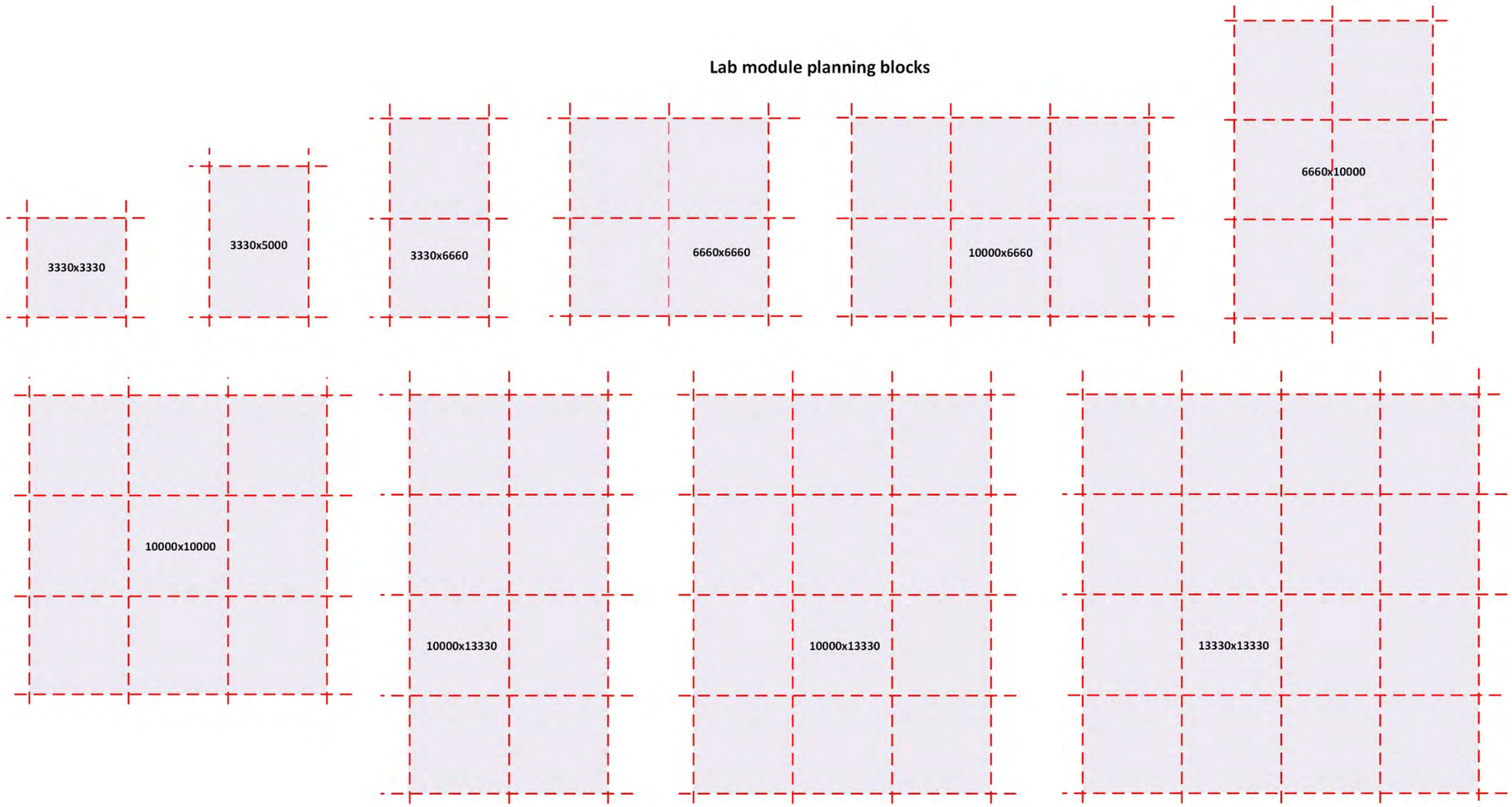


Plan

The proposed lab programme and design has been developed using a modular planning approach. For this project, the module has been sized to incorporate the lab work bench, equipment space, and appropriate aisle width required to define a safe, congestive free, and accessible laboratory workspace.

The lab module also provides a derivation for the building structural grids- 3 x 3330 = 10000 mm structural bay.

LAB PROGRAMME BLOCKS

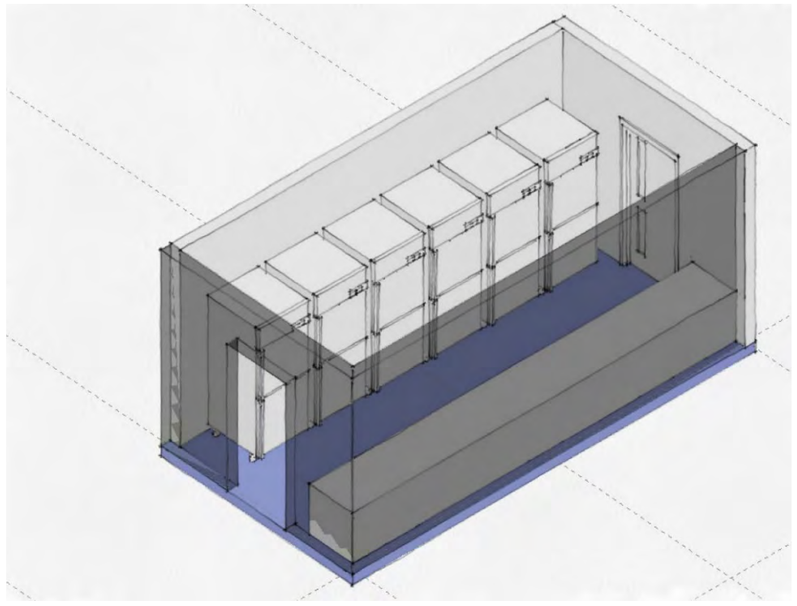


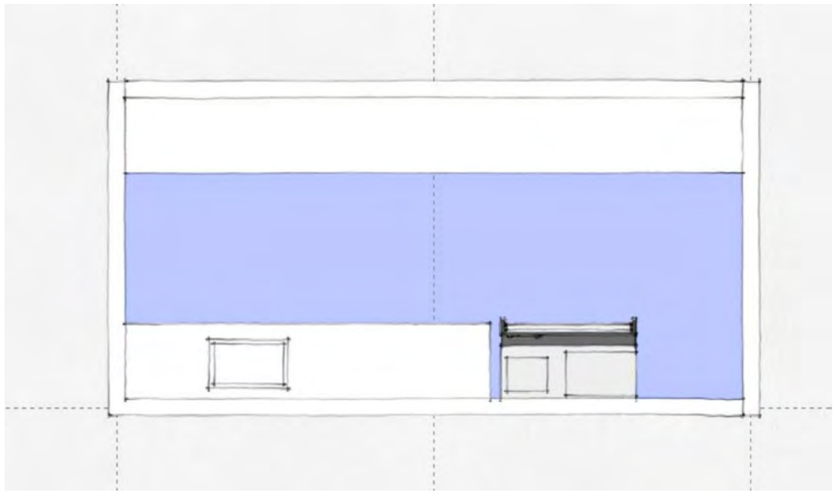
Multiples of the lab planning module of 3330x3330 can be arranged to create small, medium, and large lab room/suite sizes based on lab function.

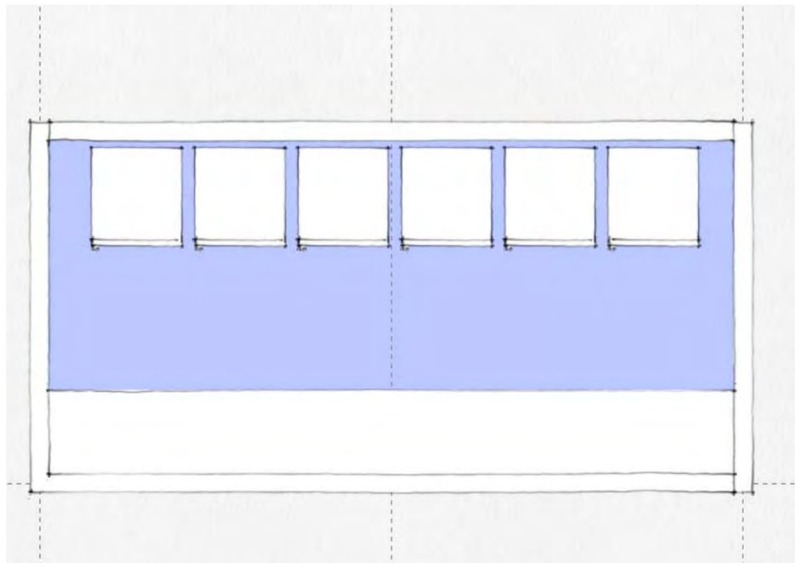
The lab planning module can also be used to define the building structural patterns, fenestration patterns, and MEP systems distribution patterns.

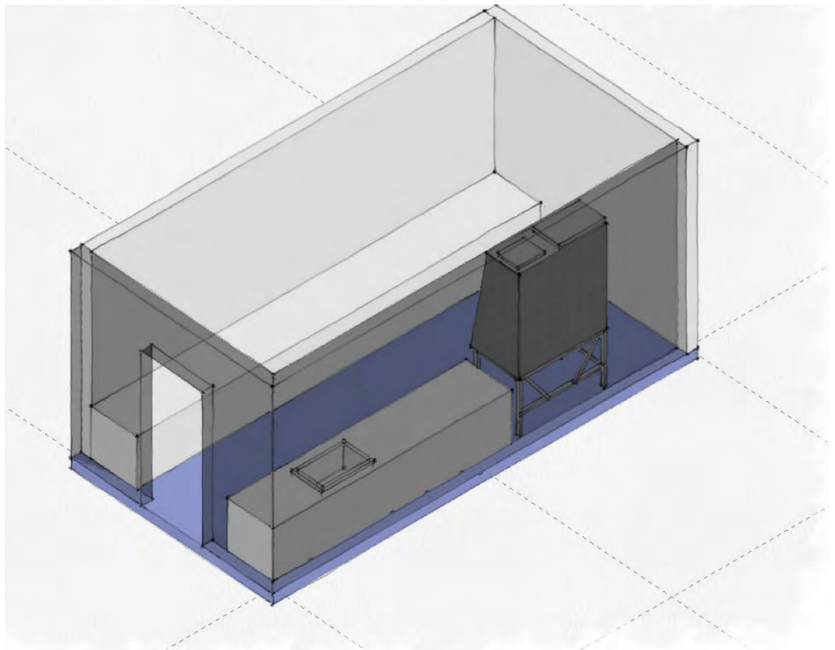
The 3x3 lab block equals a possible structural bay grid for the lab buildings (10m x 10m).

LAB MODULE OPTIONS



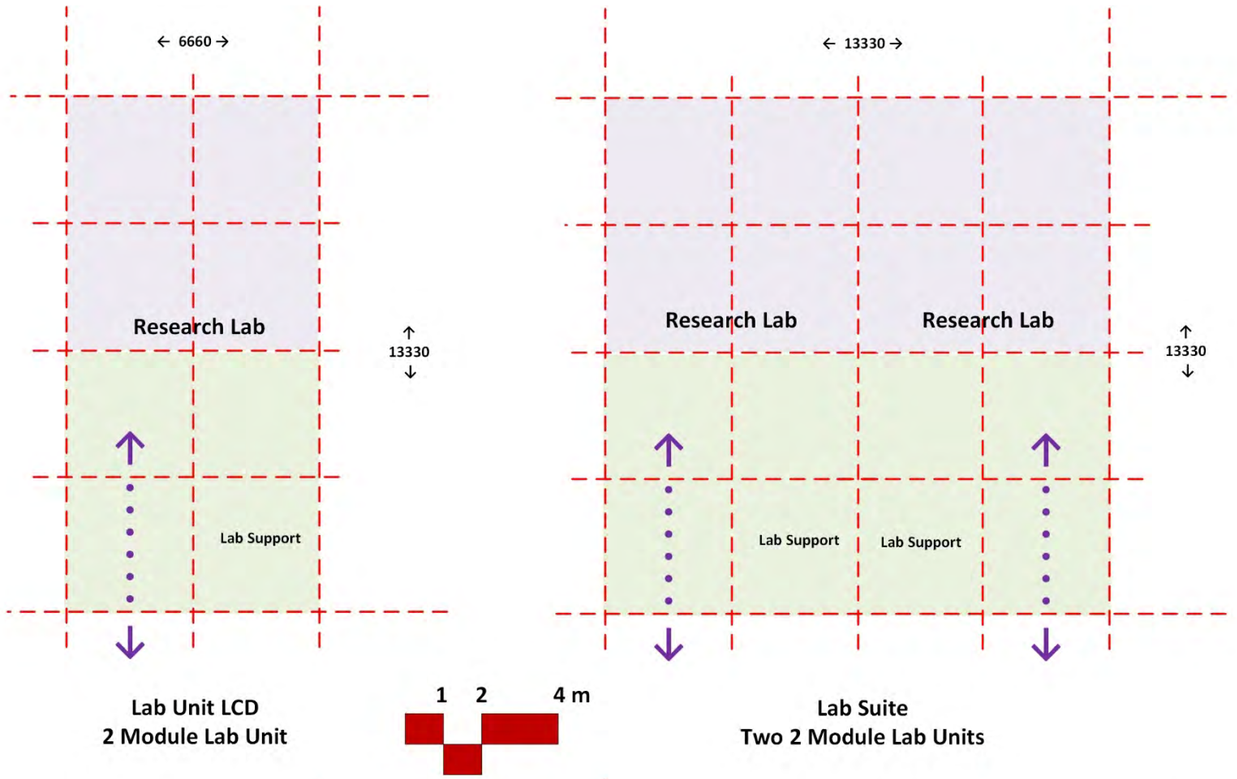






Various lab functions such as Equipment Rooms, Procedure Rooms, Environmental Rooms, ISO 7 or ISO 8 clean rooms, etc., can be accommocated using the lab module methodology.

Note: Clean room planning and design is limited to ISO 7 (class 10000) or ISO 8 (class 100000) design, which can be achieved with standard architectural design. ISO 3, 4, and 5 clean room design is not included in this report, as it requires specialized expertize of clean room engineering.



LCD LAB UNIT

Least Common Denominator for Lab Suite Leasing

The Least Common Denominator (LCD) for leasing lab space to potential lab tenants is defined to be a 2x4 lab module unit of 6660 mm wide by 13330 in depth.

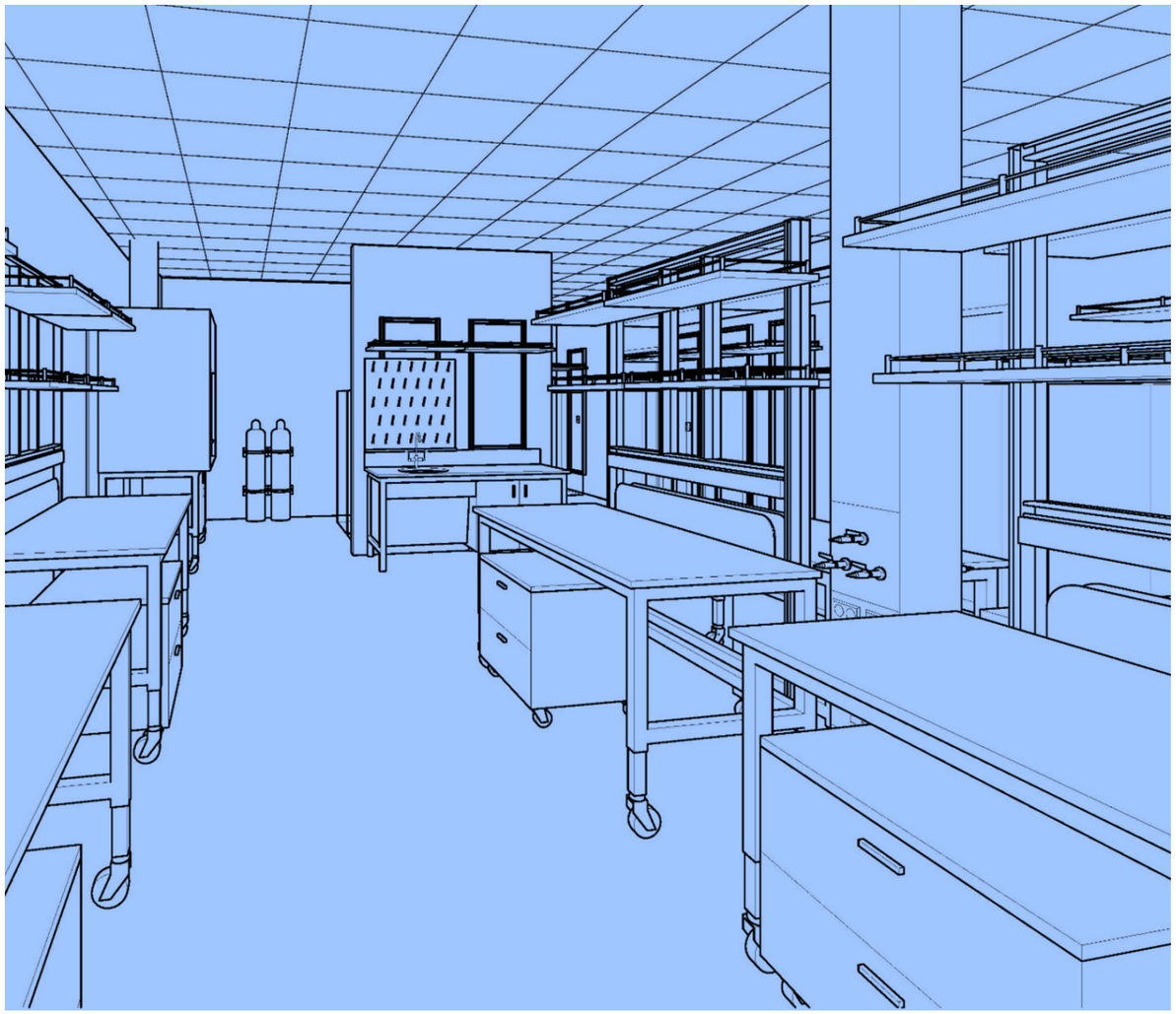
Variations of the LCD lab unit can be developed depending upon space available on a given lab floor in buildings 12W-A, or 16E-A, or the podium buildings.

A single LCD lab suite may be one entirely open area with no internal rooms. It may have one or two or three smaller lab support rooms within the lab unit, depending upon the lab prototype requirements. Support rooms within an LCD lab unit may be general procedure rooms, biological procedure rooms (BSL2 or BSL3, equipment rooms, instrument rooms, environmental rooms, autoclave rooms, and shared waste rooms for chemical and biological waste.

Lab lease tenants can occupy one or more multiples of LCD lab units.

The ratio of lab to lab support is ~1:1. This is a critical ratio for life science research buildings. Buildings that do not have adequate lab support do not have sufficient space for lab equipment such as refrigerators, freezers, autoclaves, and biological safety cabinets.

Larger lab units of 3x4 lab modules (10000 wide by 13330 depth) can also be designated where required.



SECTION 2
LAB PROGRAMME
ROOM DATA PAGES

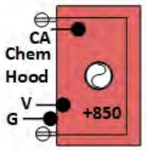
It is understood that the basic lab prototypes are BLS2, BSL3, and Engineering. However, in response to HKSP goal of achieving flexibility in the lab design, this section illustrates various other lab prototypes that could exist in the project, should HKSP choose to provide the infrastructure required for each type.

There are 8 lab types noted in this section:

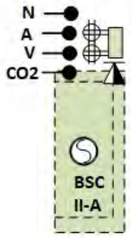
1. **Basic Research Lab Prototype (very similar to BSL2).**
2. **BSL2 Lab Prototype.**
3. **Biochemistry Lab Prototype.**
4. **Chemical Engineering Lab Prototype.**
5. **Bioengineering Lab Prototype**
6. **Bioengineering Robotics Lab Prototype.**
7. **Bioengineering Clean Room Lab Prototype.**
8. **Bioengineering Robotics High Bay Lab Prototype.**

These lab prototypes are shown in paired suites, mixing lab types adjacent to each other to illustrate flexibility of lab tenant assignment.

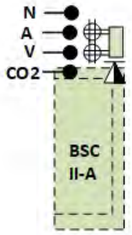
SYMBOL LEGEND



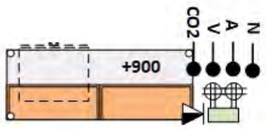
Chemical Fume Hood
1 per lab suite
1500 mm width; 1800 mm width at chemistry labs
850 mm work surface
Vacuum
Cold water and drains at chemistry labs
240v power outlets



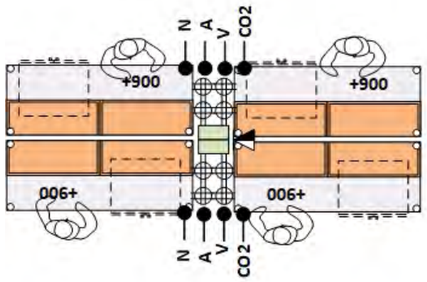
Biological Safety Cabinet (BSC)
Class II Type A2- with thimble exhaust
BSL3 lab suites only
2000 mm width
850 mm work surface
Vacuum
240v power outlets
Dedicated 240v fourplex at wall
BSC Tenant furnished
Service column HKSP furnished



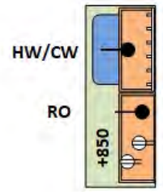
Biological Safety Cabinet (BSC)
Class II Type A- no external exhaust
BSL2/BSL3 lab suites
1400 mm width
850 mm work surface
Vacuum
Dedicated 240v fourplex at wall
BSC Tenant furnished
Service column HKSP furnished



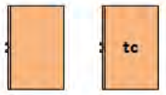
PROTEAN lab bench at wall
Service column with power, data, vaccuum, air
Gas provided by lab tenant
Adjustable height +730-960
750 depth front to back
Can be Tenant furnishde or HKSP furnished



PROTEAN lab benches at peninsula
Service column with power, data, air, vaccuum
Gas provided by lab tenant
Adjustable height +730-960
750 depth front to back
Can be Tenant furnished or HKSP furnished

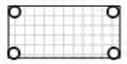


PROTEAN Sink Station
Hot/Cold industrial water
RO Water feed for point-of-use water polisher
Pure Water via polisher



PROTEAN Tall Storage Cabinet
Lockable
900 mm W x 600 mm D x 2400 mm H
Adjustable shelves inside
Shelf above at wall

PROTEAN Equipment Space
1000 mm W x 1000 mm deep
960 mm W x 600 mm D shelf above, adjustable
Tenant furnished equipment space at floor
For refrigerators, freezers, centrifuges, carts
Laminar flow hoods
Biological Safety Cabinet- Class II Type A
Dedicated circuit 240 v fourplex



Metro Shelf Unit
Provided by Lab Tenant

Cylinder restraint at wall
For Tenant furnished inert gas cylinders
Nitrogen, Helium, Argon, CO2, Natural gas

Safety Shower/Eyewash Unit
Eyewash recess mounted in wall
Shower at 2400 mm above floor
Tepid domestic water feed
Floor drain below

Electrical Panel at each lab entry

RO water unit
Tenant provided
Provides RO water for washers and autoclaves

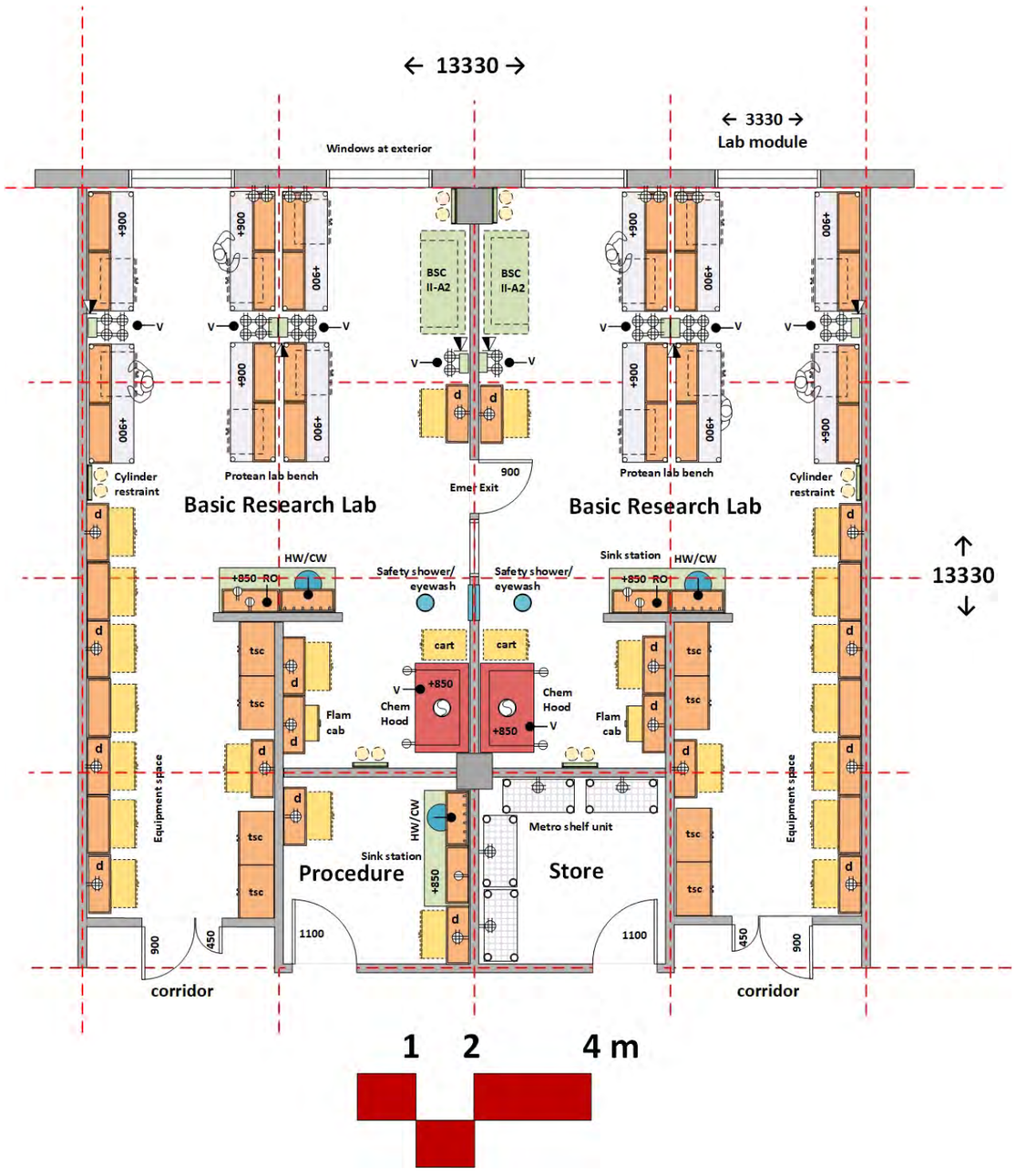
Cart
Tenant provided

Floor sink
Provide below safety showers
In rooms used for Zebra Fish Holding
In Vivaria rooms where required

BASIC RESEARCH/BASIC RESEARCH LAB SUITE-

2 modules per Lab Unit/4 modules per Lab Suite

Programme Requirements



ARCHITECTURAL

Occupancy: B (Chapter 3- IBC)
Floor: vinyl tile or rubber tile or sealed concrete
Walls: metal stud with gypsum board, epoxy paint
Ceiling: lab grade acoustic tile at 3000 mm (2800 minimum)
Can be open to structure with ceiling clouds
Stainless steel corner guards at wall corners
Doors: 900/450 x2400 pair with view window at corridor lab suite entries
1100x2400 single doors at procedure rooms
900x2100 glass panel door between lab units
Daylight attenuation: blinds at exterior windows
Sound attenuation: NC 45 or less
Security: card access

STRUCTURAL

Live floor load: 5 kPa
Vibration attenuation: 50 micrometers per second or less

MECHANICAL

Temperature: 18-22 deg C +/- 2 deg C
Humidity: 70% relative or less
100% exhaust
Air changes: up to 8/hour occupied; 2-4/hour unoccupied
Air change rate may be higher due to equipment heat gain
Equipment Heat Gain: 500 btuh/sm for open lab area;
750 btuh/sm for lab support rooms.
Pressure: Lab Suite negative to corridor
Lab Support Rooms negative or positive depending upon use
22 cubic meter per minute exhaust at chemical fume hood

PLUMBING

Hot/Cold water at sinks with vacuum breakers
Pure water at sinks via point-of-use water polishers
Domestic tepid water at safety shower/eyewash
Floor drain at safety shower/eyewash
V = central piped services as required by lab tenant: Vacuum,
and/or compressed air and/or CO2 and/or nitrogen gas
Natural gas (methane) to be provided locally by lab tenant, as required
Inert specialty gases (helium, argon) at cylinder racks

ELECTRICAL

240v duplex and fourplex outlets at walls and service columns
Dedicated circuits at equipment spaces
Standby power for scientific equipment at equipment spaces
Hardwire and wireless data
Lighting: LED at 500 LUX

CONTRACTOR FURNISHED EQUIPMENT

Metal or wood casework
Sink Stations with epoxy resin sinks, tops
Protean Lab benches (can also be Lab Tenant Furnished)
Service columns
Chemical Fume Hood
Tall cabinets
Safety Shower/Eyewash

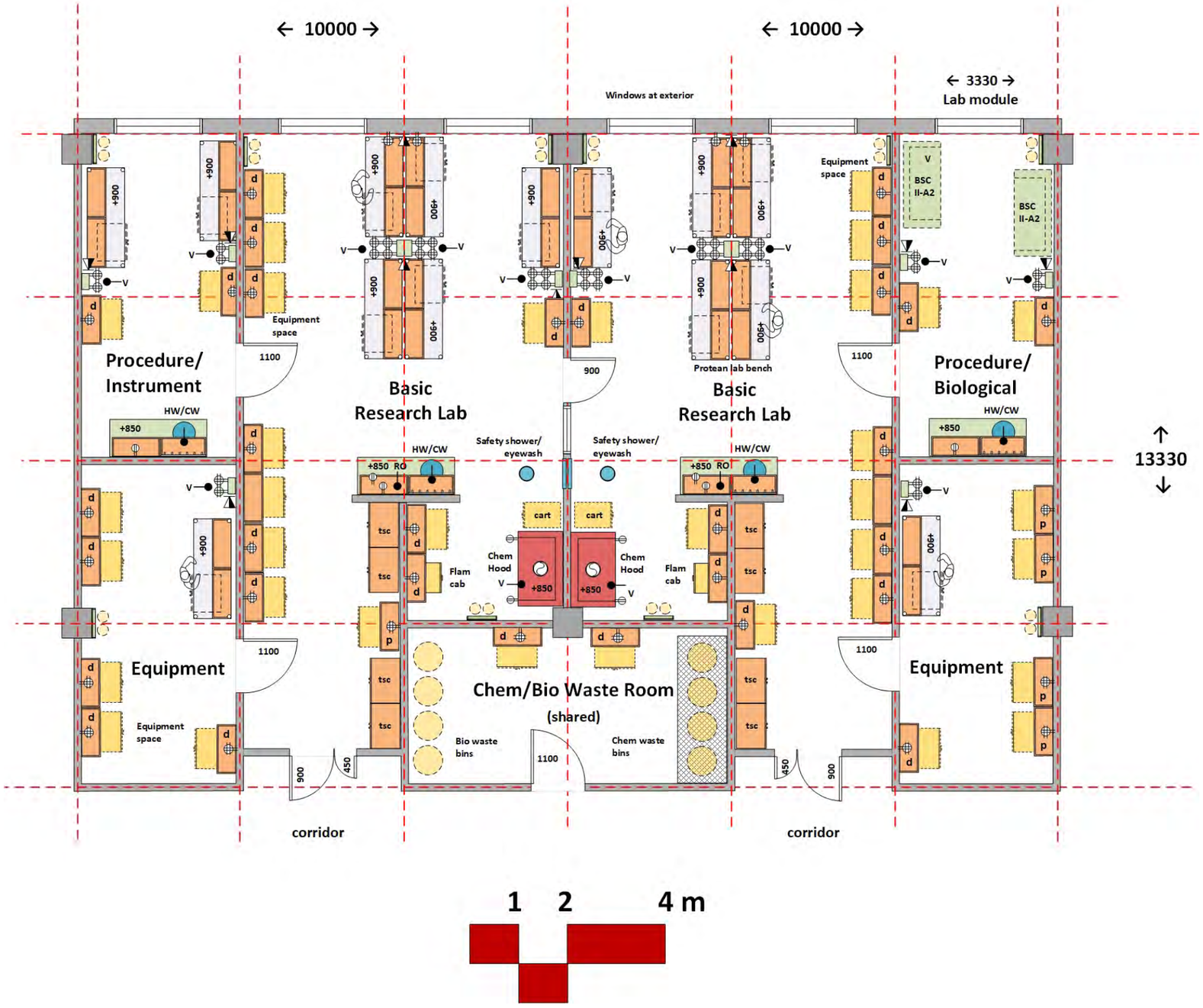
LAB TENANT FURNISHED EQUIPMENT

Refrigerators
Freezers
Centrifuges
Biological Safety Cabinets
Reach-in environmental chambers
Carts
Chemical storage cabinets

BASIC RESEARCH/BASIC RESEARCH LAB SUITE

3 modules per Lab Unit/6 modules per Lab Suite

Programme Requirements



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Centrifuges
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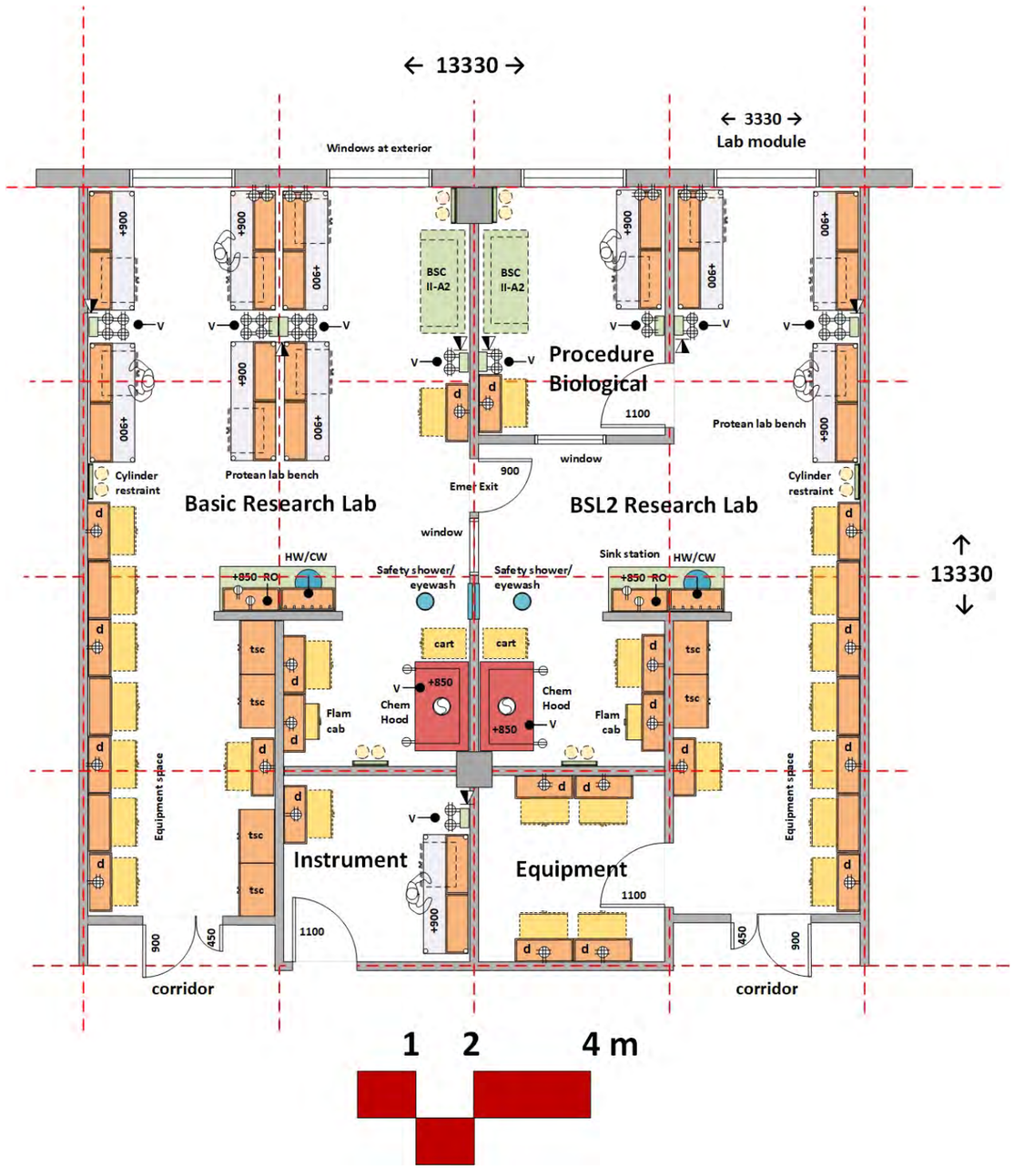
Reach-in environmental chambers
Carts
Chemical storage cabinets



BASIC RESEARCH/BSL2 LAB SUITE

2 modules per Lab Unit/4 modules per Lab Suite

Programme Requirements

ARCHITECTURAL

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Metal or wood casework
Sink Stations with epoxy resin sinks, tops
Protean Lab benches (can also be Lab Tenant Furnished)
Service columns
Chemical Fume Hood
Tall cabinets
Safety Shower/Eyewash

LAB TENANT FURNISHED EQUIPMENT

Refrigerators; Freezers
Centrifuges
Biological Safety Cabinets
Reach-in environmental chambers
Carts
Chemical storage cabinets
Mobile autoclaves where required

BASIC RESEARCH/BSL2 LAB SUITE

3 modules per Lab Unit/6 modules per Lab Suite

Programme Requirements

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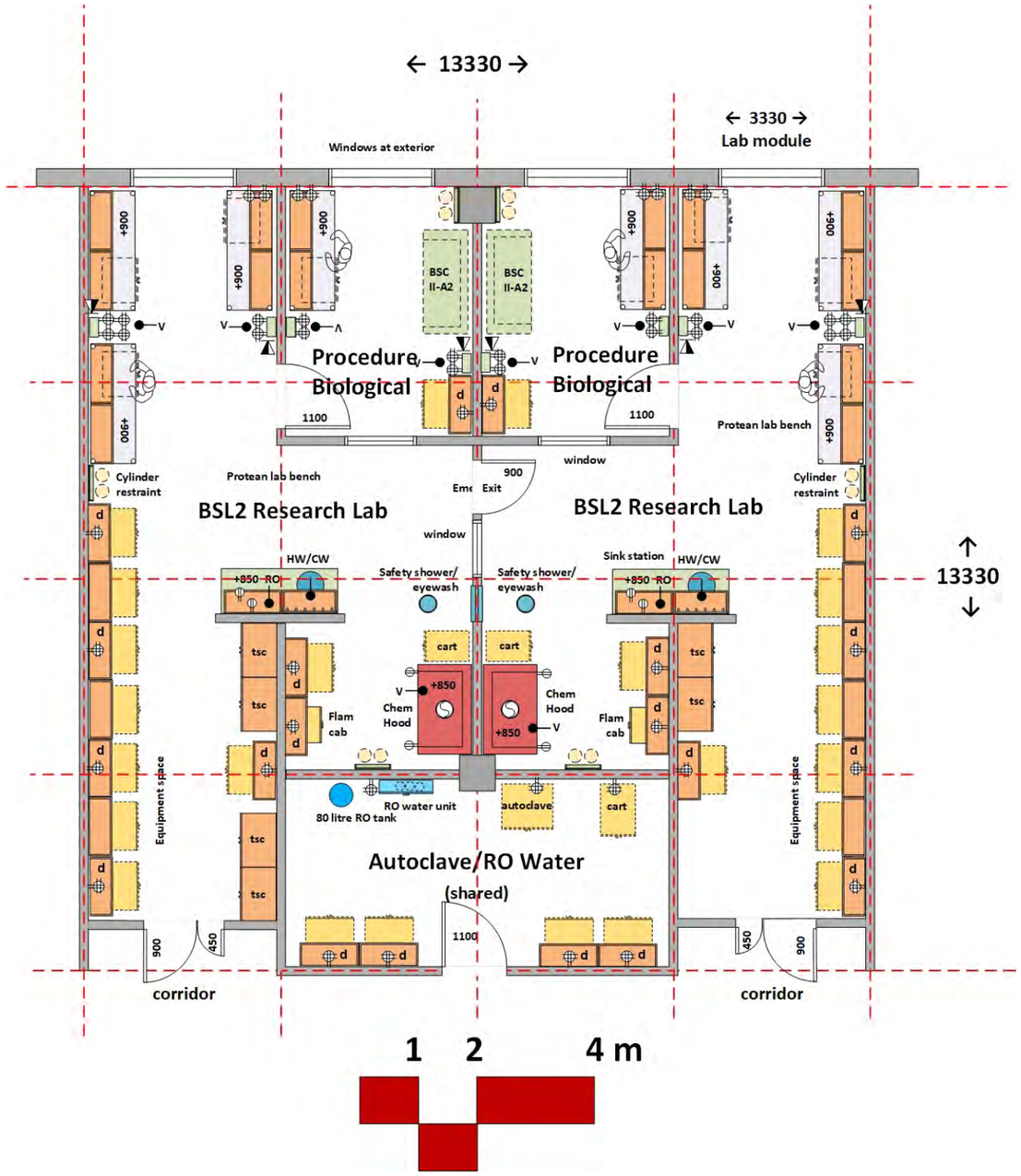
Centrifuges
Biological Safety Cabinets
Reach-in environmental chambers
Carts
Chemical storage cabinets
Mobile autoclaves where required

BSL2/BSL2 RESEARCH LAB SUITE

2 modules per Lab Unit/4 modules per Lab Suite

Programme Requirements



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Air changes: up to 8/hour occupied; 2-4/hour unoccupied
Air change rate may be higher due to equipment heat gain
Equipment Heat Gain: 500 btuh/sm for open lab area;
750 btuh/sm for lab support rooms.
Pressure: Lab Suite negative to corridor
Lab Support Rooms negative or positive depending upon use
22 cubic meter per minute exhaust at chemical fume hood

PLUMBING

Hot/Cold water at sinks with vacuum breakers
Pure water at sinks via point-of-use water polishers
Domestic tepid water at safety shower/eyewash
Floor drain at safety shower/eyewash
V = central piped services as required by lab tenant: Vacuum,
and/or compressed air and/or CO2 and/or nitrogen gas
Natural gas (methane) to be provided locally by lab tenant, as required
Inert specialty gases (helium, argon) at cylinder racks

ELECTRICAL

240v duplex and fourplex outlets at walls and service columns
Dedicated circuits at equipment spaces
Standby power for scientific equipment at equipment spaces
Hardwire and wireless data
Lighting: LED at 500 LUX

CONTRACTOR FURNISHED EQUIPMENT

Metal or wood casework
Sink Stations with epoxy resin sinks, tops
Protean Lab benches (can also be Lab Tenant Furnished)
Service columns
Chemical Fume Hood
Tall cabinets
Safety Shower/Eyewash

LAB TENANT FURNISHED EQUIPMENT

Refrigerators; Freezers
Centrifuges
Biological Safety Cabinets
Reach-in environmental chambers
Carts
Chemical storage cabinets
Zebra fish aquaria and aquaria racks
Mobile autoclaves where required

BSL2/BSL2 RESEARCH LAB SUITE

3 modules per Lab Unit/6 modules per Lab Suite

Programme Requirements

ARCHITECTURAL

Occupancy: B (Chapter 3- IBC)
Floor: vinyl tile or rubber tile
Walls: metal stud with gypsum board, epoxy paint
Ceiling: lab grade acoustic tile at 3000 mm (2800 minimum)
Stainless steel corner guards at wall corners
Doors: 900/450 x2400 pair with view window at corridor lab suite entries
1100x2400 single doors at procedure rooms
900x2100 glass panel door between lab units
Daylight attenuation: blinds at exterior windows
Sound attenuation: NC 45 or less
Security: card access

STRUCTURAL

Live floor load: 5 kPa
Vibration attenuation: 50 micrometers per second or less

MECHANICAL

Temperature: 18-22 deg C +/- 2 deg C
Humidity: 70% relative or less
100% exhaust
Air changes: up to 8/hour occupied; 2-4/hour unoccupied
Air change rate may be higher due to equipment heat gain
Equipment Heat Gain: 500 btuh/sm for open lab area;
750 btuh/sm for lab support rooms.
Pressure: Lab Suite negative to corridor
Lab Support Rooms negative or positive depending upon use
22 cubic meter per minute exhaust at chemical fume hood

PLUMBING

Hot/Cold water at sinks with vacuum breakers
Pure water at sinks via point-of-use water polishers
Domestic tepid water at safety shower/eyewash
Floor drain at safety shower/eyewash
V = central piped services as required by lab tenant: Vacuum,
and/or compressed air and/or CO2 and/or nitrogen gas
Natural gas (methane) to be provided locally by lab tenant, as required
Inert specialty gases (helium, argon) at cylinder racks

ELECTRICAL

240v duplex and fourplex outlets at walls and service columns
Dedicated circuits at equipment spaces
Standby power for scientific equipment at equipment spaces
Hardwire and wireless data
Lighting: LED at 500 LUX

CONTRACTOR FURNISHED EQUIPMENT

Metal or wood casework
Sink Stations with epoxy resin sinks, tops
Protean Lab benches (can also be Lab Tenant Furnished)
Service columns
Chemical Fume Hood
Tall cabinets
Safety Shower/Eyewash

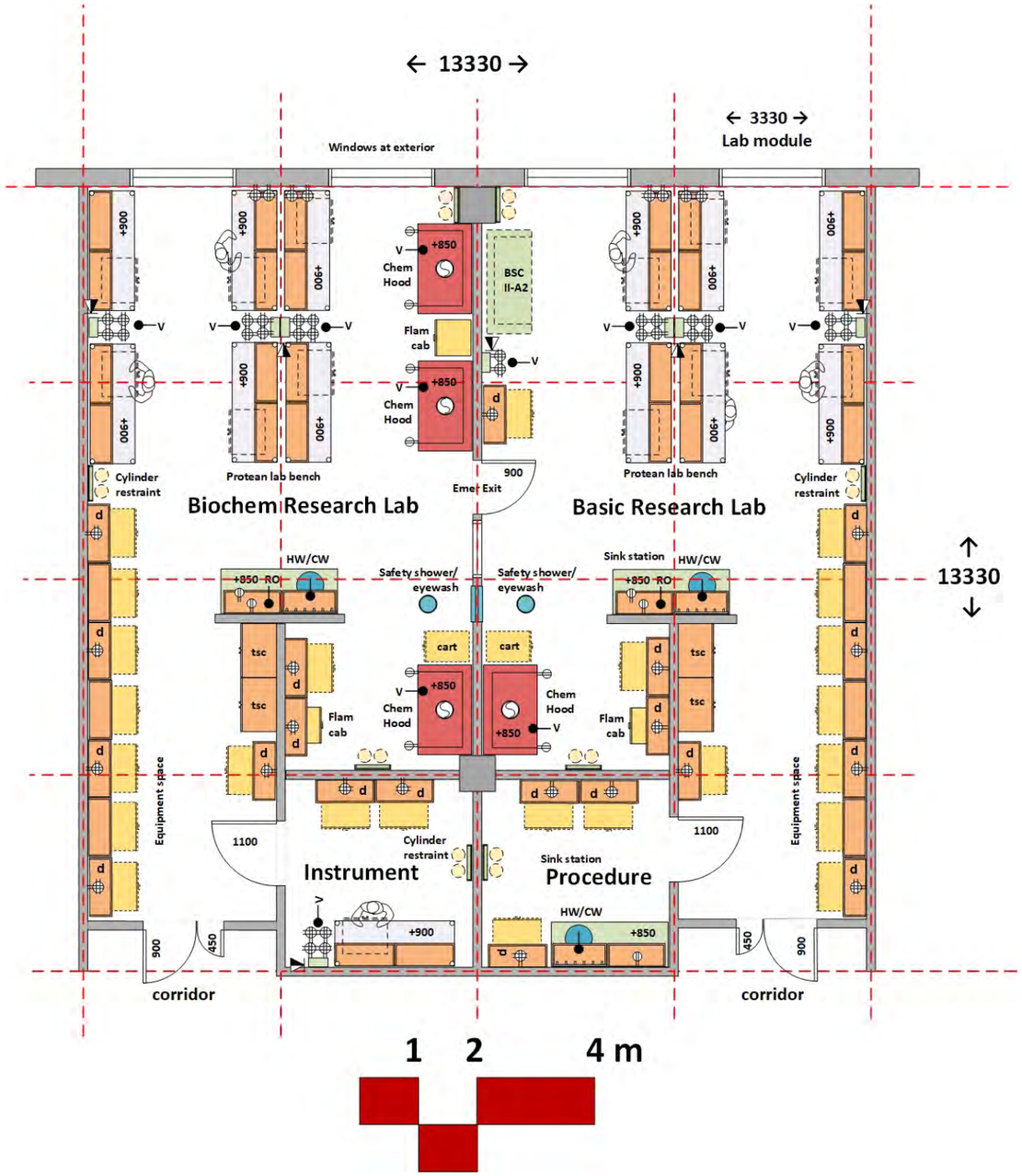
LAB TENANT FURNISHED EQUIPMENT

Refrigerators; Freezers
Centrifuges
Biological Safety Cabinets
Reach-in environmental chambers
Carts
Chemical storage cabinets
Zebra fish aquaria and aquaria racks
Mobile autoclaves where required

BIOCHEMISTRY/BASIC RESEARCH LAB SUITE

2 modules per Lab Unit/4 modules per Lab Suite

Programme Requirements



ARCHITECTURAL

Occupancy: B (Chapter 3- IBC)
Floor: vinyl tile or rubber tile
Walls: metal stud with gypsum board, epoxy paint
Ceiling: lab grade acoustic tile at 3000 mm (2800 minimum)
Stainless steel corner guards at wall corners
Doors: 900/450 x2400 pair with view window at corridor lab suite entries
1100x2400 single doors at procedure rooms
900x2100 glass panel door between lab units
Daylight attenuation: blinds at exterior windows
Sound attenuation: NC 45 or less
Security: card access

STRUCTURAL

Live floor load: 5 kPa
Vibration attenuation: 50 micrometers per second or less

MECHANICAL

Temperature: 18-22 deg C +/- 2 deg C
Humidity: 70% relative or less
100% exhaust
Air changes: up to 8/hour occupied; 2-4/hour unoccupied
Air change rate may be higher due to equipment heat gain
Equipment Heat Gain: 500 btuh/sm for open lab area;
750 btuh/sm for lab support rooms.
Pressure: Lab Suite negative to corridor
Lab Support Rooms negative or positive depending upon use
22 cubic meter per minute exhaust at chemical fume hood

PLUMBING

Hot/Cold water at sinks with vacuum breakers
Pure water at sinks via point-of-use water polishers
Domestic tepid water at safety shower/eyewash
Floor drain at safety shower/eyewash
V = central piped services as required by lab tenant: Vacuum,
and/or compressed air and/or CO2 and/or nitrogen gas
Natural gas (methane) to be provided locally by lab tenant, as required
Inert specialty gases (helium, argon) at cylinder racks

ELECTRICAL

240v duplex and fourplex outlets at walls and service columns
Dedicated circuits at equipment spaces
Standby power for scientific equipment at equipment spaces
Hardwire and wireless data
Lighting: LED at 500 LUX

CONTRACTOR FURNISHED EQUIPMENT

Metal or wood casework
Sink Stations with epoxy resin sinks, tops
Protean Lab benches (can also be Lab Tenant Furnished)
Service columns
Chemical Fume Hoods
Tall cabinets
Safety Shower/Eyewash

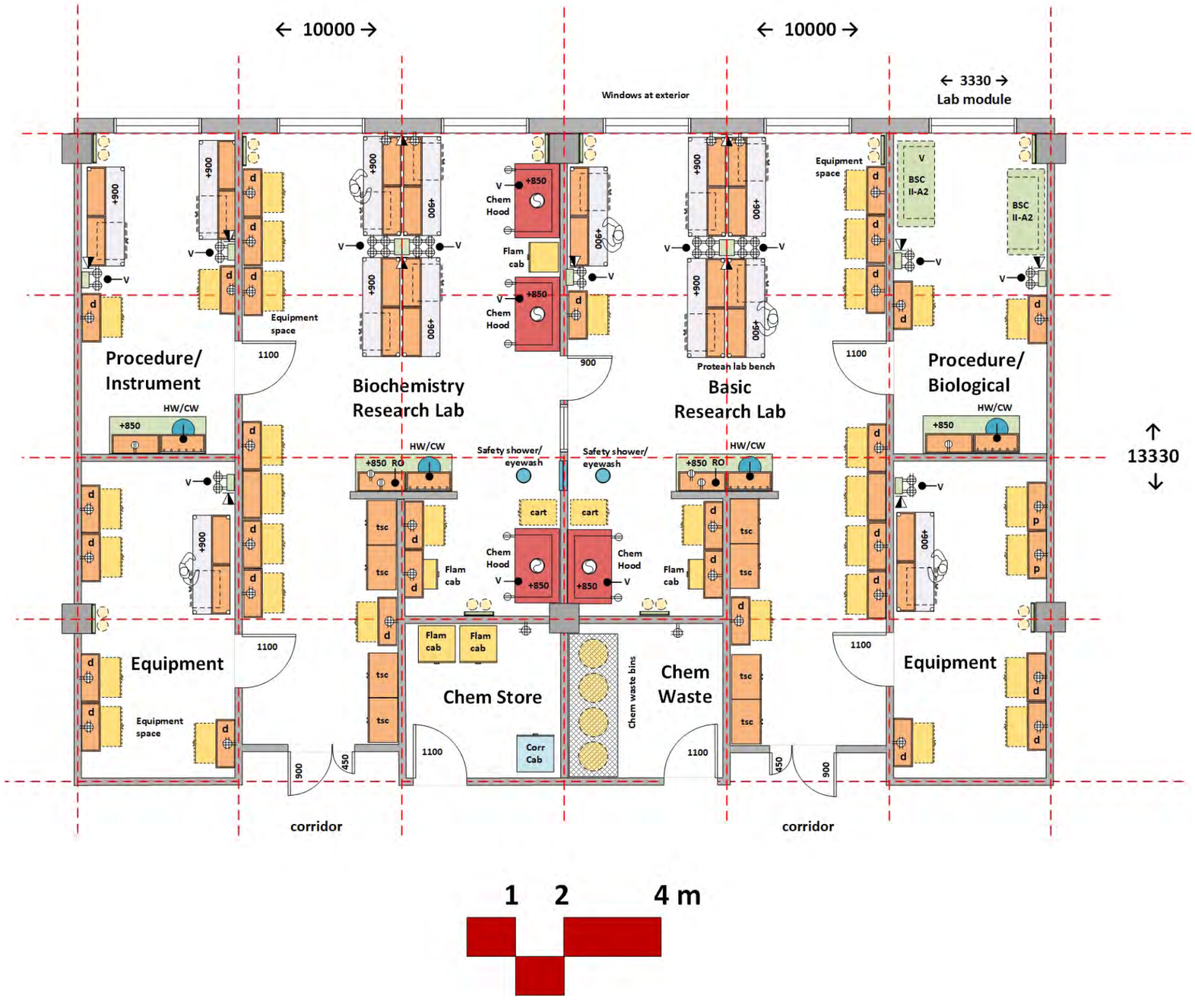
LAB TENANT FURNISHED EQUIPMENT

Refrigerators; Freezers
Centrifuges
Biological Safety Cabinets
Reach-in environmental chambers
Carts
Chemical storage cabinets

BIOCHEMISTRY/BASIC RESEARCH LAB SUITE

3 modules per Lab Unit/6 modules per Lab Suite

Programme Requirements



ARCHITECTURAL

Occupancy: B (Chapter 3- IBC)
Floor: vinyl tile or rubber tile
Walls: metal stud with gypsum board, epoxy paint
Ceiling: lab grade acoustic tile at 3000 mm (2800 minimum)
Stainless steel corner guards at wall corners
Doors: 900/450 x2400 pair with view window at corridor lab suite entries
1100x2400 single doors at procedure rooms
900x2100 glass panel door between lab units
Daylight attenuation: blinds at exterior windows
Sound attenuation: NC 45 or less
Security: card access

STRUCTURAL

Live floor load: 5 kPa
Vibration attenuation: 50 micrometers per second or less

MECHANICAL

Temperature: 18-22 deg C +/- 2 deg C
Humidity: 70% relative or less
100% exhaust
Air changes: up to 8/hour occupied; 2-4/hour unoccupied
Air change rate may be higher due to equipment heat gain
Equipment Heat Gain: 500 btuh/sm for open lab area;
750 btuh/sm for lab support rooms.
Pressure: Lab Suite negative to corridor
Lab Support Rooms negative or positive depending upon use
22 cubic meter per minute exhaust at chemical fume hood

PLUMBING

Hot/Cold water at sinks with vacuum breakers
Pure water at sinks via point-of-use water polishers
Domestic tepid water at safety shower/eyewash
Floor drain at safety shower/eyewash
V = central piped services as required by lab tenant: Vacuum,
and/or compressed air and/or CO2 and/or nitrogen gas
Natural gas (methane) to be provided locally by lab tenant, as required
Inert specialty gases (helium, argon) at cylinder racks

ELECTRICAL

240v duplex and fourplex outlets at walls and service columns
Dedicated circuits at equipment spaces
Standby power for scientific equipment at equipment spaces
Hardwire and wireless data
Lighting: LED at 500 LUX

CONTRACTOR FURNISHED EQUIPMENT

Metal or wood casework
Sink Stations with epoxy resin sinks, tops
Protean Lab benches (can also be Lab Tenant Furnished)
Service columns
Chemical Fume Hoods
Tall cabinets
Safety Shower/Eyewash

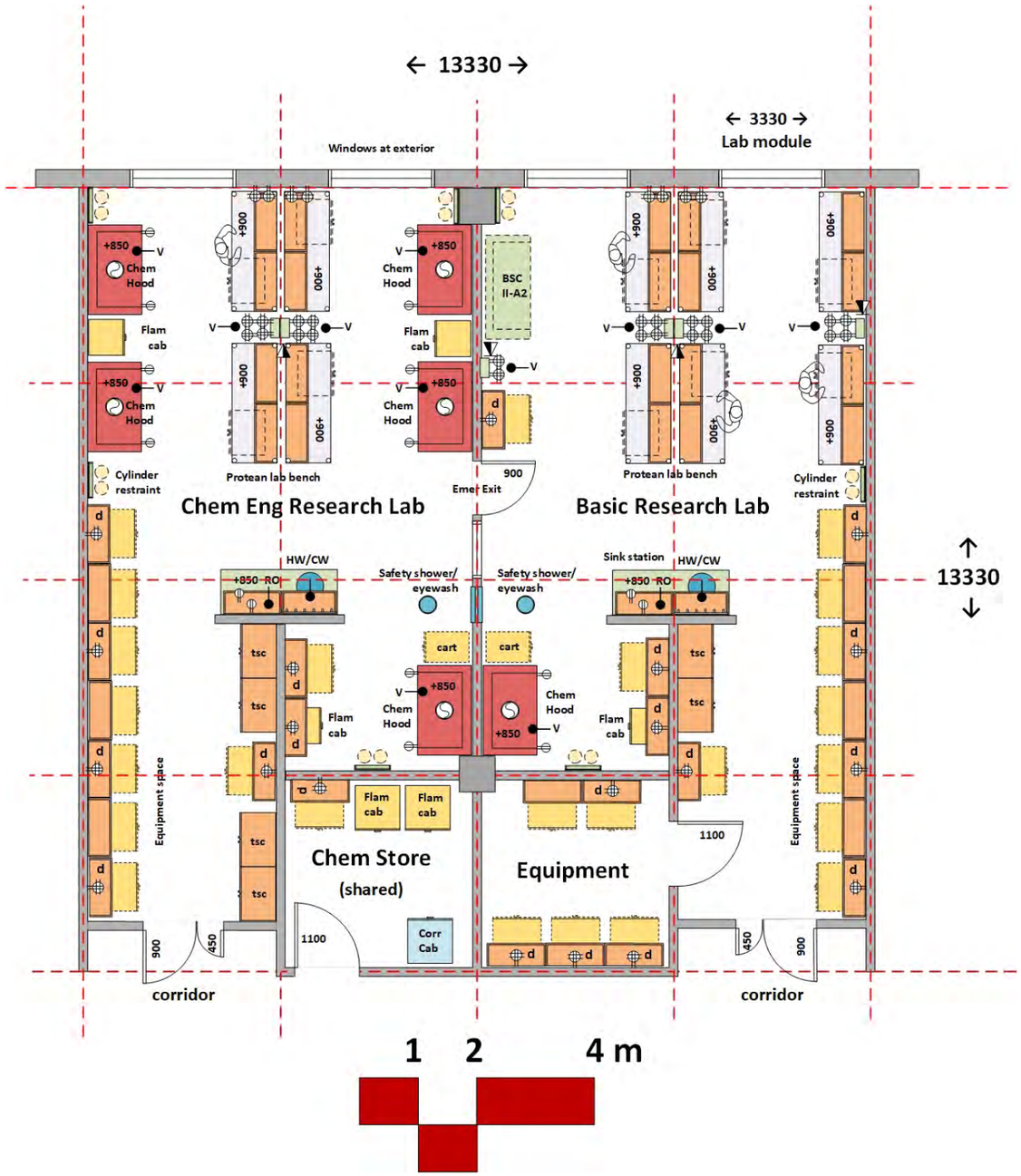
LAB TENANT FURNISHED EQUIPMENT

Refrigerators; Freezers
Centrifuges
Biological Safety Cabinets
Reach-in environmental chambers
Carts
Chemical storage cabinets

CHEMICAL ENGINEERING/BASIC RESEARCH LAB SUITE

2 modules per Lab Unit/4 modules per Lab Suite

Programme Requirements



ARCHITECTURAL

Occupancy: B (Chapter 3- IBC)
Floor: vinyl tile or rubber tile or sealed concrete
Walls: metal stud with gypsum board, epoxy paint
Ceiling: lab grade acoustic tile at 3000 mm (2800 minimum)
Stainless steel corner guards at wall corners
Doors: 900/450 x2400 pair with view window at corridor lab suite entries
1100x2400 single doors at procedure rooms
900x2100 glass panel door between lab units
Daylight attenuation: blinds at exterior windows
Sound attenuation: NC 45 or less
Security: card access

STRUCTURAL

Live floor load: 5 kPa
Vibration attenuation: 50 micrometers per second or less

MECHANICAL

Temperature: 18-22 deg C +/- 2 deg C
Humidity: 70% relative or less
100% exhaust
Air changes: up to 8/hour occupied; 2-4/hour unoccupied
Air change rate may be higher due to equipment heat gain
Equipment Heat Gain: 500 btuh/sm for open lab area;
750 btuh/sm for lab support rooms.
Pressure: Lab Suite negative to corridor
Lab Support Rooms negative or positive depending upon use
22 cubic meter per minute exhaust at chemical fume hood

PLUMBING

Hot/Cold water at sinks with vacuum breakers
Pure water at sinks via point-of-use water polishers
Domestic tepid water at safety shower/eyewash
Floor drain at safety shower/eyewash
V = central piped services as required by lab tenant: Vacuum,
and/or compressed air and/or CO2 and/or nitrogen gas
Natural gas (methane) to be provided locally by lab tenant, as required
Inert specialty gases (helium, argon) at cylinder racks

ELECTRICAL

240v duplex and fourplex outlets at walls and service columns
Dedicated circuits at equipment spaces
Standby power for scientific equipment at equipment spaces
Hardwire and wireless data
Lighting: LED at 500 LUX

CONTRACTOR FURNISHED EQUIPMENT

Metal or wood casework
Sink Stations with epoxy resin sinks, tops
Protean Lab benches (can also be Lab Tenant Furnished)
Service columns
Chemical Fume Hoods
Tall cabinets
Safety Shower/Eyewash

LAB TENANT FURNISHED EQUIPMENT

Refrigerators; Freezers
Centrifuges
Biological Safety Cabinets
Reach-in environmental chambers
Carts
Chemical storage cabinets

CHEMICAL ENGINEERING/BASIC RESEARCH LAB SUITE

3 modules per Lab Unit/6 modules per Lab Suite

Programme Requirements

ARCHITECTURAL

Occupancy: B (Chapter 3- IBC)
Floor: vinyl tile or rubber tile or sealed concrete
Walls: metal stud with gypsum board, epoxy paint
Ceiling: lab grade acoustic tile at 3000 mm (2800 minimum)
Stainless steel corner guards at wall corners
Doors: 900/450 x2400 pair with view window at corridor lab suite entries
1100x2400 single doors at procedure rooms
900x2100 glass panel door between lab units
Daylight attenuation: blinds at exterior windows
Sound attenuation: NC 45 or less
Security: card access

STRUCTURAL

Live floor load: 5 kPa
Vibration attenuation: 50 micrometers per second or less

MECHANICAL

Temperature: 18-22 deg C +/- 2 deg C
Humidity: 70% relative or less
100% exhaust
Air changes: up to 8/hour occupied; 2-4/hour unoccupied
Air change rate may be higher due to equipment heat gain
Equipment Heat Gain: 500 btuh/sm for open lab area;
750 btuh/sm for lab support rooms.
Pressure: Lab Suite negative to corridor
Lab Support Rooms negative or positive depending upon use
22 cubic meter per minute exhaust at chemical fume hood

PLUMBING

Hot/Cold water at sinks with vacuum breakers
Pure water at sinks via point-of-use water polishers
Domestic tepid water at safety shower/eyewash
Floor drain at safety shower/eyewash
V = central piped services as required by lab tenant: Vacuum,
and/or compressed air and/or CO2 and/or nitrogen gas
Natural gas (methane) to be provided locally by lab tenant, as required
Inert specialty gases (helium, argon) at cylinder racks

ELECTRICAL

240v duplex and fourplex outlets at walls and service columns
Dedicated circuits at equipment spaces
Standby power for scientific equipment at equipment spaces
Hardwire and wireless data
Lighting: LED at 500 LUX

CONTRACTOR FURNISHED EQUIPMENT

Metal or wood casework
Sink Stations with epoxy resin sinks, tops
Protean Lab benches (can also be Lab Tenant Furnished)
Service columns
Chemical Fume Hoods
Tall cabinets
Safety Shower/Eyewash

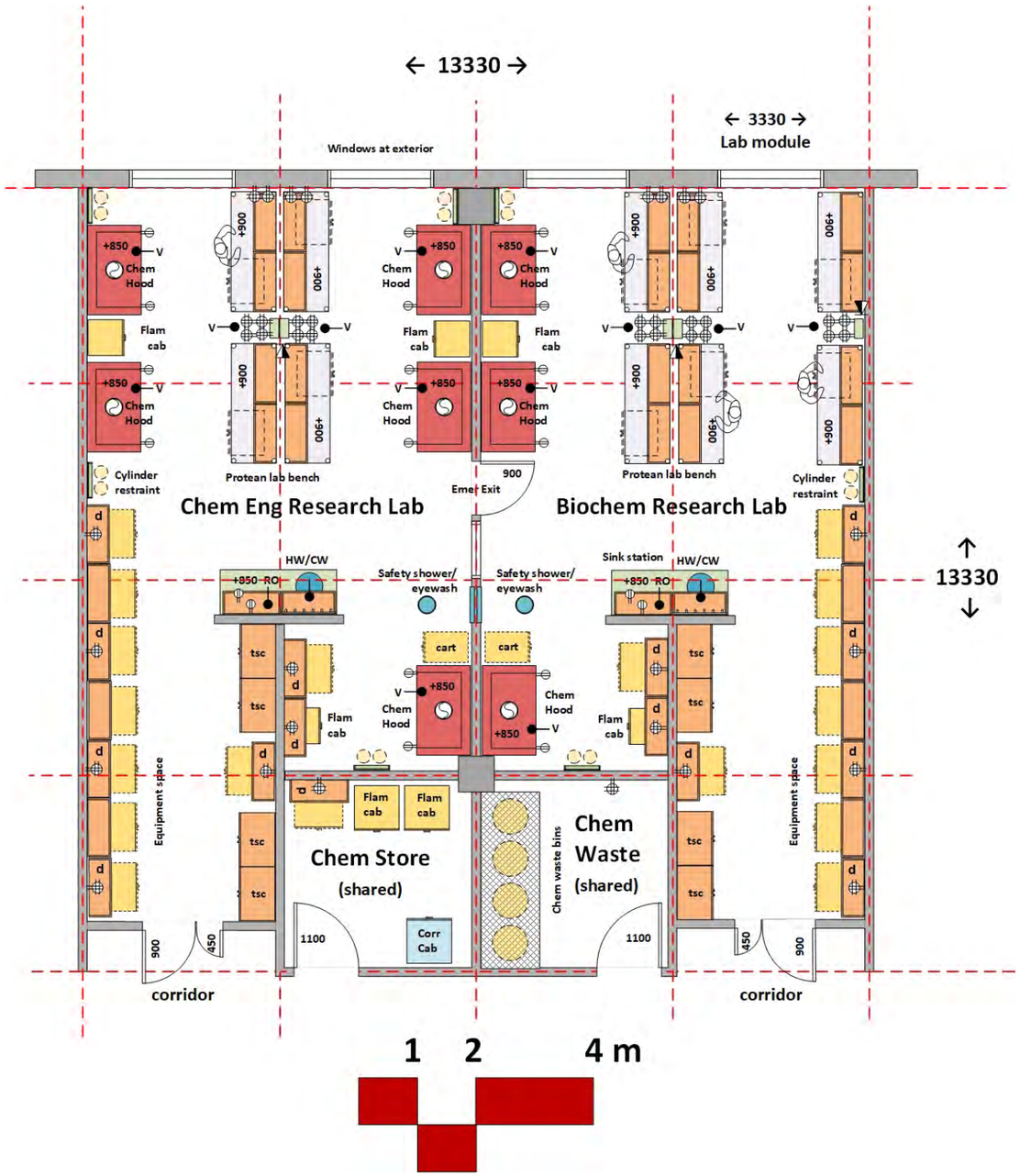
LAB TENANT FURNISHED EQUIPMENT

Refrigerators; Freezers
Centrifuges
Biological Safety Cabinets
Reach-in environmental chambers
Carts
Chemical storage cabinets

CHEMICAL ENGINEERING/BIOCHEMISTRY LAB SUITE

2 modules per Lab Unit/4 modules per Lab Suite

Programme Requirements



ARCHITECTURAL

Occupancy: B (Chapter 3- IBC)
Floor: vinyl tile or rubber tile or sealed concrete
Walls: metal stud with gypsum board, epoxy paint
Ceiling: lab grade acoustic tile at 3000 mm (2800 minimum)
Stainless steel corner guards at wall corners
Doors: 900/450 x2400 pair with view window at corridor lab suite entries
1100x2400 single doors at procedure rooms
900x2100 glass panel door between lab units
Daylight attenuation: blinds at exterior windows
Sound attenuation: NC 45 or less
Security: card access

STRUCTURAL

Live floor load: 5 kPa
Vibration attenuation: 50 micrometers per second or less

MECHANICAL

Temperature: 18-22 deg C +/- 2 deg C
Humidity: 70% relative or less
100% exhaust
Air changes: up to 8/hour occupied; 2-4/hour unoccupied
Air change rate may be higher due to equipment heat gain
Equipment Heat Gain: 500 btuh/sm for open lab area;
750 btuh/sm for lab support rooms.
Pressure: Lab Suite negative to corridor
Lab Support Rooms negative or positive depending upon use
22 cubic meter per minute exhaust at chemical fume hood

PLUMBING

Hot/Cold water at sinks with vacuum breakers
Pure water at sinks via point-of-use water polishers
Domestic tepid water at safety shower/eyewash
Floor drain at safety shower/eyewash
V = central piped services as required by lab tenant: Vacuum,
and/or compressed air and/or CO2 and/or nitrogen gas
Natural gas (methane) to be provided locally by lab tenant, as required
Inert specialty gases (helium, argon) at cylinder racks

ELECTRICAL

240v duplex and fourplex outlets at walls and service columns
Dedicated circuits at equipment spaces
Standby power for scientific equipment at equipment spaces
Hardwire and wireless data
Lighting: LED at 500 LUX

CONTRACTOR FURNISHED EQUIPMENT

Metal or wood casework
Sink Stations with epoxy resin sinks, tops
Protean Lab benches (can also be Lab Tenant Furnished)
Service columns
Chemical Fume Hoods
Tall cabinets
Safety Shower/Eyewash

LAB TENANT FURNISHED EQUIPMENT

Refrigerators; Freezers
Centrifuges
Biological Safety Cabinets
Reach-in environmental chambers
Carts
Chemical storage cabinets

CHEMICAL ENGINEERING/BIOCHEMISTRY LAB SUITE

3 modules per Lab Unit/6 modules per Lab Suite

Programme Requirements

ARCHITECTURAL

Occupancy: B (Chapter 3- IBC)
Floor: vinyl tile or rubber tile or sealed concrete
Walls: metal stud with gypsum board, epoxy paint
Ceiling: lab grade acoustic tile at 3000 mm (2800 minimum)
Stainless steel corner guards at wall corners
Doors: 900/450 x2400 pair with view window at corridor lab suite entries
1100x2400 single doors at procedure rooms
900x2100 glass panel door between lab units
Daylight attenuation: blinds at exterior windows
Sound attenuation: NC 45 or less
Security: card access

STRUCTURAL

Live floor load: 5 kPa
Vibration attenuation: 50 micrometers per second or less

MECHANICAL

Temperature: 18-22 deg C +/- 2 deg C
Humidity: 70% relative or less
100% exhaust
Air changes: up to 8/hour occupied; 2-4/hour unoccupied
Air change rate may be higher due to equipment heat gain
Equipment Heat Gain: 500 btuh/sm for open lab area;
750 btuh/sm for lab support rooms.
Pressure: Lab Suite negative to corridor
Lab Support Rooms negative or positive depending upon use
22 cubic meter per minute exhaust at chemical fume hood

PLUMBING

Hot/Cold water at sinks with vacuum breakers
Pure water at sinks via point-of-use water polishers
Domestic tepid water at safety shower/eyewash
Floor drain at safety shower/eyewash
V = central piped services as required by lab tenant: Vacuum,
and/or compressed air and/or CO2 and/or nitrogen gas
Natural gas (methane) to be provided locally by lab tenant, as required
Inert specialty gases (helium, argon) at cylinder racks

ELECTRICAL

240v duplex and fourplex outlets at walls and service columns
Dedicated circuits at equipment spaces
Standby power for scientific equipment at equipment spaces
Hardwire and wireless data
Lighting: LED at 500 LUX

CONTRACTOR FURNISHED EQUIPMENT

Metal or wood casework
Sink Stations with epoxy resin sinks, tops
Protean Lab benches (can also be Lab Tenant Furnished)
Service columns
Chemical Fume Hoods
Tall cabinets
Safety Shower/Eyewash

LAB TENANT FURNISHED EQUIPMENT

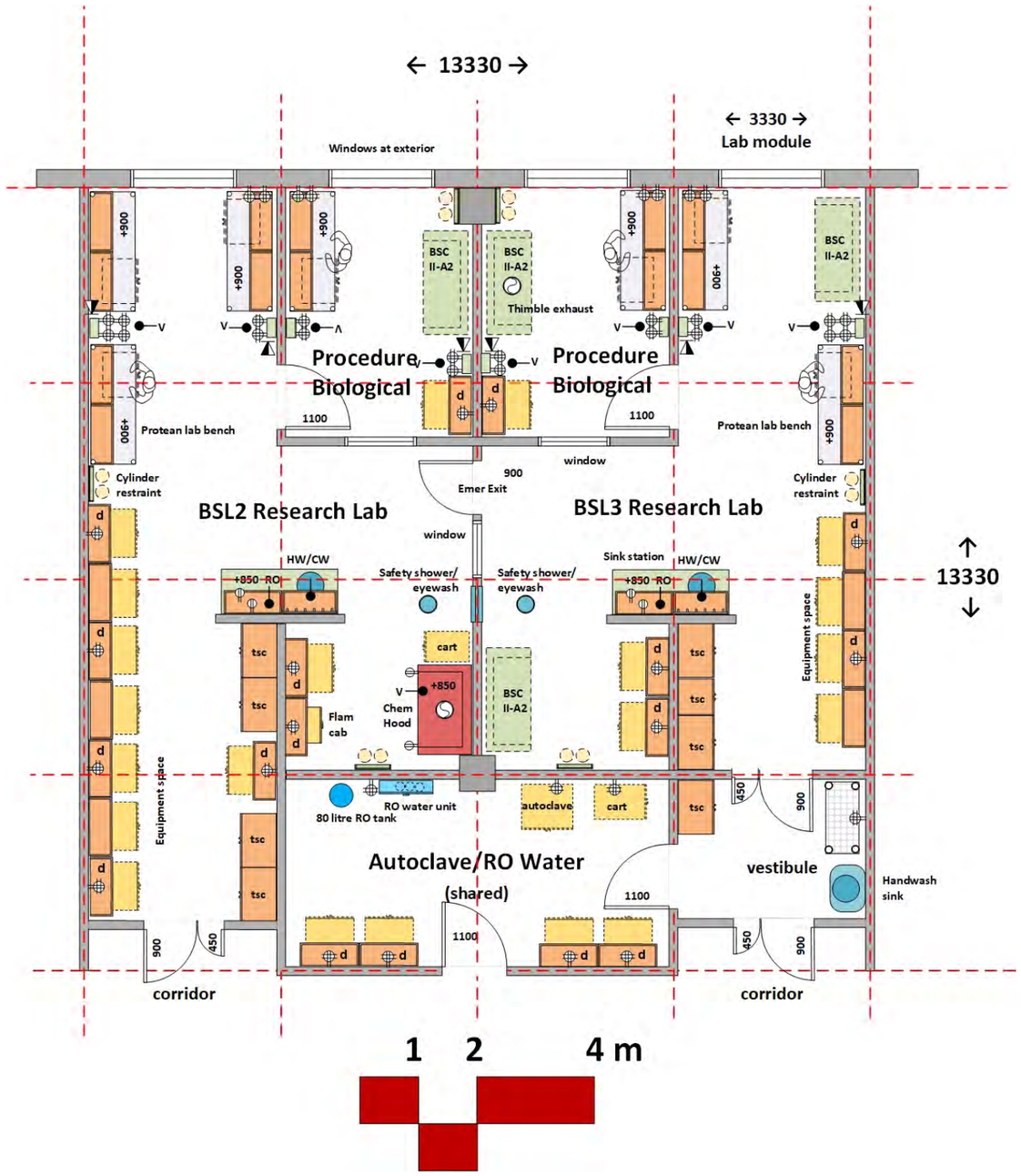
Refrigerators; Freezers
Centrifuges
Biological Safety Cabinets
Reach-in environmental chambers
Carts
Chemical storage cabinets

CHEMICAL ENGINEERING/BIOCHEMISTRY LAB SUITE

Axonometric view from corridor

CHEMICAL ENGINEERING/BIOCHEMISTRY LAB SUITE

Axonometric view from exterior



BSL2/BSL3 RESEARCH LAB SUITE

2 modules per Lab Unit/4 modules per Lab Suite

Programme Requirements

ARCHITECTURAL

Occupancy: B (Chapter 3- IBC)
Floor: BSL2- vinyl tile or rubber tile; BSL3- welded seam sheet vinyl
Walls: metal stud with gypsum board, epoxy paint
Ceiling: lab grade acoustic tile at 3000 mm (2800 minimum)
Hard, seamless gyp board at BSL3 ceiling
All pipe and conduit penetrations to BSL3 lab suite to be sealed
Stainless steel corner guards at wall corners
Doors: 900/450 x2400 pair with view window at corridor lab suite entries
1100x2400 single doors at procedure rooms
900x2100 glass panel door between lab units
Daylight attenuation: shades at exterior windows
Sound attenuation: NC 45 or less
Security: card access

STRUCTURAL

Live floor load: 5 kPa
Vibration attenuation: 50 micrometers per second or less

MECHANICAL

Temperature: 18-22 deg C +/- 2 deg C
Humidity: 70% relative or less
100% exhaust
Air changes: up to 8/hour occupied; 2-4/hour unoccupied
Air change rate may be higher due to equipment heat gain
Equipment Heat Gain: 500 btuh/sm for open lab area;
750 btuh/sm for lab support rooms.
Pressure: Lab Suite negative to corridor
Lab Support Rooms negative or positive depending upon use
22 cubic meter per minute exhaust at chemical fume hood

PLUMBING

Hot/Cold water at sinks with vacuum breakers
Pure water at sinks via point-of-use water polishers
Domestic tepid water at safety shower/eyewash
Floor drain at safety shower/eyewash
V = central piped services as required by lab tenant: Vacuum,
and/or compressed air and/or CO2 and/or nitrogen gas
Natural gas (methane) to be provided locally by lab tenant, as required
Inert specialty gases (helium, argon) at cylinder racks

ELECTRICAL

240v duplex and fourplex outlets at walls and service columns
Dedicated circuits at equipment spaces
Standby power for scientific equipment at equipment spaces
Hardwire and wireless data
Lighting: LED at 500 LUX

CONTRACTOR FURNISHED EQUIPMENT

Metal or wood casework for BLS2; metal casework for BSL3
Sink Stations with epoxy resin sinks, tops
Protean Lab benches (can also be Lab Tenant Furnished)
Service columns
Chemical Fume Hoods
Tall cabinets
Safety Shower/Eyewash

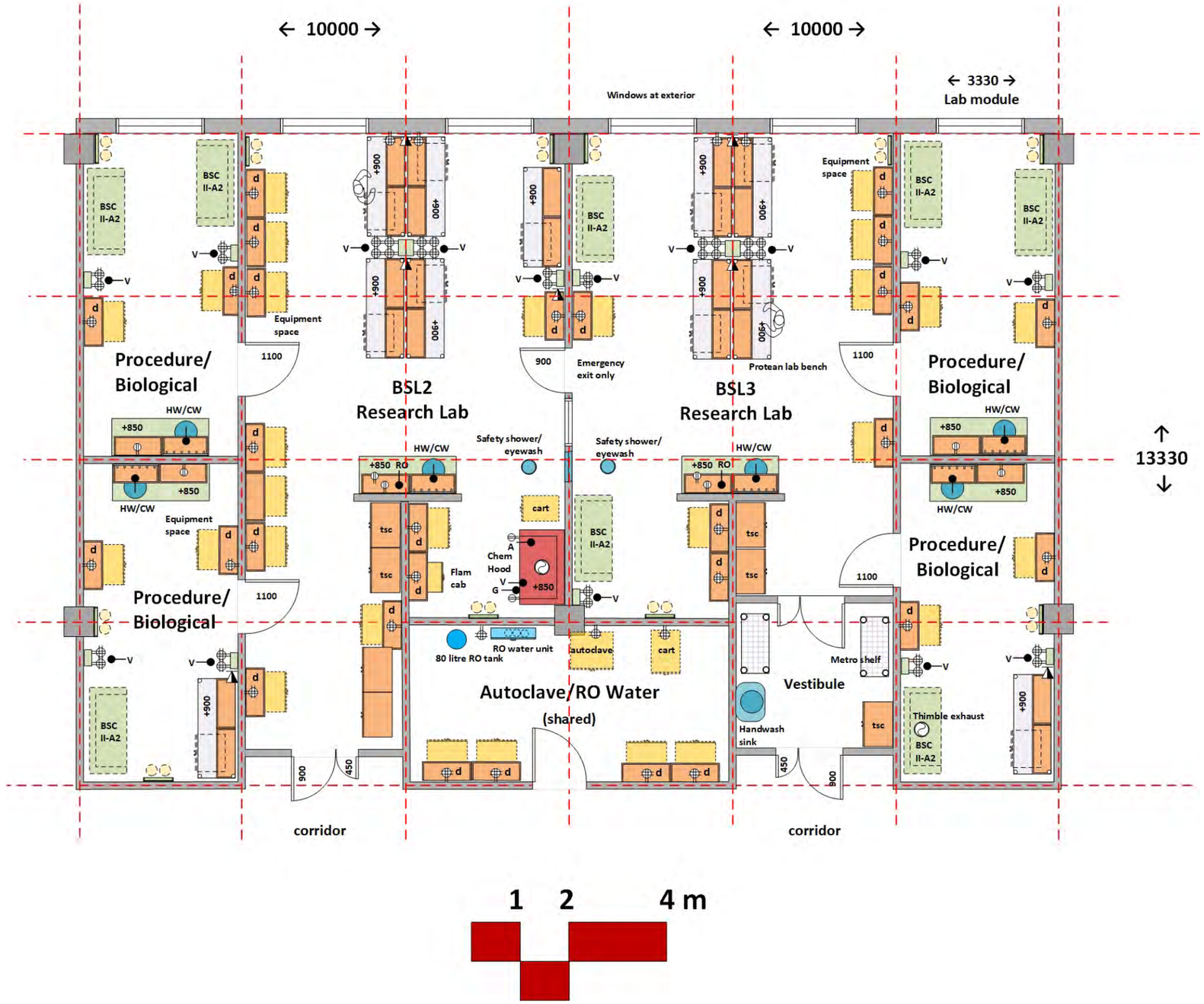
LAB TENANT FURNISHED EQUIPMENT

Refrigerators; Freezers; Centrifuges
Biological Safety Cabinets
Reach-in environmental chambers
Carts
Chemical storage cabinets
Mobile autoclave
RO water unit

BSL2/BSL3 RESEARCH LAB SUITE

3 modules per Lab Unit/6 modules per Lab Suite

Programme Requirements



ARCHITECTURAL

Occupancy: B (Chapter 3- IBC)
Floor: BSL2: vinyl tile or rubber tile; BSL3: welded seam sheet vinyl
Walls: metal stud with gypsum board, epoxy paint
Ceiling: lab grade acoustic tile at 3000 mm (2800 minimum)
Hard, seamless gyp board at BSL3 ceiling
All pipe and conduit penetrations to BSL3 lab suite to be sealed
Stainless steel corner guards at wall corners
Doors: 900/450 x2400 pair with view window at corridor lab suite entries
1100x2400 single doors at procedure rooms
900x2100 glass panel door between lab units
Daylight attenuation: shades at exterior windows
Sound attenuation: NC 45 or less
Security: card access

STRUCTURAL

Live floor load: 5 kPa
Vibration attenuation: 50 micrometers per second or less

MECHANICAL

Temperature: 18-22 deg C +/- 2 deg C
Humidity: 70% relative or less
100% exhaust
Air changes: up to 8/hour occupied; 2-4/hour unoccupied
Air change rate may be higher due to equipment heat gain
Equipment Heat Gain: 500 btuh/sm for open lab area;
750 btuh/sm for lab support rooms.
Pressure: Lab Suite negative to corridor
Lab Support Rooms negative or positive depending upon use
22 cubic meter per minute exhaust at chemical fume hood

PLUMBING

Hot/Cold water at sinks with vacuum breakers
Pure water at sinks via point-of-use water polishers
Domestic tepid water at safety shower/eyewash
Floor drain at safety shower/eyewash
V = central piped services as required by lab tenant: Vacuum,
and/or compressed air and/or CO2 and/or nitrogen gas
Natural gas (methane) to be provided locally by lab tenant, as required
Inert specialty gases (helium, argon) at cylinder racks

ELECTRICAL

240v duplex and fourplex outlets at walls and service columns
Dedicated circuits at equipment spaces
Standby power for scientific equipment at equipment spaces
Hardwire and wireless data
Lighting: LED at 500 LUX

CONTRACTOR FURNISHED EQUIPMENT

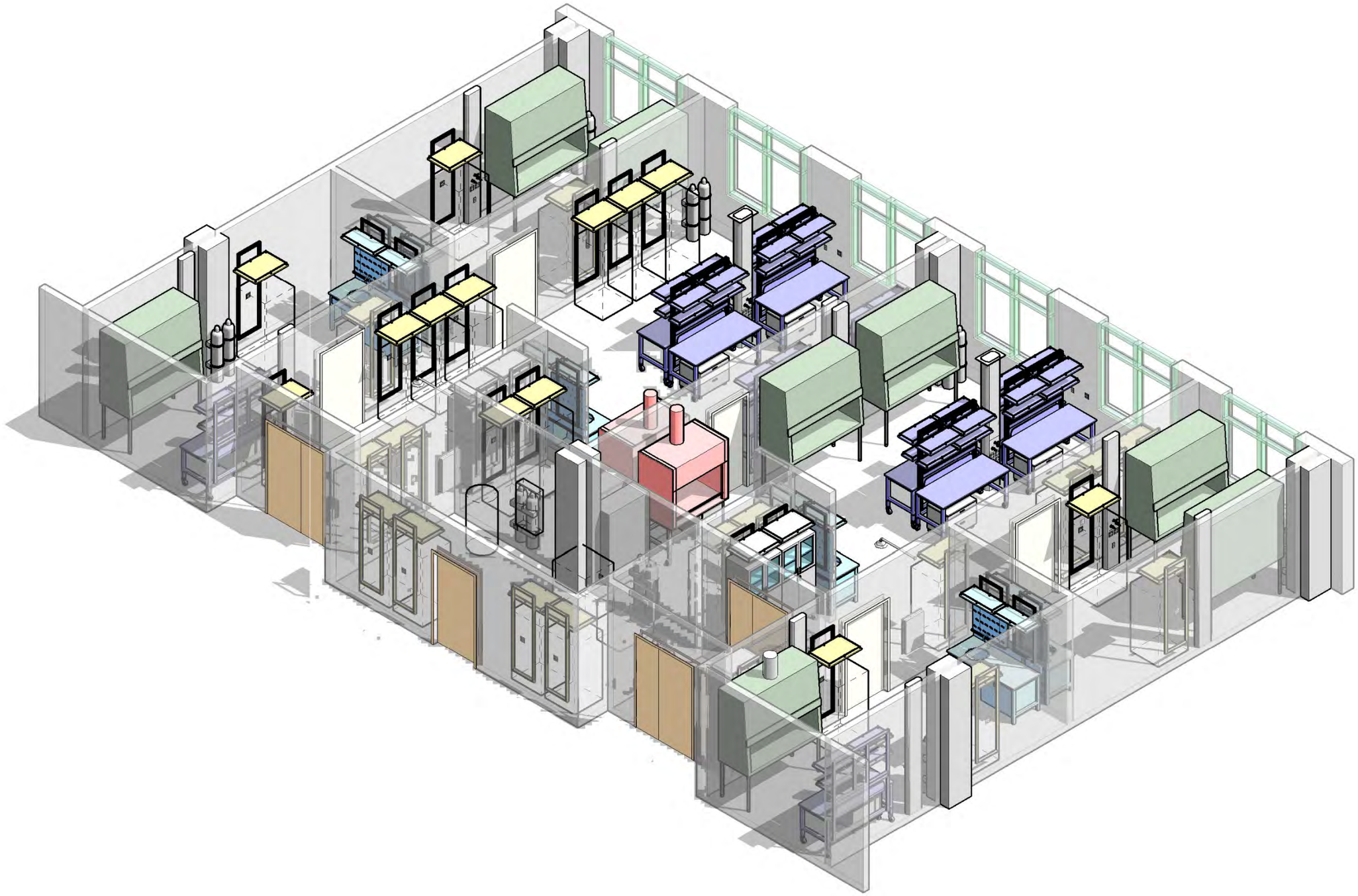
Metal or wood casework for BLS2; metal casework for BSL3
Sink Stations with epoxy resin sinks, tops
Protean Lab benches (can also be Lab Tenant Furnished)
Service columns
Chemical Fume Hoods
Tall cabinets
Safety Shower/Eyewash

LAB TENANT FURNISHED EQUIPMENT

Refrigerators; Freezers; Centrifuges
Biological Safety Cabinets
Reach-in environmental chambers
Carts
Chemical storage cabinets
Mobile autoclave
RO water unit

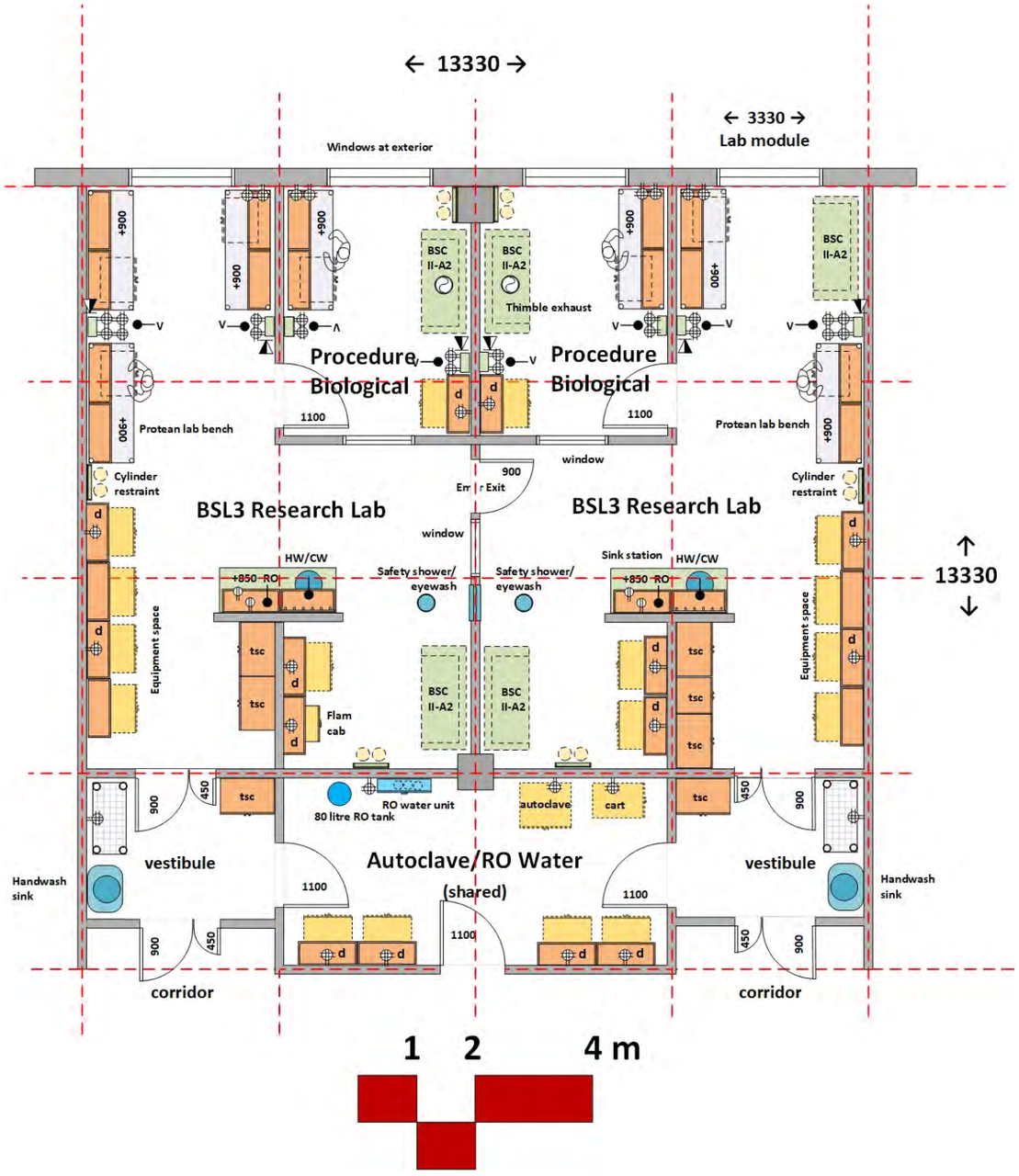
BSL2/BSL3 RESEARCH LAB SUITE

Axonometric view from corridor



BSL2/BSL3 RESEARCH LAB SUITE

Axonometric view from exterior



BSL3/BSL3 RESEARCH LAB SUITE

2 modules per Lab Unit/4 modules per Lab Suite

Programme Requirements

ARCHITECTURAL

Occupancy: B (Chapter 3- IBC)
Floor: welded seam sheet vinyl
Walls: metal stud with gypsum board, epoxy paint
Ceiling: hard, seamless gyp board ceiling, epoxy paint
All pipe and conduit penetrations to lab suite to be sealed
Stainless steel corner guards at wall corners
Doors: 900/450 x2400 pair with view window at corridor lab suite entries
1100x2400 single doors at procedure rooms
900x2100 glass panel door between lab units
Daylight attenuation: shades at exterior windows
Sound attenuation: NC 45 or less
Security: card access

STRUCTURAL

Live floor load: 5 kPa
Vibration attenuation: 50 micrometers per second or less

MECHANICAL

Temperature: 18-22 deg C +/- 2 deg C
Humidity: 70% relative or less
100% exhaust
Air changes: up to 8/hour occupied; 2-4/hour unoccupied
Air change rate may be higher due to equipment heat gain
Equipment Heat Gain: 500 btuh/sm for open lab area;
750 btuh/sm for lab support rooms.
Pressure: Lab Suite negative to corridor
Lab Support Rooms negative or positive depending upon use
22 cubic meter per minute exhaust at chemical fume hood

PLUMBING

Hot/Cold water at sinks with vacuum breakers
Pure water at sinks via point-of-use water polishers
Domestic tepid water at safety shower/eyewash
Floor drain at safety shower/eyewash
V = central piped services as required by lab tenant: Vacuum,
and/or compressed air and/or CO2 and/or nitrogen gas
Natural gas (methane) to be provided locally by lab tenant, as required
Inert specialty gases (helium, argon) at cylinder racks

ELECTRICAL

240v duplex and fourplex outlets at walls and service columns
Dedicated circuits at equipment spaces
Standby power for scientific equipment at equipment spaces
Hardwire and wireless data
Lighting: LED at 500 LUX

CONTRACTOR FURNISHED EQUIPMENT

Metal casework
Sink Stations with epoxy resin sinks, tops
Protean Lab benches (can also be Lab Tenant Furnished)
Service columns
Tall cabinets
Safety Shower/Eyewash

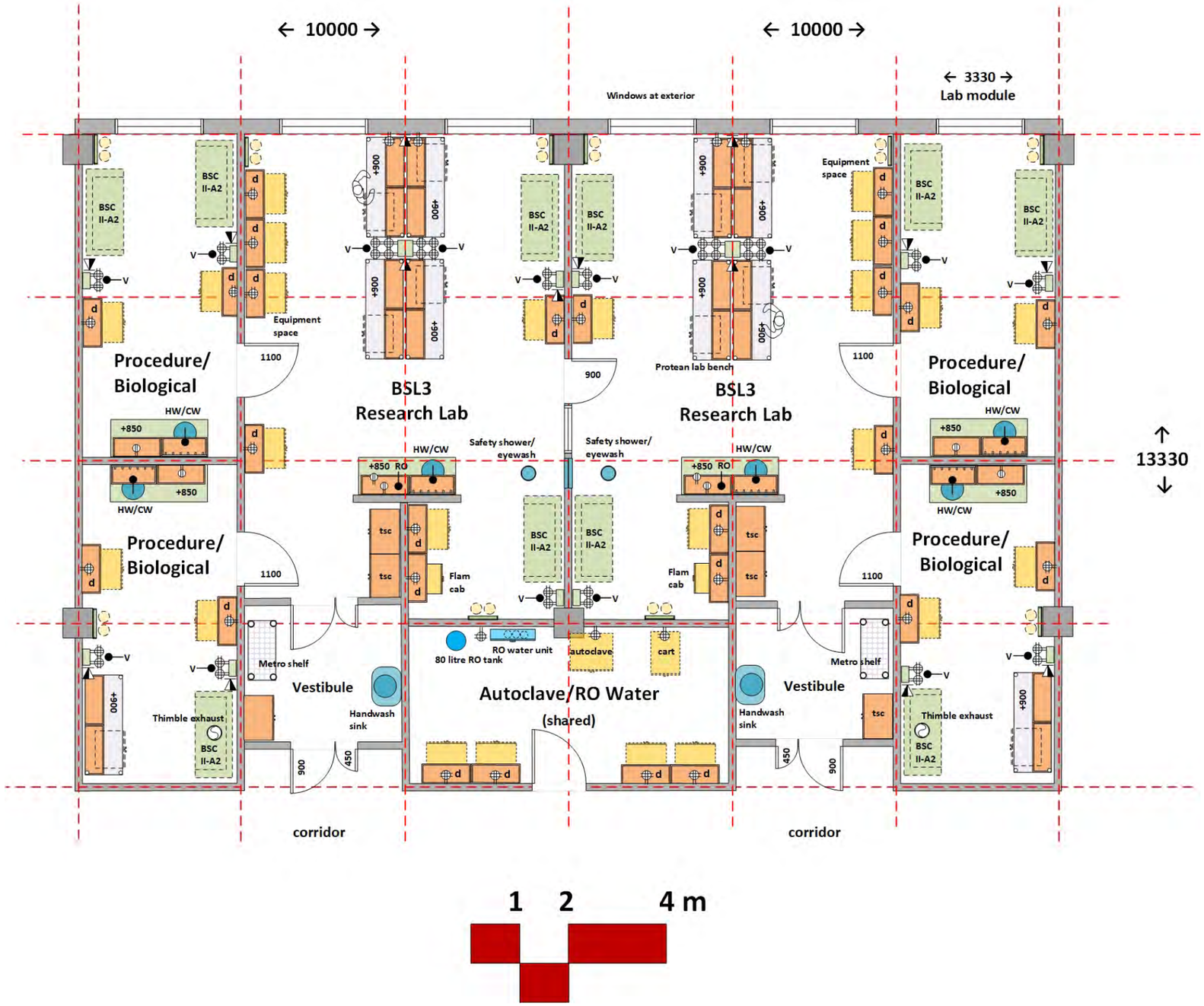
LAB TENANT FURNISHED EQUIPMENT

Refrigerators; Freezers
Centrifuges
Biological Safety Cabinets
Reach-in environmental chambers
Carts
Chemical storage cabinets
Mobile autoclave

BSL3/BSL3 RESEARCH LAB SUITE

3 modules per Lab Unit/6 modules per Lab Suite

Programme Requirements



ARCHITECTURAL

Occupancy: B (Chapter 3- IBC)
Floor: welded seam sheet vinyl
Walls: metal stud with gypsum board, epoxy paint
Ceiling: hard, seamless gyp board ceiling, epoxy paint
All pipe and conduit penetrations to lab suite to be sealed
Stainless steel corner guards at wall corners
Doors: 900/450 x2400 pair with view window at corridor lab suite entries
1100x2400 single doors at procedure rooms
900x2100 glass panel door between lab units
Daylight attenuation: shades at exterior windows
Sound attenuation: NC 45 or less
Security: card access

STRUCTURAL

Live floor load: 5 kPa
Vibration attenuation: 50 micrometers per second or less

MECHANICAL

Temperature: 18-22 deg C +/- 2 deg C
Humidity: 70% relative or less
100% exhaust
Air changes: up to 8/hour occupied; 2-4/hour unoccupied
Air change rate may be higher due to equipment heat gain
Equipment Heat Gain: 500 btuh/sm for open lab area;
750 btuh/sm for lab support rooms.
Pressure: Lab Suite negative to corridor
Lab Support Rooms negative or positive depending upon use
22 cubic meter per minute exhaust at chemical fume hood

PLUMBING

Hot/Cold water at sinks with vacuum breakers
Pure water at sinks via point-of-use water polishers
Domestic tepid water at safety shower/eyewash
Floor drain at safety shower/eyewash
V = central piped services as required by lab tenant: Vacuum,
and/or compressed air and/or CO2 and/or nitrogen gas
Natural gas (methane) to be provided locally by lab tenant, as required
Inert specialty gases (helium, argon) at cylinder racks

ELECTRICAL

240v duplex and fourplex outlets at walls and service columns
Dedicated circuits at equipment spaces
Standby power for scientific equipment at equipment spaces
Hardwire and wireless data
Lighting: LED at 500 LUX

CONTRACTOR FURNISHED EQUIPMENT

Metal casework
Sink Stations with epoxy resin sinks, tops
Protean Lab benches (can also be Lab Tenant Furnished)
Service columns
Tall cabinets
Safety Shower/Eyewash

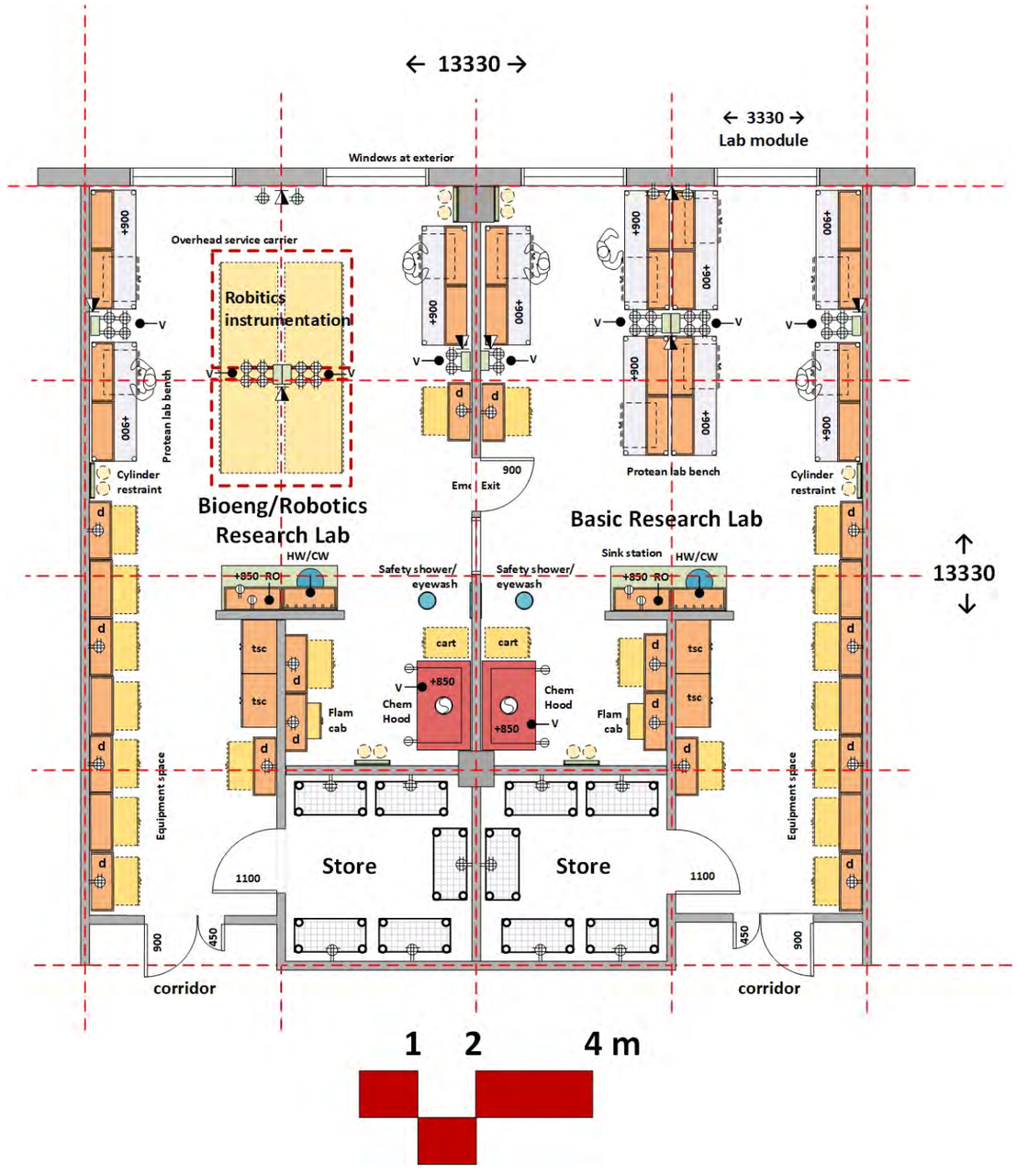
LAB TENANT FURNISHED EQUIPMENT

Refrigerators; Freezers; Centrifuges
Biological Safety Cabinets
Reach-in environmental chambers
Carts
Chemical storage cabinets
Mobile autoclave
RO water unit

BIOENGINEERING-ROBOTICS/BASIC RESEARCH LAB SUITE

2 modules per Lab Unit/4 modules per Lab Suite

Programme Requirements



ARCHITECTURAL

Occupancy: B (Chapter 3- IBC)
Floor: vinyl tile or rubber tile or sealed concrete
Walls: metal stud with gypsum board, epoxy paint
Ceiling: lab grade acoustic tile at 3000 mm (2800 minimum)
Or open to structure
Stainless steel corner guards at wall corners
Doors: 900/450 x2400 pair with view window at corridor lab suite entries
1100x2400 single doors at procedure rooms
900x2100 glass panel door between lab units
Daylight attenuation: blinds at exterior windows
Sound attenuation: NC 45 or less
Security: card access

STRUCTURAL

Live floor load: 5 kPa
Vibration attenuation: 50 micrometers per second or less

MECHANICAL

Temperature: 18-22 deg C +/- 2 deg C
Humidity: 70% relative or less
100% exhaust
Air changes: up to 8/hour occupied; 2-4/hour unoccupied
Air change rate may be higher due to equipment heat gain
Equipment Heat Gain: 500 btuh/sm for open lab area;
750 btuh/sm for lab support rooms.
Pressure: Lab Suite negative to corridor
Lab Support Rooms negative or positive depending upon use
22 cubic meter per minute exhaust at chemical fume hood

PLUMBING

Hot/Cold water at sinks with vacuum breakers
Pure water at sinks via point-of-use water polishers
Domestic tepid water at safety shower/eyewash
Floor drain at safety shower/eyewash
V = central piped services as required by lab tenant: Vacuum,
and/or compressed air and/or CO2 and/or nitrogen gas
Natural gas (methane) to be provided locally by lab tenant, as required
Inert specialty gases (helium, argon) at cylinder racks

ELECTRICAL

240v duplex and fourplex outlets at walls and service columns
Dedicated circuits at equipment spaces
Standby power for scientific equipment at equipment spaces
Hardwire and wireless data
Lighting: LED at 500 LUX

CONTRACTOR FURNISHED EQUIPMENT

Metal or wood casework
Sink Stations with epoxy resin sinks, tops
Protean Lab benches (can also be Lab Tenant Furnished)
Service columns
Chemical Fume Hoods
Tall cabinets
Safety Shower/Eyewash

LAB TENANT FURNISHED EQUIPMENT

Refrigerators
Freezers
Centrifuges
Biological Safety Cabinets
Reach-in environmental chambers
Carts
Chemical storage cabinets

BIOENGINEERING-ROBOTICS/BASIC RESEARCH LAB SUITE

3 modules per Lab Unit/6 modules per Lab Suite

Programme Requirements

ARCHITECTURAL

Occupancy: B (Chapter 3- IBC)
Floor: vinyl tile or rubber tile or sealed concrete
Walls: metal stud with gypsum board, epoxy paint
Ceiling: lab grade acoustic tile at 3000 mm (2800 minimum)
Or open to structure
Stainless steel corner guards at wall corners
Doors: 900/450 x2400 pair with view window at corridor lab suite entries
1100x2400 single doors at procedure rooms
900x2100 glass panel door between lab units
Daylight attenuation: blinds at exterior windows
Sound attenuation: NC 45 or less
Security: card access

STRUCTURAL

Live floor load: 5 kPa
Vibration attenuation: 50 micrometers per second or less

MECHANICAL

Temperature: 18-22 deg C +/- 2 deg C
Humidity: 70% relative or less
100% exhaust
Air changes: up to 8/hour occupied; 2-4/hour unoccupied
Air change rate may be higher due to equipment heat gain
Equipment Heat Gain: 500 btuh/sm for open lab area;
750 btuh/sm for lab support rooms.
Pressure: Lab Suite negative to corridor
Lab Support Rooms negative or positive depending upon use
22 cubic meter per minute exhaust at chemical fume hood

PLUMBING

Hot/Cold water at sinks with vacuum breakers
Pure water at sinks via point-of-use water polishers
Domestic tepid water at safety shower/eyewash
Floor drain at safety shower/eyewash
V = central piped services as required by lab tenant: Vacuum,
and/or compressed air and/or CO2 and/or nitrogen gas
Natural gas (methane) to be provided locally by lab tenant, as required
Inert specialty gases (helium, argon) at cylinder racks

ELECTRICAL

240v duplex and fourplex outlets at walls and service columns
Dedicated circuits at equipment spaces
Standby power for scientific equipment at equipment spaces
Hardwire and wireless data
Lighting: LED at 500 LUX

CONTRACTOR FURNISHED EQUIPMENT

Metal or wood casework
Sink Stations with epoxy resin sinks, tops
Protean Lab benches (can also be Lab Tenant Furnished)
Service columns
Chemical Fume Hoods
Tall cabinets
Safety Shower/Eyewash

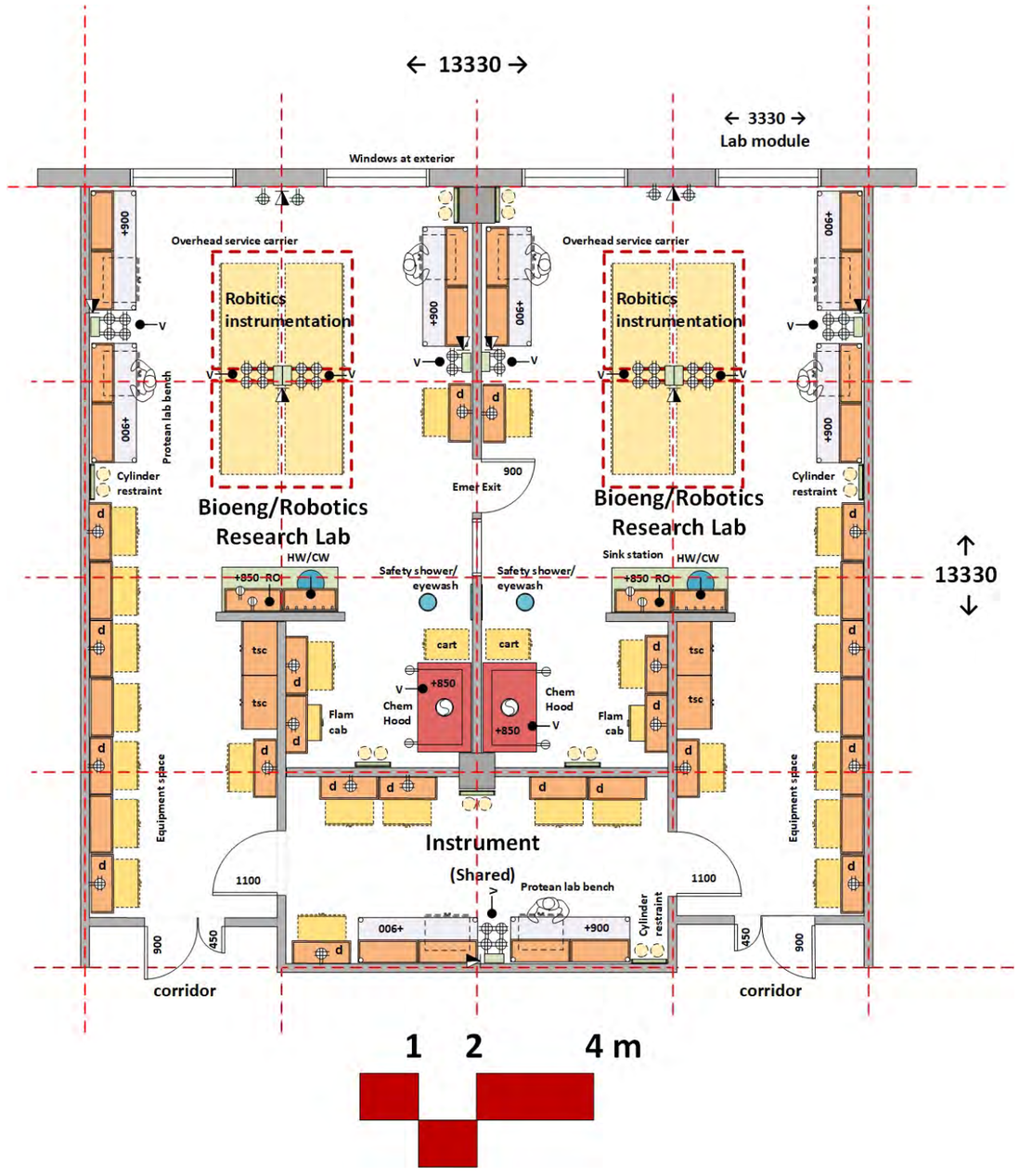
LAB TENANT FURNISHED EQUIPMENT

Refrigerators; Freezers
Centrifuges
Biological Safety Cabinets
Reach-in environmental chambers
Carts
Chemical storage cabinets

BIOENGINEERING-ROBOTICS/BIOENGINEERING-ROBOTICS RESEARCH LAB SUITE

2 modules per Lab Unit/4 modules per Lab Suite

Programme Requirements



ARCHITECTURAL

Occupancy: B (Chapter 3- IBC)
Floor: vinyl tile or rubber tile or sealed concrete
Walls: metal stud with gypsum board, epoxy paint
Ceiling: open to structure
Stainless steel corner guards at wall corners
Doors: 900/450 x2400 pair with view window at corridor lab suite entries
1100x2400 single doors at procedure rooms
900x2100 glass panel door between lab units
Daylight attenuation: blinds at exterior windows
Sound attenuation: NC 45 or less
Security: card access

STRUCTURAL

Live floor load: 5 kPa
Vibration attenuation: 50 micrometers per second or less

MECHANICAL

Temperature: 18-22 deg C +/- 2 deg C
Humidity: 70% relative or less
100% exhaust
Air changes: up to 8/hour occupied; 2-4/hour unoccupied
Air change rate may be higher due to equipment heat gain
Equipment Heat Gain: 500 btuh/sm for open lab area;
750 btuh/sm for lab support rooms.
Pressure: Lab Suite negative to corridor
Lab Support Rooms negative or positive depending upon use
22 cubic meter per minute exhaust at chemical fume hood

PLUMBING

Hot/Cold water at sinks with vacuum breakers
Pure water at sinks via point-of-use water polishers
Domestic tepid water at safety shower/eyewash
Floor drain at safety shower/eyewash
V = central piped services as required by lab tenant: Vacuum,
and/or compressed air and/or CO2 and/or nitrogen gas
Natural gas (methane) to be provided locally by lab tenant, as required
Inert specialty gases (helium, argon) at cylinder racks

ELECTRICAL

240v duplex and fourplex outlets at walls and service columns
Dedicated circuits at equipment spaces
Standby power for scientific equipment at equipment spaces
Hardwire and wireless data
Lighting: LED at 500 LUX

CONTRACTOR FURNISHED EQUIPMENT

Metal or wood casework
Sink Stations with epoxy resin sinks, tops
Protean Lab benches (can also be Lab Tenant Furnished)
Service columns
Chemical Fume Hoods
Tall cabinets
Safety Shower/Eyewash

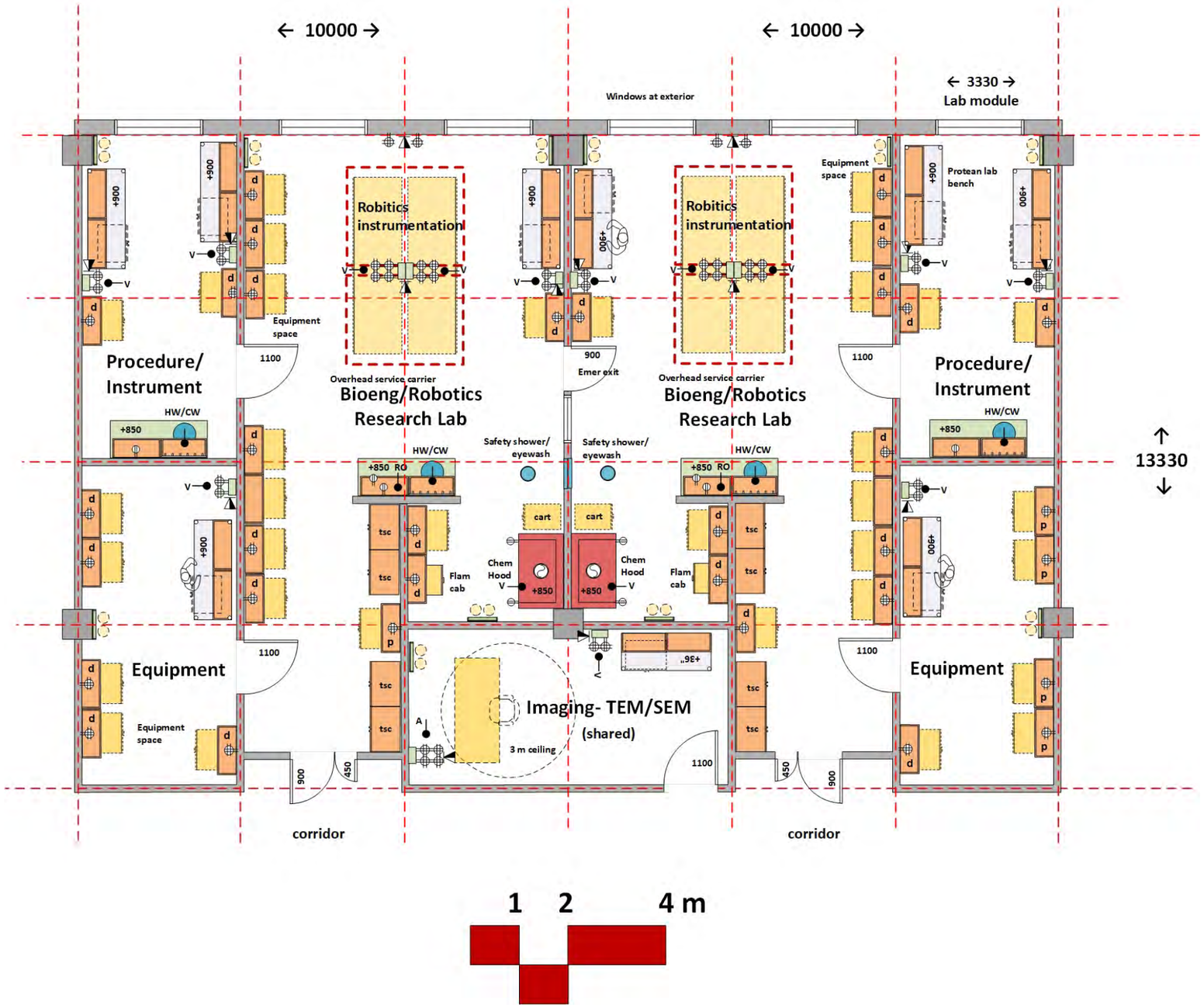
LAB TENANT FURNISHED EQUIPMENT

Refrigerators; Freezers
Centrifuges
Biological Safety Cabinets
Reach-in environmental chambers
Carts
Chemical storage cabinets
Robotics instruments/equipment

BIOENGINEERING-ROBOTICS/BIOENGINEERING-ROBOTICS RESEARCH LAB SUITE

3 modules per Lab Unit/6 modules per Lab Suite

Programme Requirements



ARCHITECTURAL

Occupancy: B (Chapter 3- IBC)
Floor: vinyl tile or rubber tile or sealed concrete
Walls: metal stud with gypsum board, epoxy paint
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Stainless steel corner guards at wall corners
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1100x2400 single doors at procedure rooms
900x2100 glass panel door between lab units
Daylight attenuation: blinds at exterior windows
Sound attenuation: NC 45 or less
Security: card access

STRUCTURAL

Live floor load: 5 kPa
Vibration attenuation: 50 micrometers per second or less

MECHANICAL

Temperature: 18-22 deg C +/- 2 deg C
Humidity: 70% relative or less
100% exhaust
Air changes: up to 8/hour occupied; 2-4/hour unoccupied
Air change rate may be higher due to equipment heat gain
Equipment Heat Gain: 500 btuh/sm for open lab area;
750 btuh/sm for lab support rooms.
Pressure: Lab Suite negative to corridor
Lab Support Rooms negative or positive depending upon use
22 cubic meter per minute exhaust at chemical fume hood

PLUMBING

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Natural gas (methane) to be provided locally by lab tenant, as required
Inert specialty gases (helium, argon) at cylinder racks

ELECTRICAL

240v duplex and fourplex outlets at walls and service columns
Dedicated circuits at equipment spaces
Standby power for scientific equipment at equipment spaces
Hardwire and wireless data
Lighting: LED at 500 LUX

CONTRACTOR FURNISHED EQUIPMENT

Metal or wood casework
Sink Stations with epoxy resin sinks, tops
Protean Lab benches (can also be Lab Tenant Furnished)
Service columns
Chemical Fume Hoods
Tall cabinets
Safety Shower/Eyewash

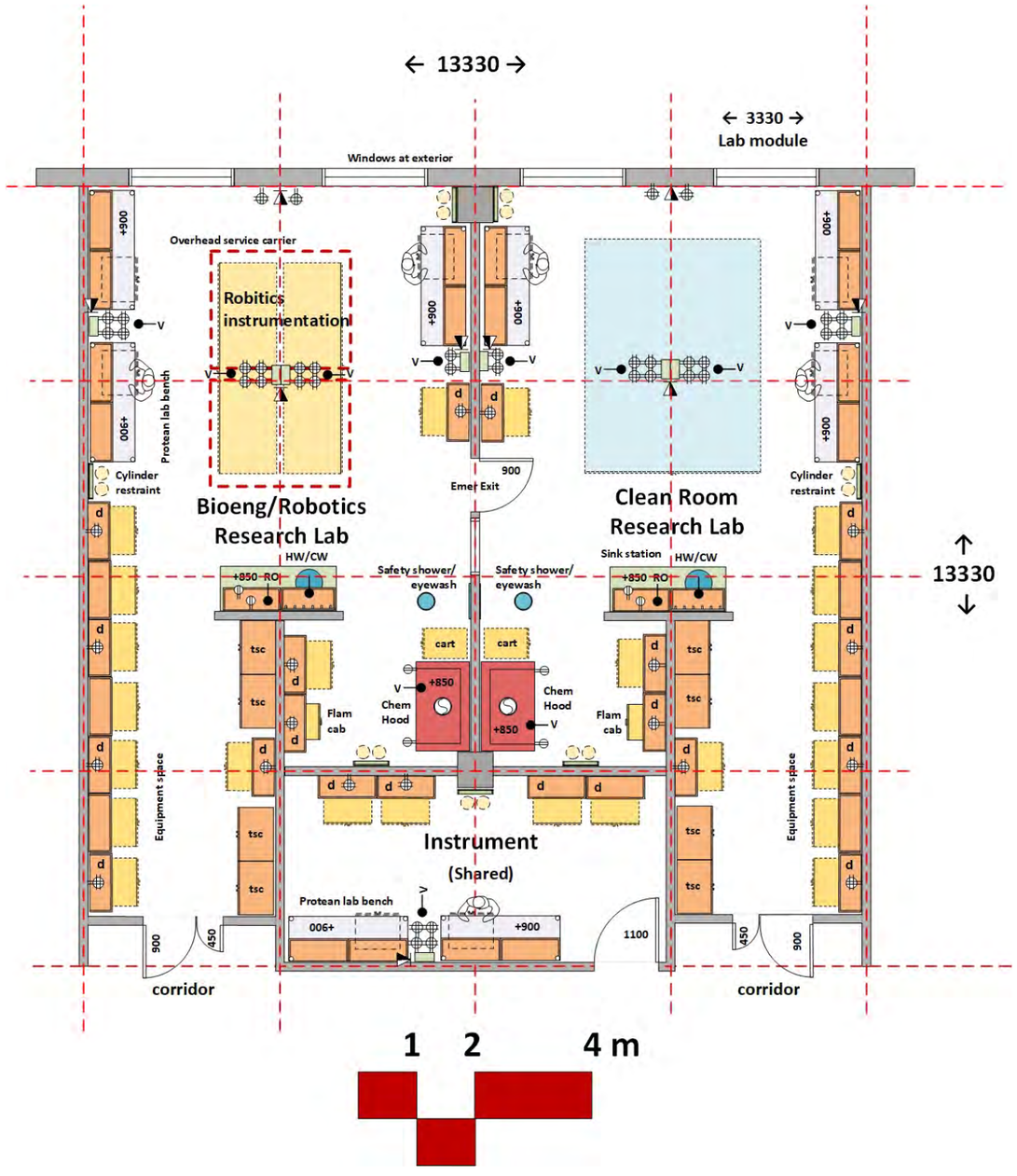
LAB TENANT FURNISHED EQUIPMENT

Refrigerators; Freezers; Centrifuges
Biological Safety Cabinets
Reach-in environmental chambers; Carts
Chemical storage cabinets
Robotics instruments/equipment
TEM/SEM (electron microscope) instruments

BIOENGINEERING-ROBOTICS/CLEAN ROOM RESEARCH LAB SUITE

2 modules per Lab Unit/4 modules per Lab Suite

Programme Requirements



ARCHITECTURAL

Occupancy: B (Chapter 3- IBC)
Floor: vinyl tile or rubber tile or sealed concrete
Walls: metal stud with gypsum board, epoxy paint
Ceiling: open to structure
Stainless steel corner guards at wall corners
Doors: 900/450 x2400 pair with view window at corridor lab suite entries
1100x2400 single doors at procedure rooms
900x2100 glass panel door between lab units
Daylight attenuation: blinds at exterior windows
Sound attenuation: NC 45 or less
Security: card access

STRUCTURAL

Live floor load: 7 kPa
Vibration attenuation: 50 micrometers per second or less

MECHANICAL

Temperature: 18-22 deg C +/- 2 deg C
Humidity: 70% relative or less
100% exhaust
Air changes: up to 8/hour occupied; 2-4/hour unoccupied
Air change rate may be higher due to equipment heat gain
Equipment Heat Gain: 500 btuh/sm for open lab area;
750 btuh/sm for lab support rooms.
Pressure: Lab Suite negative to corridor
Lab Support Rooms negative or positive depending upon use
22 cubic meter per minute exhaust at chemical fume hood

PLUMBING

Hot/Cold water at sinks with vacuum breakers
Pure water at sinks via point-of-use water polishers
Domestic tepid water at safety shower/eyewash
Floor drain at safety shower/eyewash
V = central piped services as required by lab tenant: Vacuum,
and/or compressed air and/or CO2 and/or nitrogen gas
Natural gas (methane) to be provided locally by lab tenant, as required
Inert specialty gases (helium, argon) at cylinder racks

ELECTRICAL

240v duplex and fourplex outlets at walls and service columns
Dedicated circuits at equipment spaces
Standby power for scientific equipment at equipment spaces
Hardwire and wireless data
Lighting: LED at 500 LUX

CONTRACTOR FURNISHED EQUIPMENT

Metal or wood casework
Sink Stations with epoxy resin sinks, tops
Protean Lab benches (can also be Lab Tenant Furnished)
Service columns
Chemical Fume Hoods
Tall cabinets
Safety Shower/Eyewash

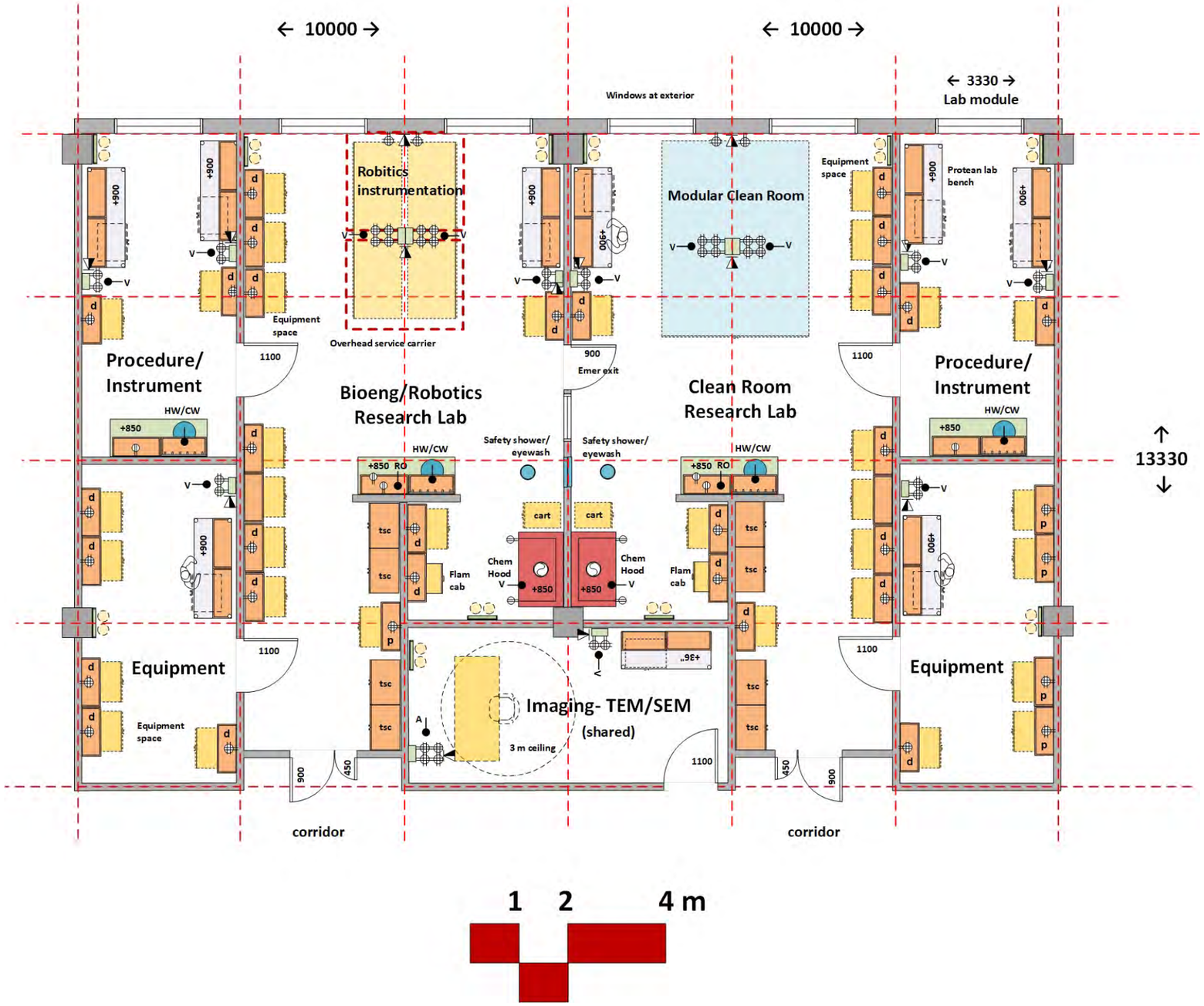
LAB TENANT FURNISHED EQUIPMENT

Refrigerators; Freezers; Centrifuges
Biological Safety Cabinets
Reach-in environmental chambers
Carts
Chemical storage cabinets
Robotics instruments/equipment
Modular Clean Room
Imaging equipment- TEM, SEM

BIOENGINEERING-ROBOTICS/CLEAN ROOM RESEARCH LAB SUITE

3 modules per Lab Unit/6 modules per Lab Suite

Programme Requirements



ARCHITECTURAL

Occupancy: B (Chapter 3- IBC)
Floor: vinyl tile or rubber tile or sealed concrete
Walls: metal stud with gypsum board, epoxy paint
Ceiling: open to structure
Stainless steel corner guards at wall corners
Doors: 900/450 x2400 pair with view window at corridor lab suite entries
1100x2400 single doors at procedure rooms
900x2100 glass panel door between lab units
Daylight attenuation: blinds at exterior windows
Sound attenuation: NC 45 or less
Security: card access

STRUCTURAL

Live floor load: 7 kPa
Vibration attenuation: 50 micrometers per second or less

MECHANICAL

Temperature: 18-22 deg C +/- 2 deg C
Humidity: 70% relative or less
100% exhaust
Air changes: up to 8/hour occupied; 2-4/hour unoccupied
Air change rate may be higher due to equipment heat gain
Equipment Heat Gain: 500 btuh/sm for open lab area;
750 btuh/sm for lab support rooms.
Pressure: Lab Suite negative to corridor
Lab Support Rooms negative or positive depending upon use
22 cubic meter per minute exhaust at chemical fume hood

PLUMBING

Hot/Cold water at sinks with vacuum breakers
Pure water at sinks via point-of-use water polishers
Domestic tepid water at safety shower/eyewash
Floor drain at safety shower/eyewash
V = central piped services as required by lab tenant: Vacuum,
and/or compressed air and/or CO2 and/or nitrogen gas
Natural gas (methane) to be provided locally by lab tenant, as required
Inert specialty gases (helium, argon) at cylinder racks

ELECTRICAL

240v duplex and fourplex outlets at walls and service columns
Dedicated circuits at equipment spaces
Standby power for scientific equipment at equipment spaces
Hardwire and wireless data
Lighting: LED at 500 LUX

CONTRACTOR FURNISHED EQUIPMENT

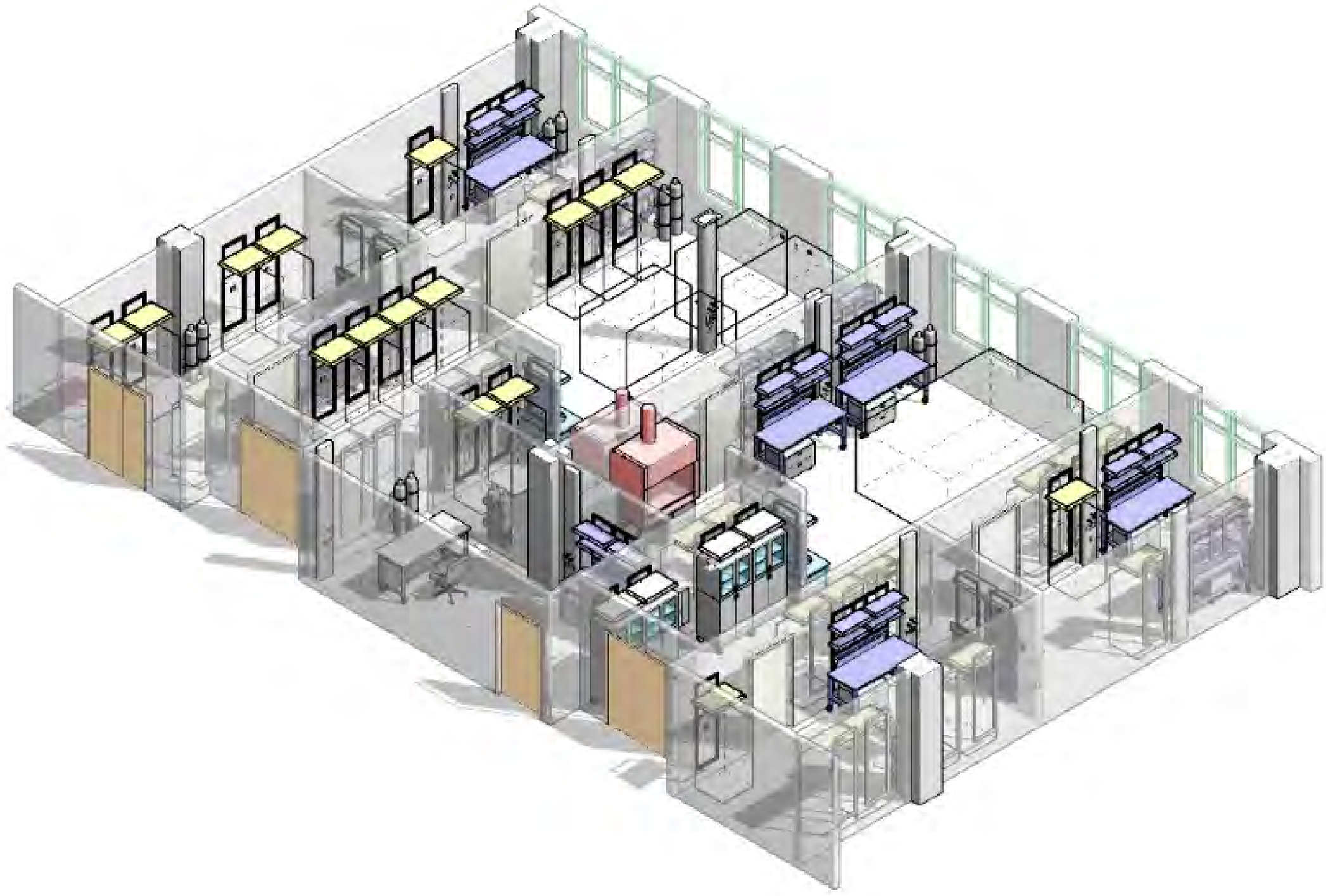
Metal or wood casework
Sink Stations with epoxy resin sinks, tops
Protean Lab benches (can also be Lab Tenant Furnished)
Service columns
Chemical Fume Hoods
Tall cabinets
Safety Shower/Eyewash

LAB TENANT FURNISHED EQUIPMENT

Refrigerators; Freezers; Centrifuges
Biological Safety Cabinets
Reach-in environmental chambers
Carts
Chemical storage cabinets
Robotics instruments/equipment
Modular Clean Room
Imaging equipment- TEM, SEM

BIOENGINEERING-ROBOTICS/CLEAN ROOM RESEARCH LAB SUITE

Axonometric view from corridor



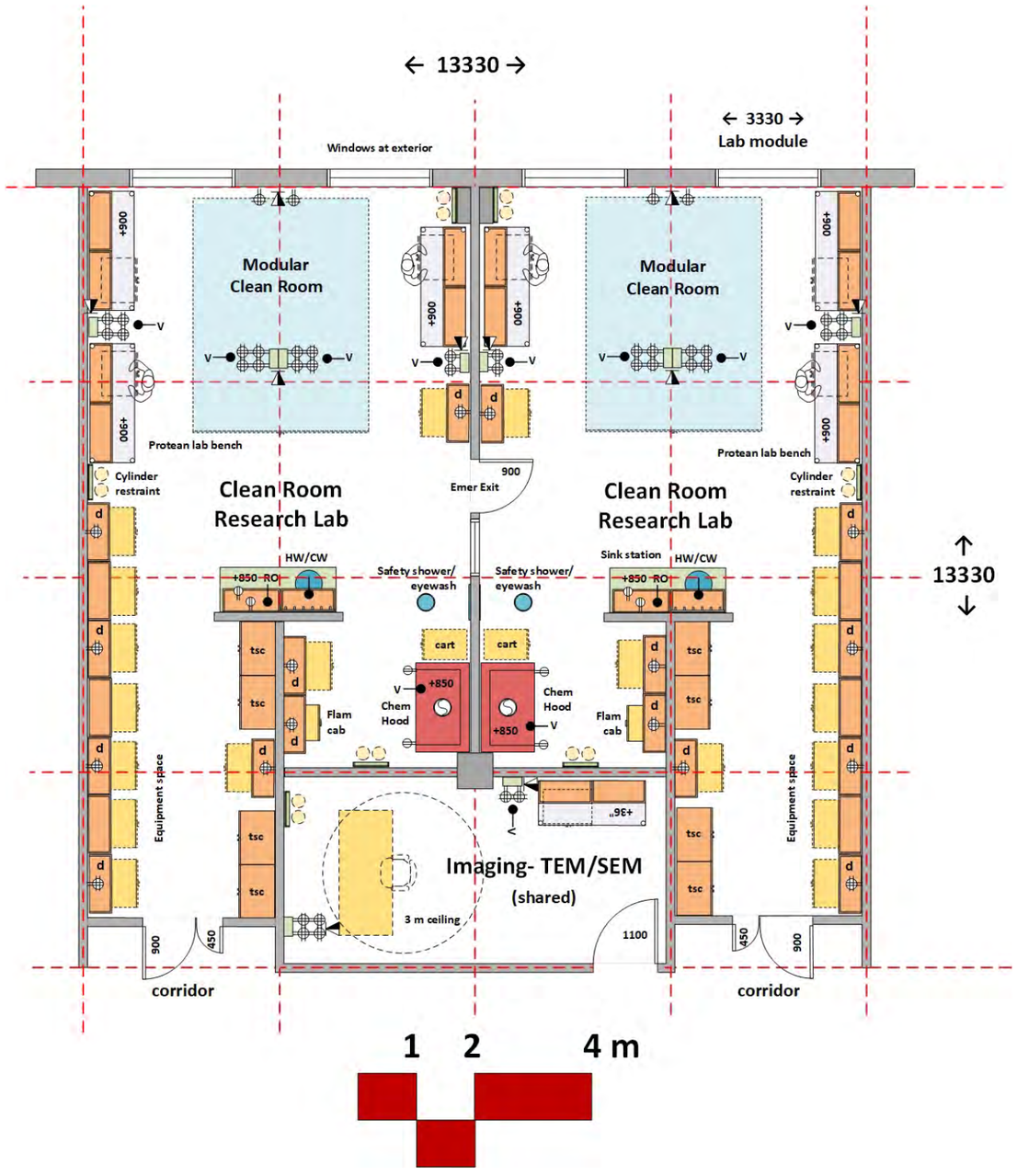
BIOENGINEERING-ROBOTICS/CLEAN ROOM RESEARCH LAB SUITE

Axonometric view from exterior

CLEAN ROOM/CLEAN ROOM RESEARCH LAB SUITE

2 modules per Lab Unit/4 modules per Lab Suite

Programme Requirements



ARCHITECTURAL

Occupancy: B (Chapter 3- IBC)
Floor: vinyl tile or rubber tile or sealed concrete
Walls: metal stud with gypsum board, epoxy paint
Ceiling: open to structure
Stainless steel corner guards at wall corners
Doors: 900/450 x2400 pair with view window at corridor lab suite entries
1100x2400 single doors at procedure rooms
900x2100 glass panel door between lab units
Daylight attenuation: blinds at exterior windows
Sound attenuation: NC 45 or less
Security: card access

STRUCTURAL

Live floor load: 7 kPa
Vibration attenuation: 50 micrometers per second or less

MECHANICAL

Temperature: 18-22 deg C +/- 2 deg C
Humidity: 70% relative or less
100% exhaust
Air changes: up to 8/hour occupied; 2-4/hour unoccupied
Air change rate may be higher due to equipment heat gain
Equipment Heat Gain: 500 btuh/sm for open lab area;
750 btuh/sm for lab support rooms.
Pressure: Lab Suite negative to corridor
Lab Support Rooms negative or positive depending upon use
22 cubic meter per minute exhaust at chemical fume hood

PLUMBING

Hot/Cold water at sinks with vacuum breakers
Pure water at sinks via point-of-use water polishers
Domestic tepid water at safety shower/eyewash
Floor drain at safety shower/eyewash
V = central piped services as required by lab tenant: Vacuum,
and/or compressed air and/or CO2 and/or nitrogen gas
Natural gas (methane) to be provided locally by lab tenant, as required
Inert specialty gases (helium, argon) at cylinder racks

ELECTRICAL

240v duplex and fourplex outlets at walls and service columns
Dedicated circuits at equipment spaces
Standby power for scientific equipment at equipment spaces
Hardwire and wireless data
Lighting: LED at 500 LUX

CONTRACTOR FURNISHED EQUIPMENT

Metal or wood casework
Sink Stations with epoxy resin sinks, tops
Protean Lab benches (can also be Lab Tenant Furnished)
Service columns
Chemical Fume Hoods
Tall cabinets
Safety Shower/Eyewash

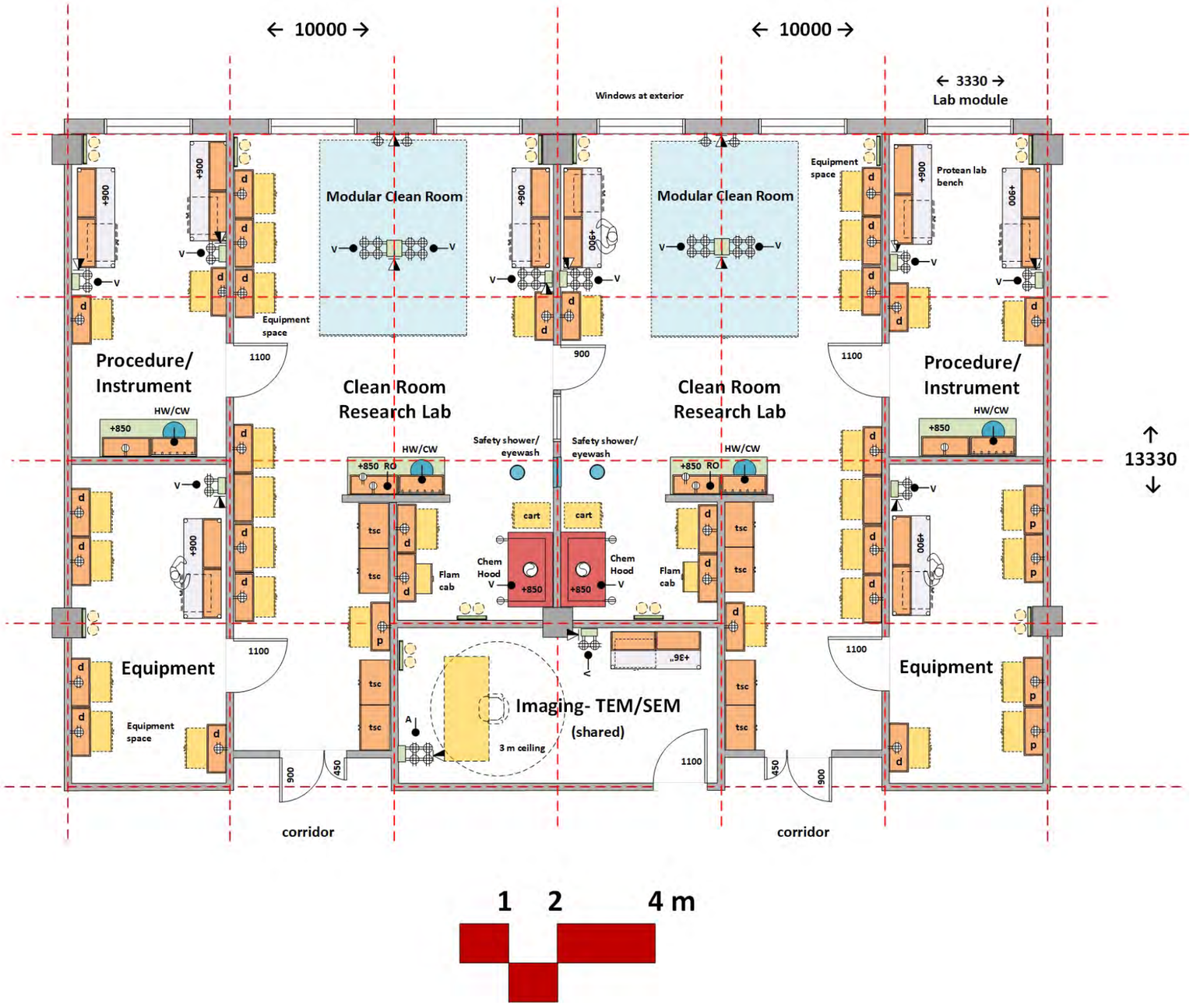
LAB TENANT FURNISHED EQUIPMENT

Refrigerators; Freezers; Centrifuges
Biological Safety Cabinets
Reach-in environmental chambers
Carts
Chemical storage cabinets
Robotics instruments/equipment
Modular Clean Room
TEM/SEM (electron microscope) instruments

CLEAN ROOM/CLEAN ROOM RESEARCH LAB SUITE

3 modules per Lab Unit/6 modules per Lab Suite

Programme Requirements



ARCHITECTURAL

Occupancy: B (Chapter 3- IBC)
Floor: vinyl tile or rubber tile or sealed concrete
Walls: metal stud with gypsum board, epoxy paint
Ceiling: open to structure
Stainless steel corner guards at wall corners
Doors: 900/450 x2400 pair with view window at corridor lab suite entries
1100x2400 single doors at procedure rooms
900x2100 glass panel door between lab units
Daylight attenuation: blinds at exterior windows
Sound attenuation: NC 45 or less
Security: card access

STRUCTURAL

Live floor load: 7 kPa
Vibration attenuation: 50 micrometers per second or less

MECHANICAL

Temperature: 18-22 deg C +/- 2 deg C
Humidity: 70% relative or less
100% exhaust
Air changes: up to 8/hour occupied; 2-4/hour unoccupied
Air change rate may be higher due to equipment heat gain
Equipment Heat Gain: 500 btuh/sm for open lab area;
750 btuh/sm for lab support rooms.
Pressure: Lab Suite negative to corridor
Lab Support Rooms negative or positive depending upon use
22 cubic meter per minute exhaust at chemical fume hood

PLUMBING

Hot/Cold water at sinks with vacuum breakers
Pure water at sinks via point-of-use water polishers
Domestic tepid water at safety shower/eyewash
Floor drain at safety shower/eyewash
V = central piped services as required by lab tenant: Vacuum,
and/or compressed air and/or CO2 and/or nitrogen gas
Natural gas (methane) to be provided locally by lab tenant, as required
Inert specialty gases (helium, argon) at cylinder racks

ELECTRICAL

240v duplex and fourplex outlets at walls and service columns
Dedicated circuits at equipment spaces
Standby power for scientific equipment at equipment spaces
Hardwire and wireless data
Lighting: LED at 500 LUX

CONTRACTOR FURNISHED EQUIPMENT

Metal or wood casework
Sink Stations with epoxy resin sinks, tops
Protean Lab benches (can also be Lab Tenant Furnished)
Service columns
Chemical Fume Hoods
Tall cabinets
Safety Shower/Eyewash

LAB TENANT FURNISHED EQUIPMENT

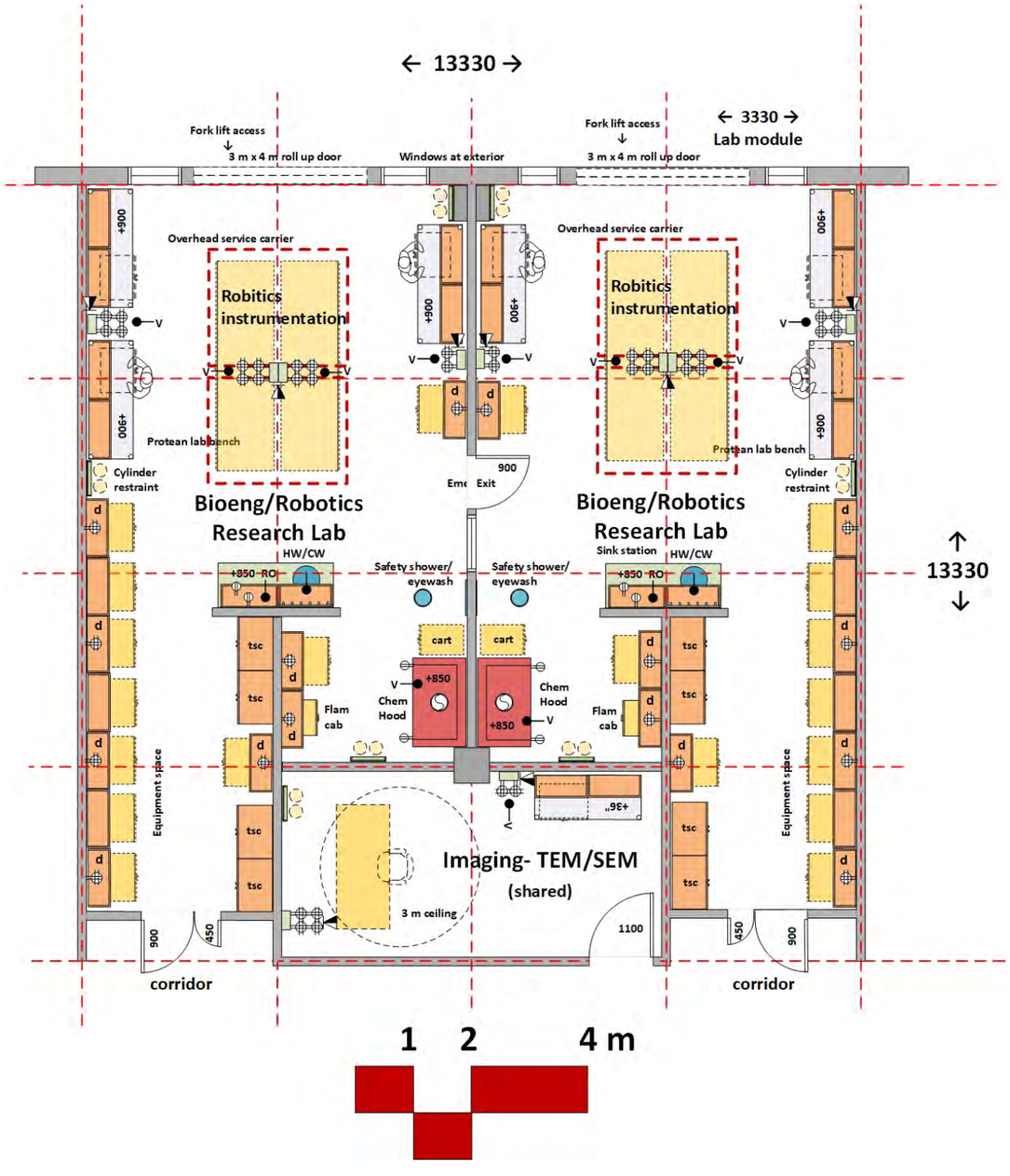
Refrigerators; Freezers; Centrifuges
Biological Safety Cabinets
Reach-in environmental chambers
Carts
Chemical storage cabinets
Robotics instruments/equipment
Modular Clean Room
TEM/SEM (electron microscope) instruments

BIOENGINEERING-ROBOTICS HIGH BAY RESEARCH LAB SUITE

2 modules per Lab Unit/4 modules per Lab Suite

Ground Floor Only

Programme Requirements



ARCHITECTURAL

Occupancy: B (Chapter 3- IBC)
Floor: vinyl tile or rubber tile
Walls: metal stud with gypsum board, epoxy paint
Ceiling: lab grade acoustic tile cloud at 3600 mm
Stainless steel wall guards at corridor; Stainless steel corner guards at wall corners
Doors: 900/450 x2400 pair with view window at corridor lab suite entries
1100x2400 single doors at procedure rooms
900x2100 glass panel door at environmental room
Daylight attenuation: blinds at exterior windows
Sound attenuation: NC 45 or less
Security: card access

STRUCTURAL

Live floor load: 7 kPa
Vibration attenuation: 50 micrometers per second or less

MECHANICAL

Temperature: 18-22 deg C +/- 2 deg C
Humidity: 70% relative or less
100% exhaust
Air changes: 8/hour occupied; 4/hour unoccupied
Air change rate may be higher due to equipment heat gain
Equipment Heat Gain: 500 btuh/sm for open lab area;
750 btuh/sm for lab support rooms.
Pressure: Negative or positive depending upon use
70 cubic meter per minute exhaust at chemical fume hood
Equipment exhaust at instrumentation/robotics areas

PLUMBING

Hot/Cold water at sinks with vacuum breakers
Pure water at sinks via point-of-use water polishers
Domestic tepid water at safety shower/eyewash
Floor drain at safety shower/eyewash
V = central piped services as required by lab tenant: Vacuum,
and/or compressed air and/or CO2 and/or nitrogen gas
Natural gas (methane) to be provided locally by lab tenant, as required
Inert specialty gases (helium, argon) at cylinder racks

ELECTRICAL

240v duplex and fourplex outlets at walls and service columns
415v with disconnect at autoclaves
Standby power for scientific equipment
Hardwire and wireless data
Lighting: LED at 500 LUX

CONTRACTOR FURNISHED EQUIPMENT

Metal or wood casework, sinks, tops
Lab benches
Service columns
Chemical Fume Hood
Tall cabinets

UNIVERSITY FURNISHED EQUIPMENT

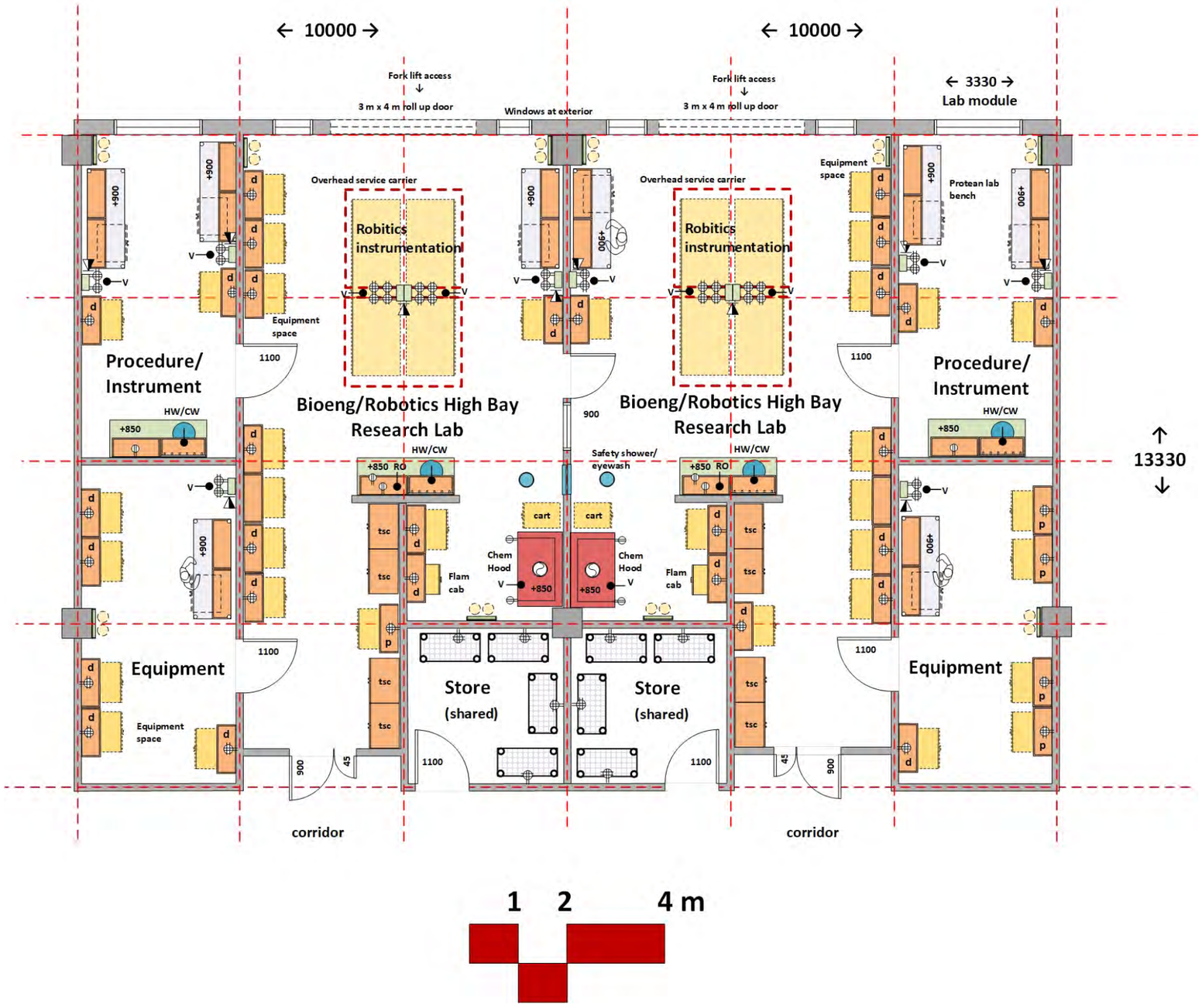
Refrigerators; Freezers
Centrifuges
Carts
Robotics Instruments
TEM/SEM (electron microscope) instruments

BIOENGINEERING-ROBOTICS HIGH BAY RESEARCH LAB SUITE

3 modules per Lab Unit/6 modules per Lab Suite

Ground Floor Only

Programme Requirements



ARCHITECTURAL

Occupancy: B (Chapter 3- IBC)
Floor: vinyl tile or rubber tile
Walls: metal stud with gypsum board, epoxy paint
Ceiling: lab grade acoustic tile cloud at 3600 mm
Stainless steel wall guards at corridor; Stainless steel corner guards at wall corners
Doors: 900/450 x2400 pair with view window at corridor lab suite entries
1100x2400 single doors at procedure rooms
900x2100 glass panel door at environmental room
Daylight attenuation: blinds at exterior windows
Sound attenuation: NC 45 or less
Security: card access

STRUCTURAL

Live floor load: 7 kPa
Vibration attenuation: 50 micrometers per second or less

MECHANICAL

Temperature: 18-22 deg C +/- 2 deg C
Humidity: 70% relative or less
100% exhaust
Air changes: 8/hour occupied; 4/hour unoccupied
Air change rate may be higher due to equipment heat gain
Equipment Heat Gain: 500 btuh/sm for open lab area;
750 btuh/sm for lab support rooms.
Pressure: Negative or positive depending upon use
70 cubic meter per minute exhaust at chemical fume hood
Equipment exhaust at instrumentation/robotics areas

PLUMBING

Hot/Cold water at sinks with vacuum breakers
Pure water at sinks via point-of-use water polishers
Domestic tepid water at safety shower/eyewash
Floor drain at safety shower/eyewash
V = central piped services as required by lab tenant: Vacuum, and/or compressed air and/or CO2 and/or nitrogen gas
Natural gas (methane) to be provided locally by lab tenant, as required
Inert specialty gases (helium, argon) at cylinder racks

ELECTRICAL

240v duplex and fourplex outlets at walls and service columns
415v with disconnect at autoclaves
Standby power for scientific equipment
Hardwire and wireless data
Lighting: LED at 500 LUX

CONTRACTOR FURNISHED EQUIPMENT

Metal or wood casework, sinks, tops
Lab benches
Service columns
Chemical Fume Hood
Tall cabinets

UNIVERSITY FURNISHED EQUIPMENT

Refrigerators; Freezers
Centrifuges
Carts
Robotics Instruments
Metro shelf units in Store Rooms

Engineering Research Laboratory
Auburn University, Alabama

SECTION 3
SCHEMATIC DESIGN
LAB FLOOR PLANS

Building 12W-A, Building 16E-A, Platform Buildings 20E-A, 22E-A

TOWER BUILDING 12W-A

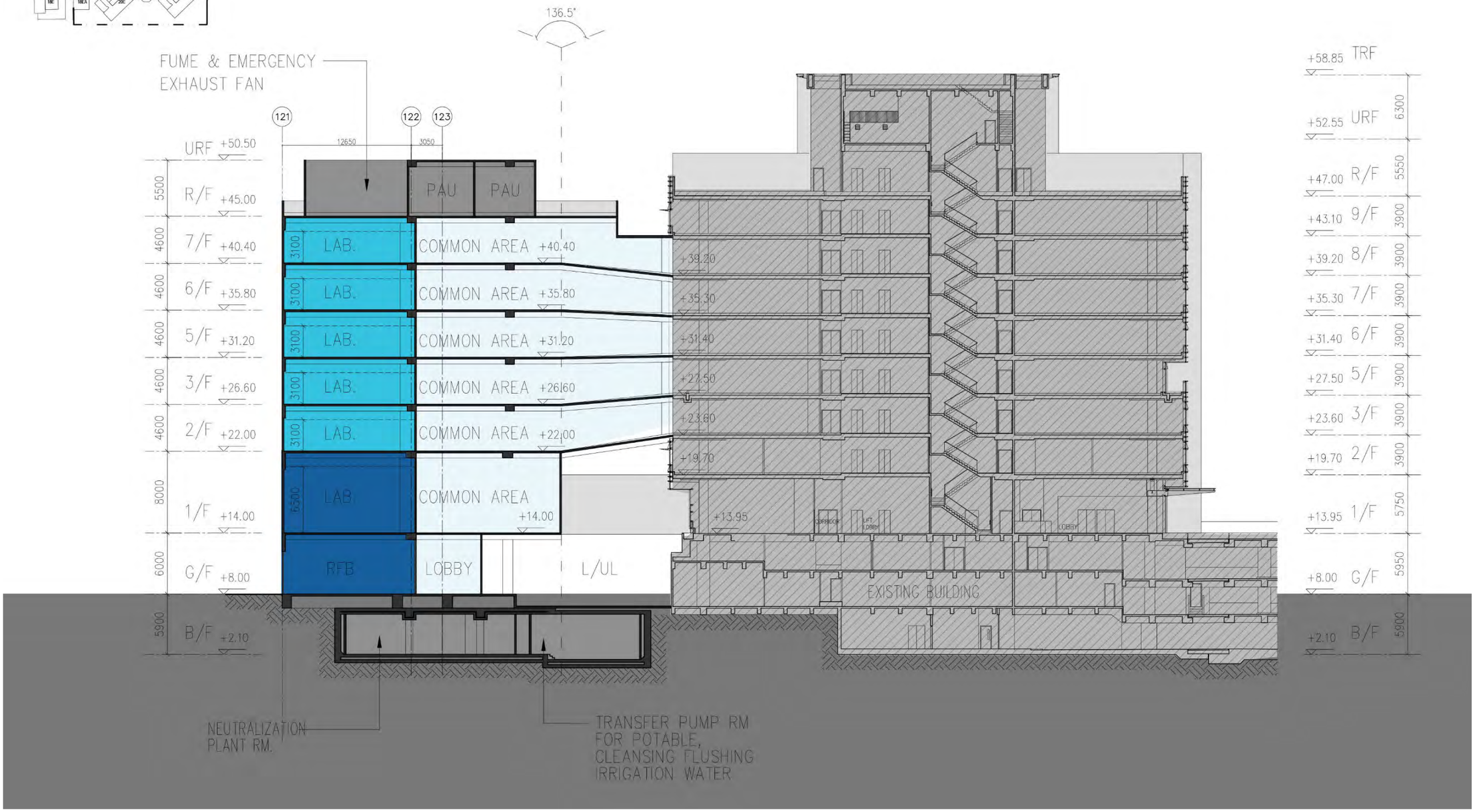
Lab Schematic Design Plan

Typcial Upper Floor

Lab assignments can be changed in both function and size. Lab tenants can choose between either 2 or 3 module lab sizes, and between BSL2 or BSL3 lab functions. The illustration shows one possible layout of many for Building 12W-A.

Red = BSL3 Lab Suite
Blue = BSL2 Lab Suite


12WA
12W
16W
18E
18EA
20E
22E


136.5°
FUME & EMERGENCY EXHAUST FAN
121
122
123
12650
3050
URF +50.50
R/F +45.00
7/F +40.40
6/F +35.80
5/F +31.20
3/F +26.60
2/F +22.00
1/F +14.00
G/F +8.00
B/F +2.10
5500
4600
4600
4600
4600
8000
6000
5900
3100
3100
3100
3100
6300
PAU
PAU
LAB.
LAB.
LAB.
LAB.
LAB.
RFB
COMMON AREA +40.40
COMMON AREA +35.80
COMMON AREA +31.20
COMMON AREA +26.60
COMMON AREA +22.00
COMMON AREA +14.00
LOBBY
L/UL
+39.20
+35.30
+31.40
+27.50
+23.60
+19.70
+13.95
CORRIDOR
LIFT LOBBY
LOBBY
EXISTING BUILDING
NEUTRALIZATION PLANT RM.
TRANSFER PUMP RM FOR POTABLE, CLEANSING FLUSHING IRRIGATION WATER
+58.85 TRF
+52.55 URF 6300
+47.00 R/F 5550
+43.10 9/F 3900
+39.20 8/F 3900
+35.30 7/F 3900
+31.40 6/F 3900
+27.50 5/F 3900
+23.60 3/F 3900
+19.70 2/F 3900
+13.95 1/F 5750
+8.00 G/F 5950
+2.10 B/F 5900

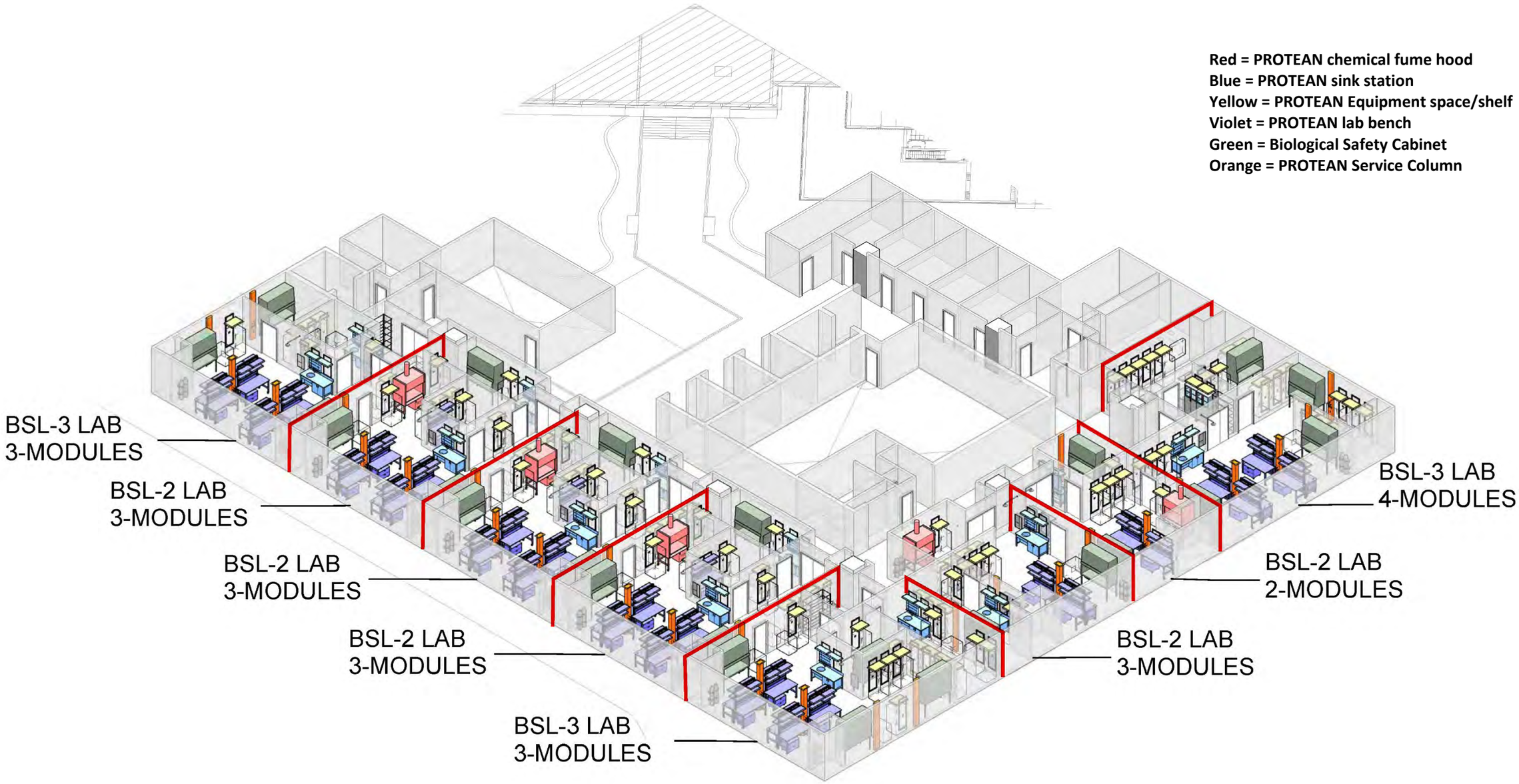
TOWER BUILDING 12W-A

Lab Schematic Design

Axonometric 1

Typical Upper Floor

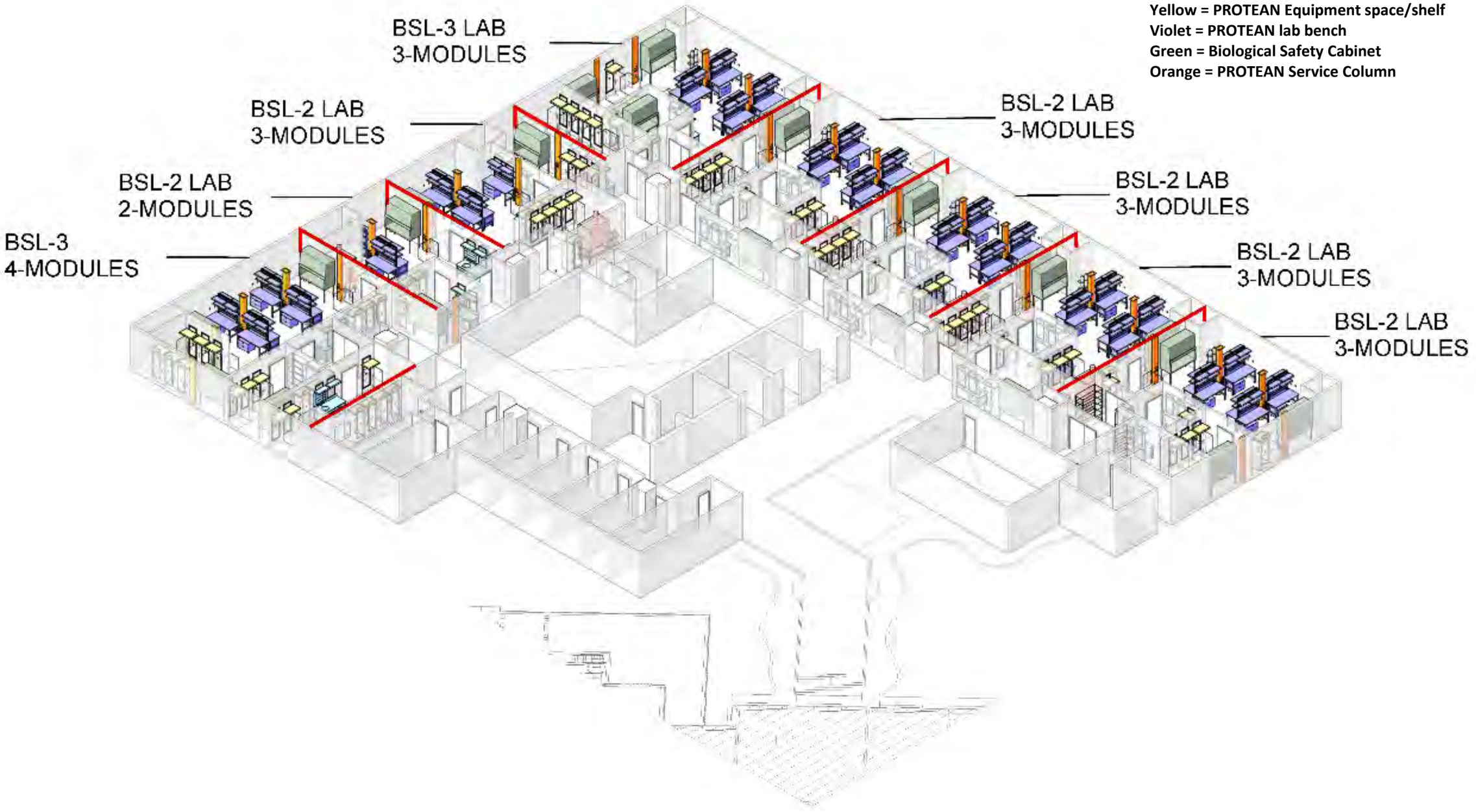
Red = PROTEAN chemical fume hood
Blue = PROTEAN sink station
Yellow = PROTEAN Equipment space/shelf
Violet = PROTEAN lab bench
Green = Biological Safety Cabinet
Orange = PROTEAN Service Column



TOWER BUILDING 12W-A

Lab Schematic Design
Axonometric 2
Typical Upper Floor

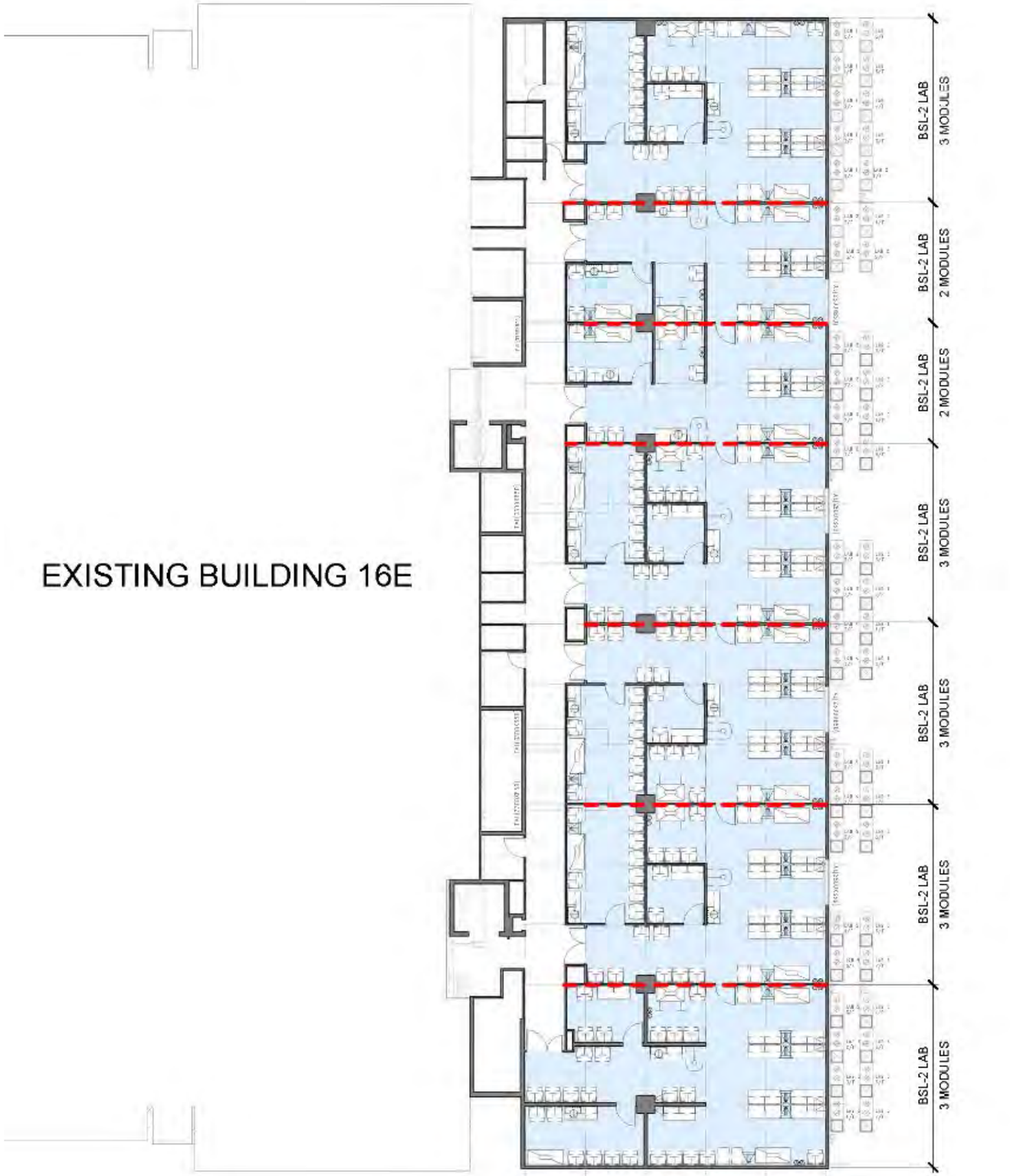
Red = PROTEAN chemical fume hood
Blue = PROTEAN sink station
Yellow = PROTEAN Equipment space/shelf
Violet = PROTEAN lab bench
Green = Biological Safety Cabinet
Orange = PROTEAN Service Column



TOWER BUILDING 16E-A

Lab Schematic Design Plan

Typcial Upper Floor

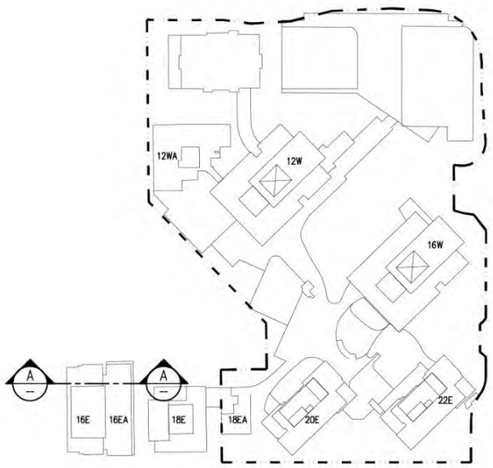


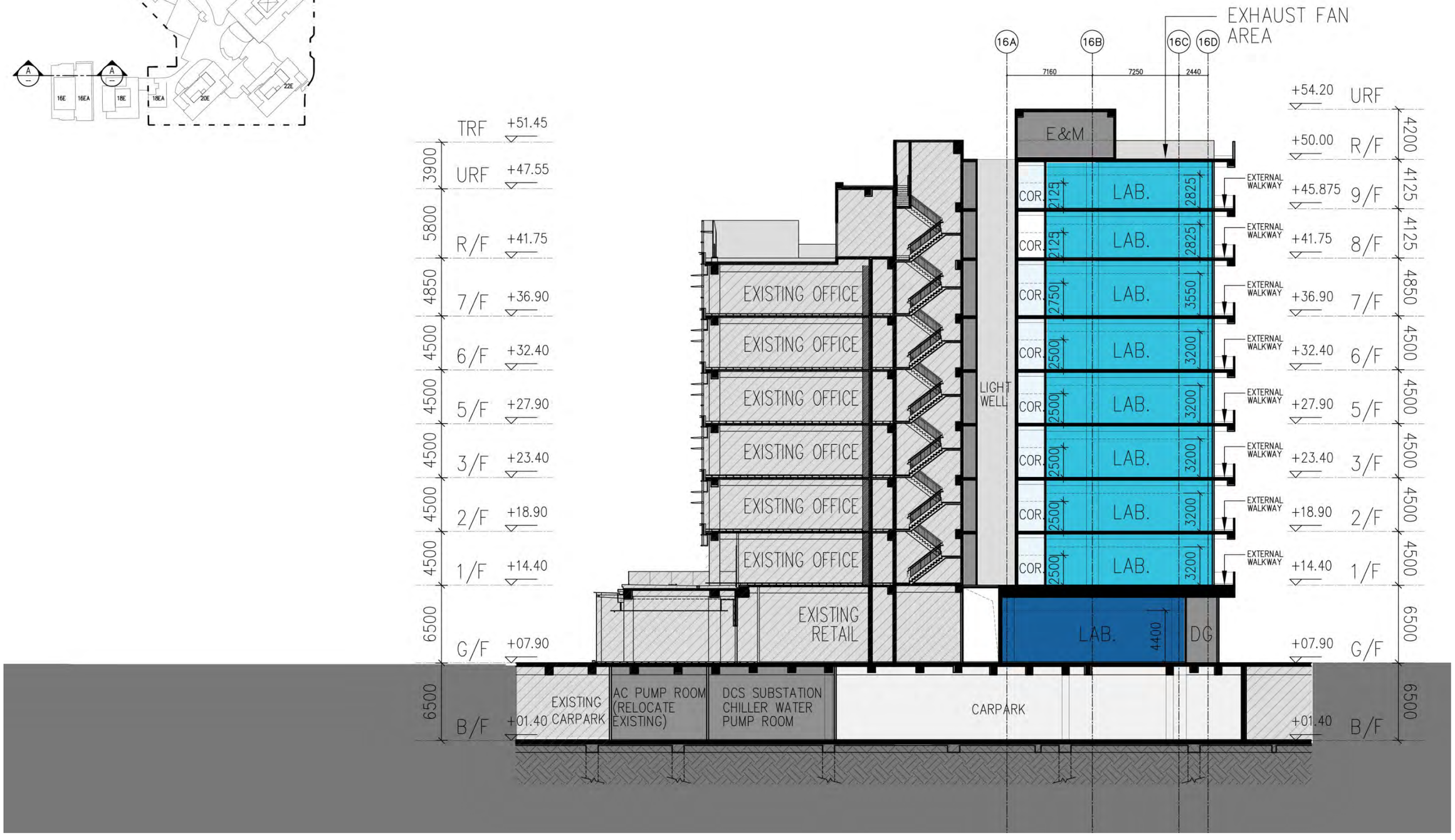
Lab assignments can be changed in both function and size. Lab tenants can choose between either 2 or 3 module lab sizes, and between BSL2 or other similar life science research lab, but not BSL3 lab functions. The illustration shows one possible layout of many for Building 16E-A.

Blue = BSL2 Lab Suite

TOWER BUILDING 16E-A

Lab Schematic Design Section





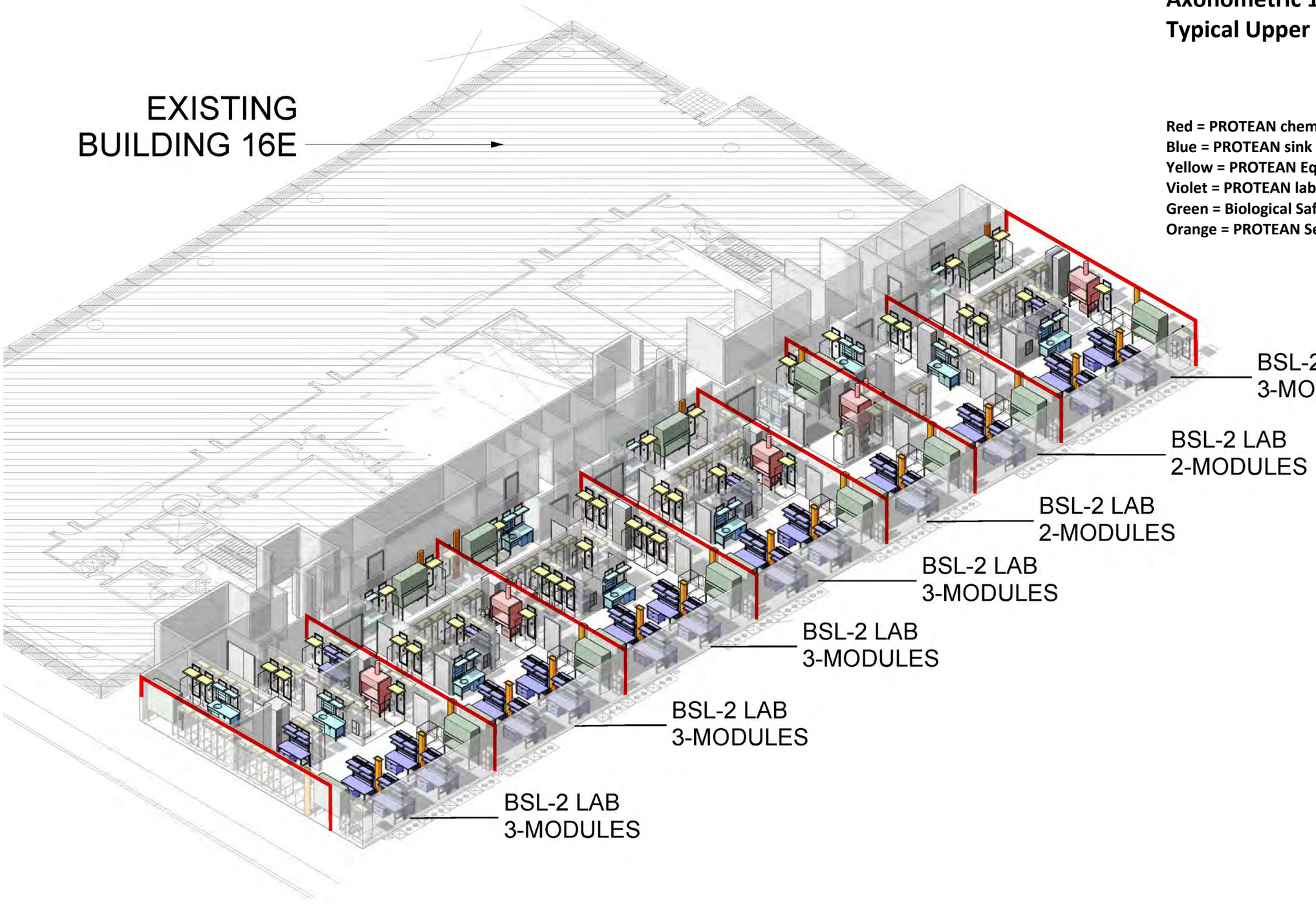
TOWER BUILDING 16E-A

Lab Schematic Design

Axonometric 1

Typical Upper Floor

Red = PROTEAN chemical fume hood
Blue = PROTEAN sink station
Yellow = PROTEAN Equipment space/shelf
Violet = PROTEAN lab bench
Green = Biological Safety Cabinet
Orange = PROTEAN Service Column



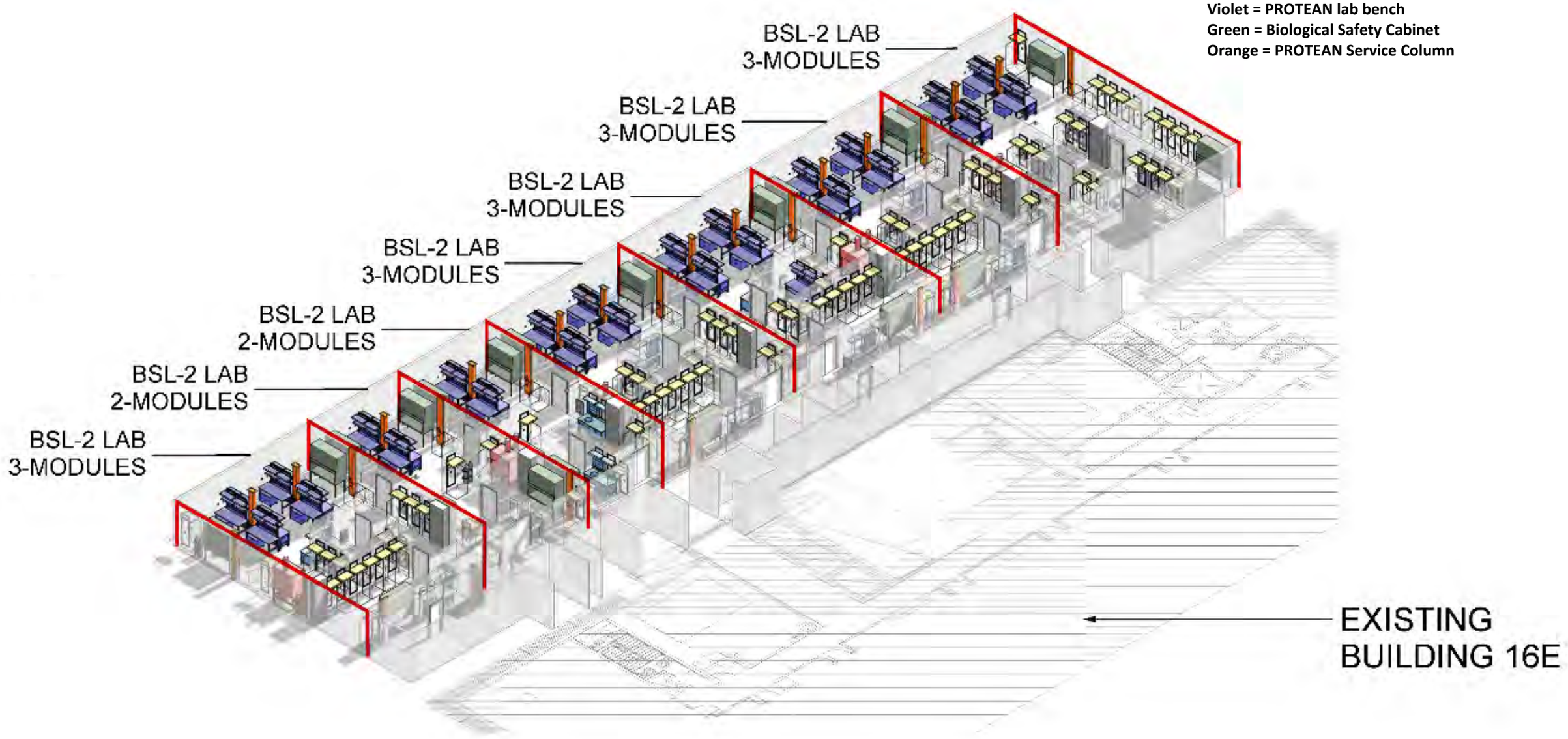
TOWER BUILDING 16E-A

Lab Schematic Design

Axonometric 2

Typical Upper Floor

Red = PROTEAN chemical fume hood
Blue = PROTEAN sink station
Yellow = PROTEAN Equipment space/shelf
Violet = PROTEAN lab bench
Green = Biological Safety Cabinet
Orange = PROTEAN Service Column



PLATFORM BUILDING 20E-A

Lab Schematic Design Plan

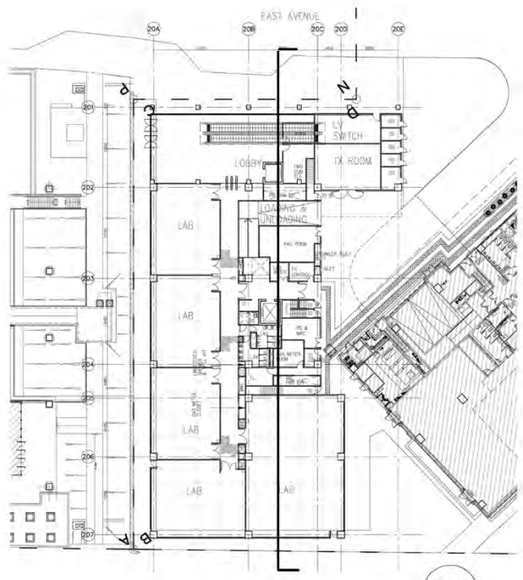
Typcial Ground Floor

Lab assignments can be changed in both function and size. Lab tenants can choose between either 2 or up to 5 module lab sizes, for a variety of Engineering Lab Prototypes, which are designed for non-chemical/non-fume hood use. The illustration shows one possible layout of many for Building 20E-A.

Green = Engineering Lab Suite

PLATFORM BUILDING 20E-A

Lab Schematic Design Section



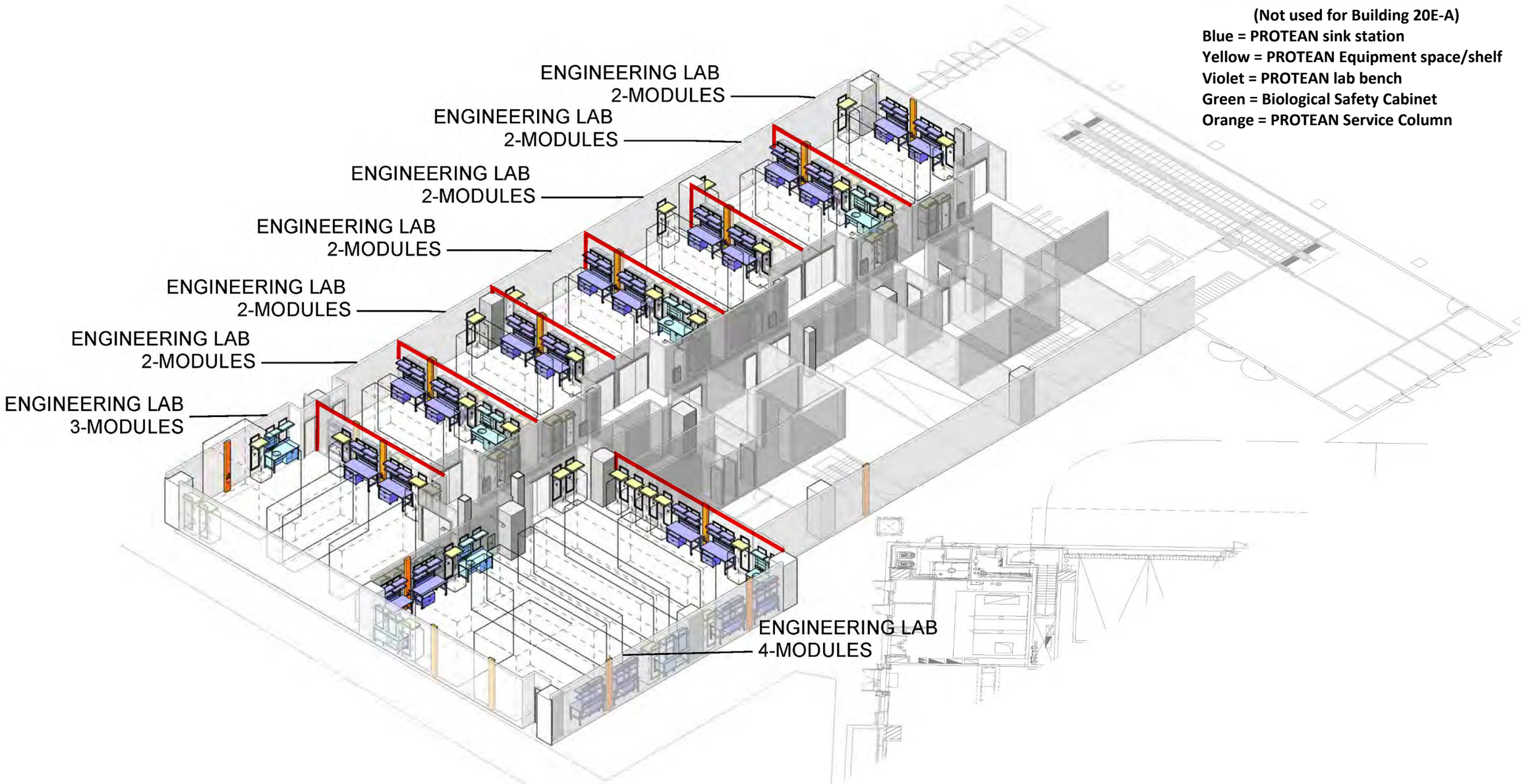
PLATFORM BUILDING 20E-A

Lab Schematic Design

Axonometric 1

Typical Ground Floor

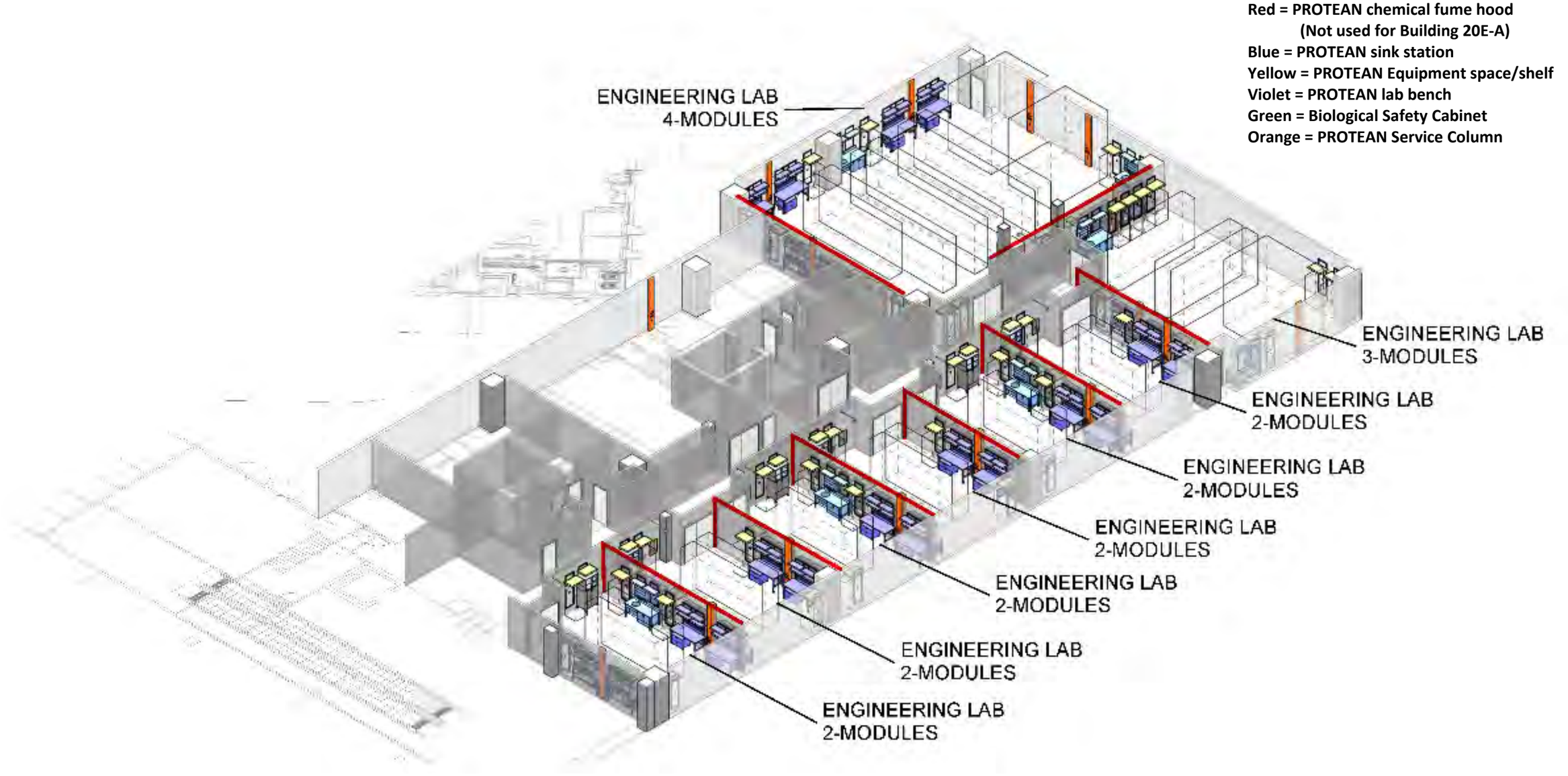
Red = PROTEAN chemical fume hood
(Not used for Building 20E-A)
Blue = PROTEAN sink station
Yellow = PROTEAN Equipment space/shelf
Violet = PROTEAN lab bench
Green = Biological Safety Cabinet
Orange = PROTEAN Service Column



PLATFORM BUILDING 20E-A

Lab Schematic Design
Axonometric 2
Typical Ground Floor

Red = PROTEAN chemical fume hood
(Not used for Building 20E-A)
Blue = PROTEAN sink station
Yellow = PROTEAN Equipment space/shelf
Violet = PROTEAN lab bench
Green = Biological Safety Cabinet
Orange = PROTEAN Service Column



PLATFORM BUILDING 20E-A

Lab Schematic Design Plan

Typcial First Floor

Lab assignments can be changed in both function and size. Lab tenants can choose between either 2 or up to 5 module lab sizes, for a variety of Engineering Lab Prototypes, which are designed for non-chemical/non-fume hood use. The illustration shows one possible layout of many for Building 20E-A.

Green = Engineering Lab Suite

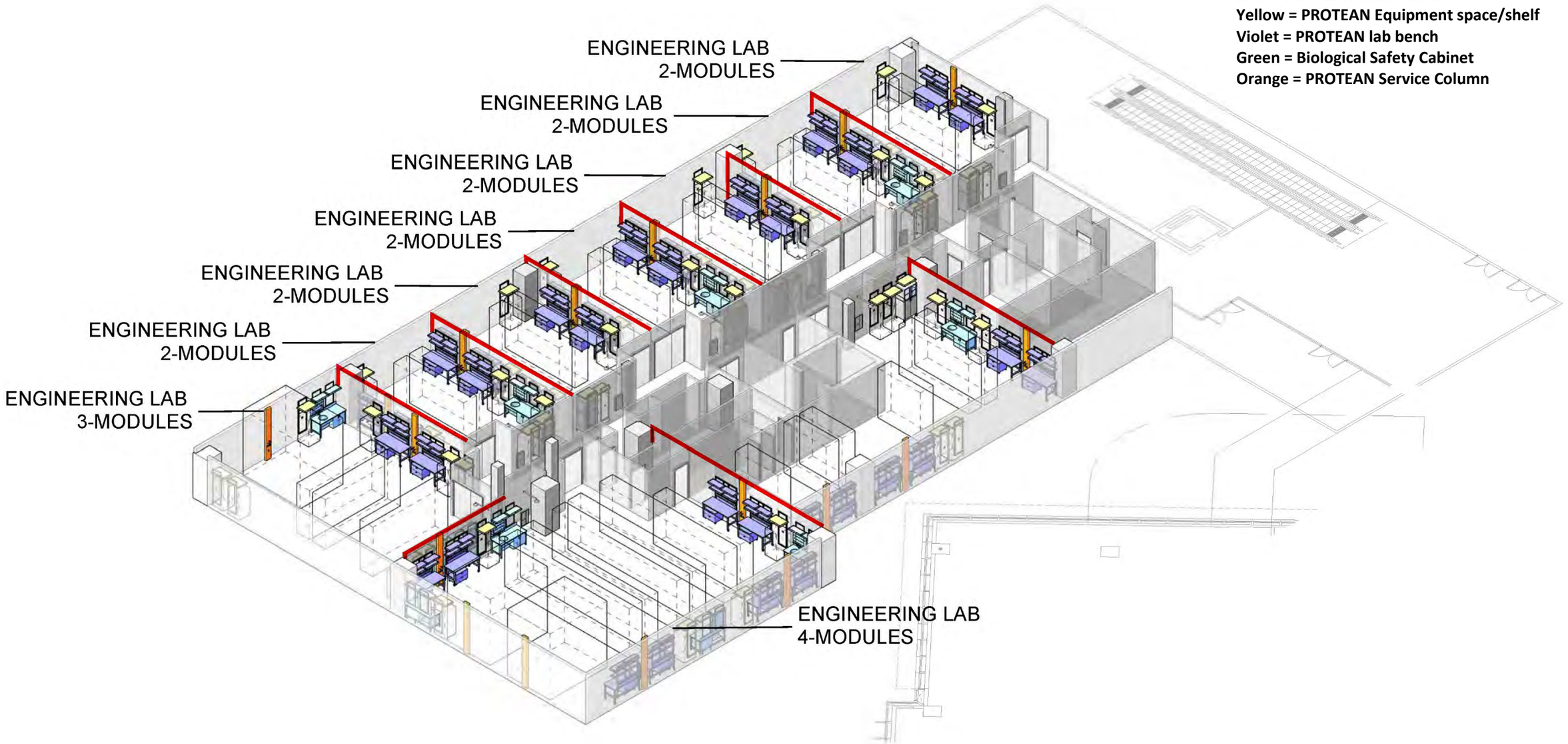
PLATFORM BUILDING 20E-A

Lab Schematic Design

Axonometric 1

Typical First Floor

Red = PROTEAN chemical fume hood
(Not used for Building 20E-A)
Blue = PROTEAN sink station
Yellow = PROTEAN Equipment space/shelf
Violet = PROTEAN lab bench
Green = Biological Safety Cabinet
Orange = PROTEAN Service Column



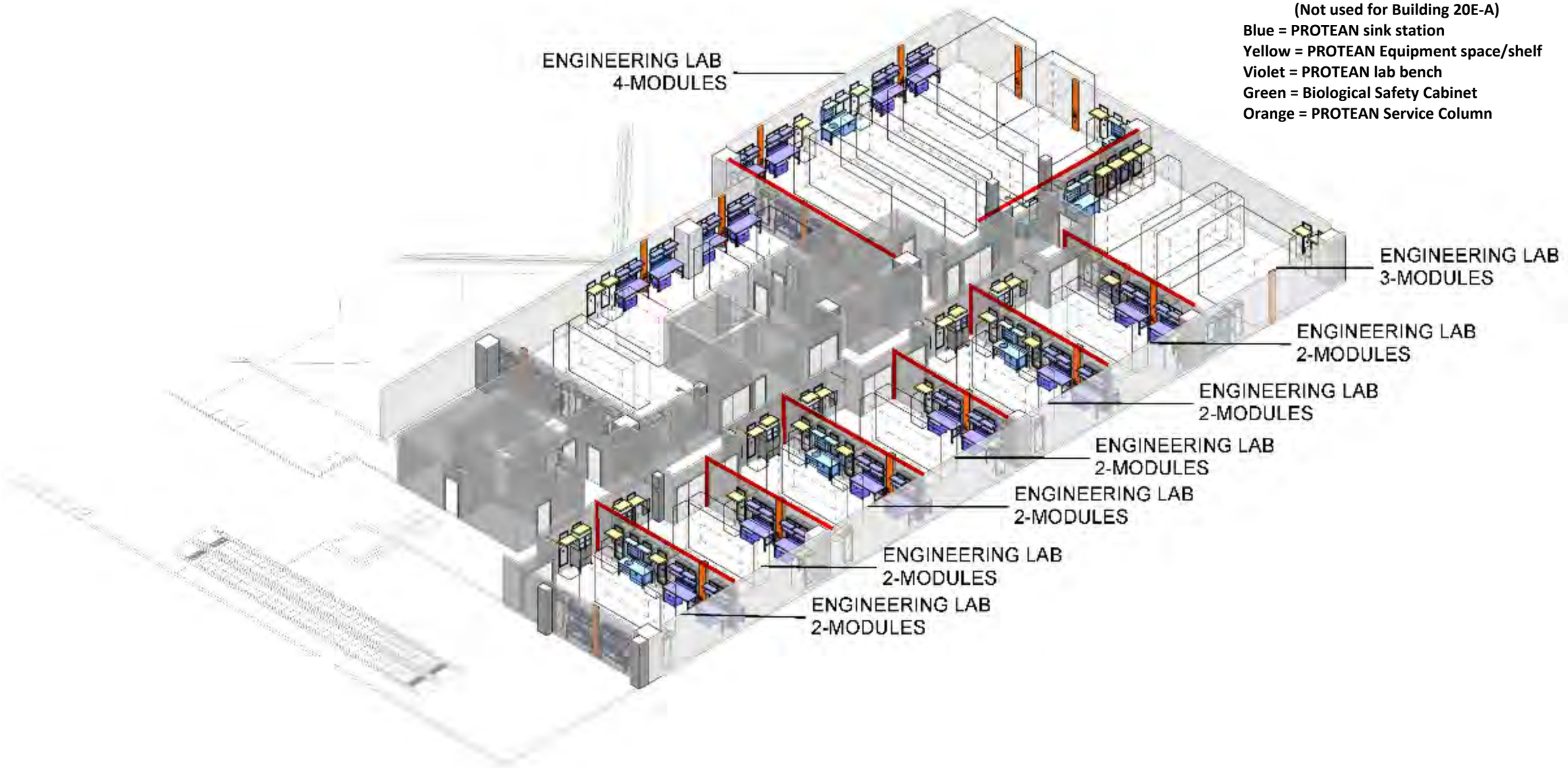
PLATFORM BUILDING 20E-A

Lab Schematic Design

Axonometric 2

Typical First Floor

Red = PROTEAN chemical fume hood
(Not used for Building 20E-A)
Blue = PROTEAN sink station
Yellow = PROTEAN Equipment space/shelf
Violet = PROTEAN lab bench
Green = Biological Safety Cabinet
Orange = PROTEAN Service Column



PLATFORM BUILDING 22E-A

Lab Schematic Design Plan

Typcial Ground Floor

Lab assignments can be changed in both function and size. Lab tenants can choose between either 2 or up to 3 module lab sizes, for a variety of Engineering Lab Prototypes, which are designed for non-chemical/non-fume hood use. The illustration shows one possible layout of many for Building 22E-A.

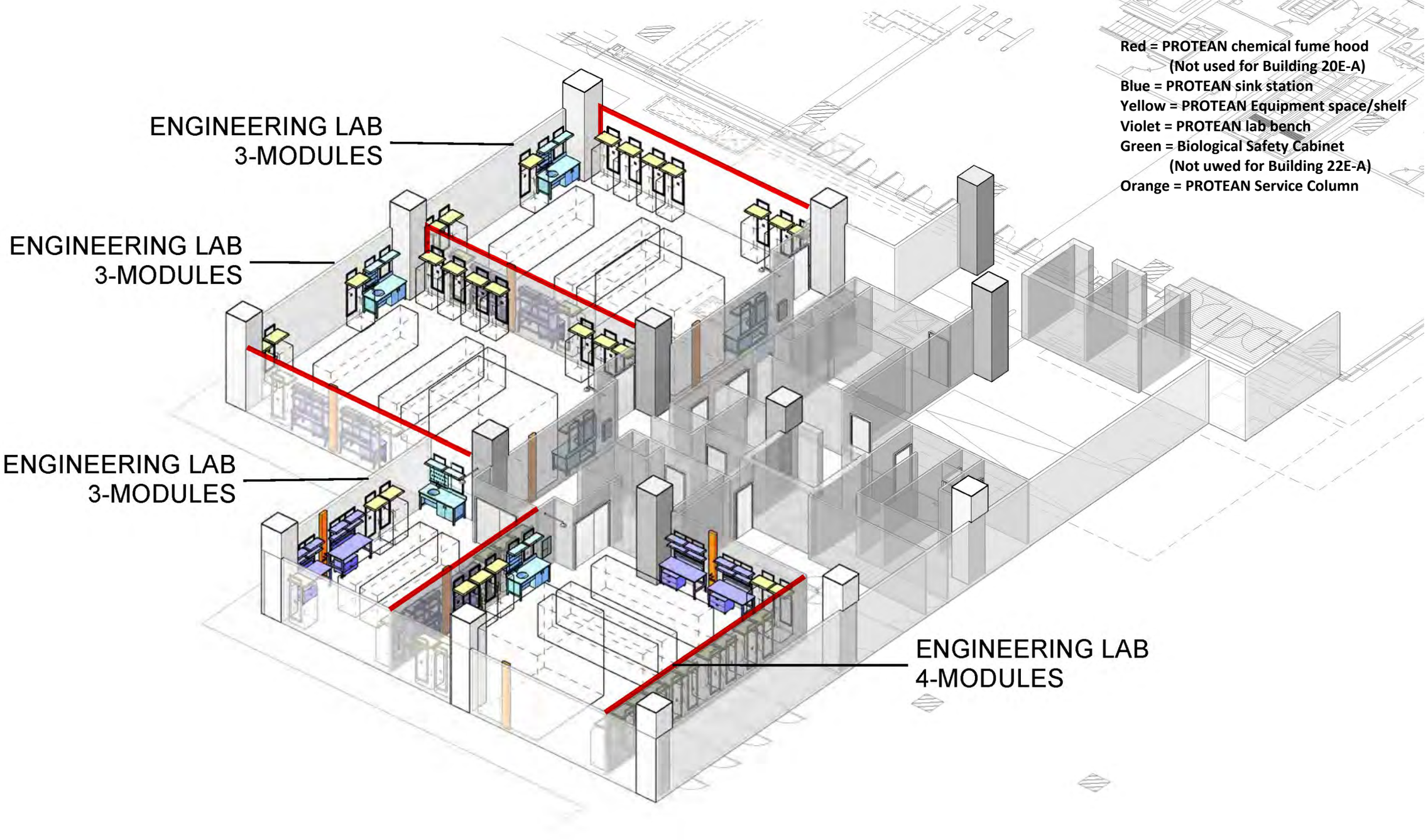
Green = Engineering Lab Suite

PLATFORM BUILDING 22E-A

Lab Schematic Design

Axonometric 1

Typical Ground Floor



Red = PROTEAN chemical fume hood
(Not used for Building 20E-A)
Blue = PROTEAN sink station
Yellow = PROTEAN Equipment space/shelf
Violet = PROTEAN lab bench
Green = Biological Safety Cabinet
(Not uwed for Building 22E-A)
Orange = PROTEAN Service Column

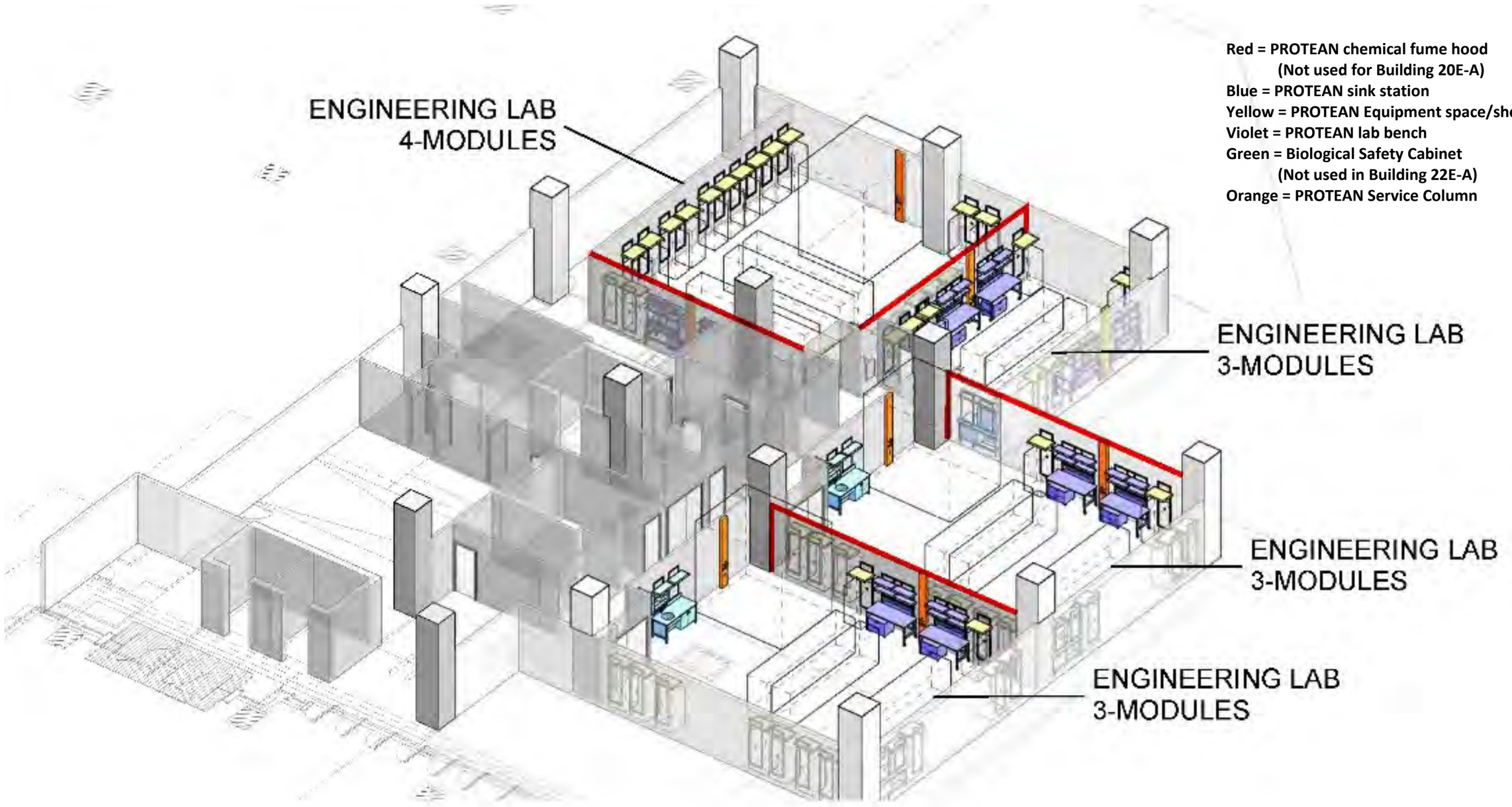
PLATFORM BUILDING 22E-A

Lab Schematic Design

Axonometric 2

Typical Ground Floor

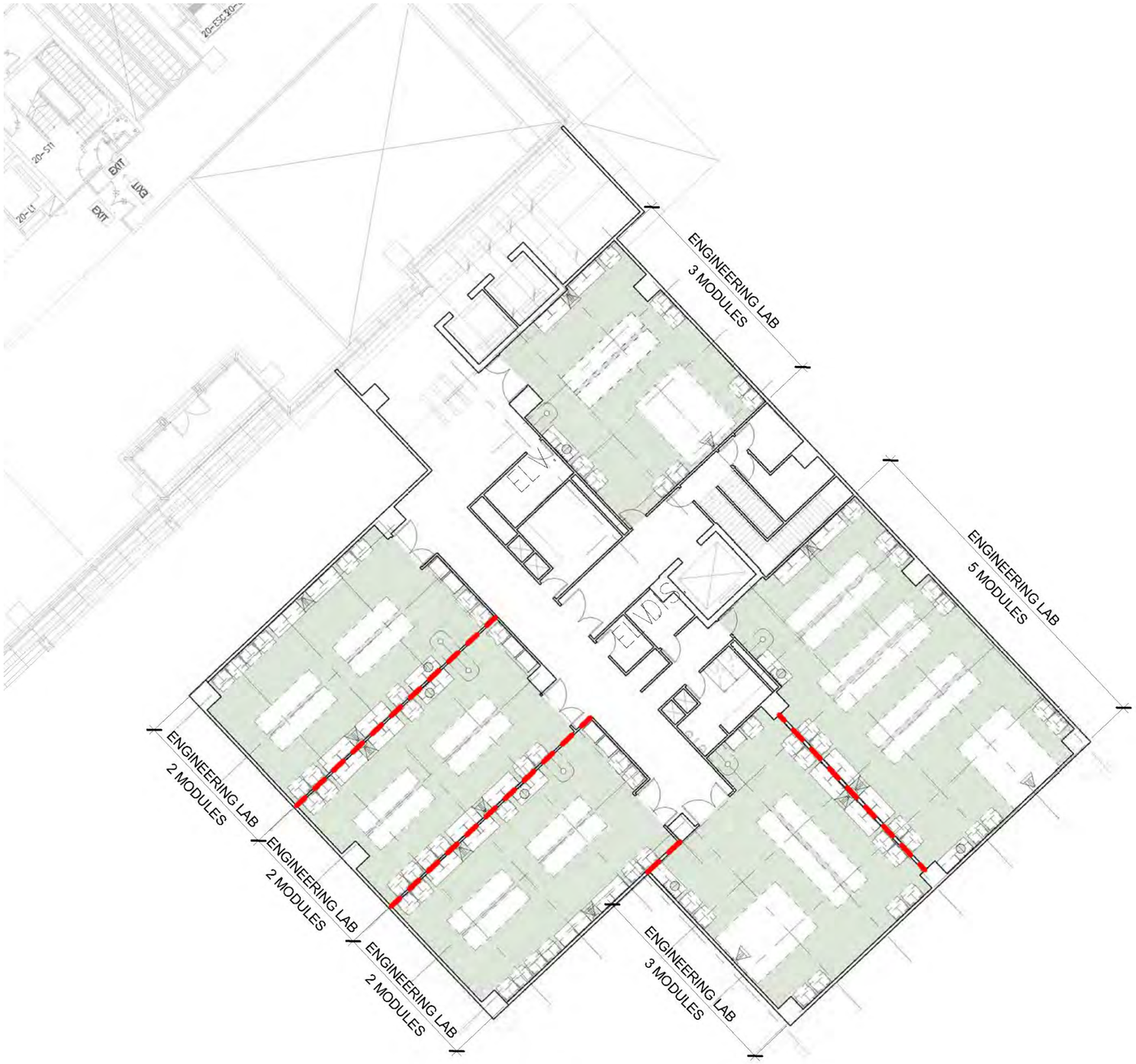
Red = PROTEAN chemical fume hood
(Not used for Building 20E-A)
Blue = PROTEAN sink station
Yellow = PROTEAN Equipment space/shelf
Violet = PROTEAN lab bench
Green = Biological Safety Cabinet
(Not used in Building 22E-A)
Orange = PROTEAN Service Column



PLATFORM BUILDING 22E-A

Lab Schematic Design

Typical First Floor



Lab assignments can be changed in both function and size. Lab tenants can choose between either 2 or up to 3 module lab sizes, for a variety of Engineering Lab Prototypes, which are designed for non-chemical/non-fume hood use. The illustration shows one possible layout of many for Building 22E-A.

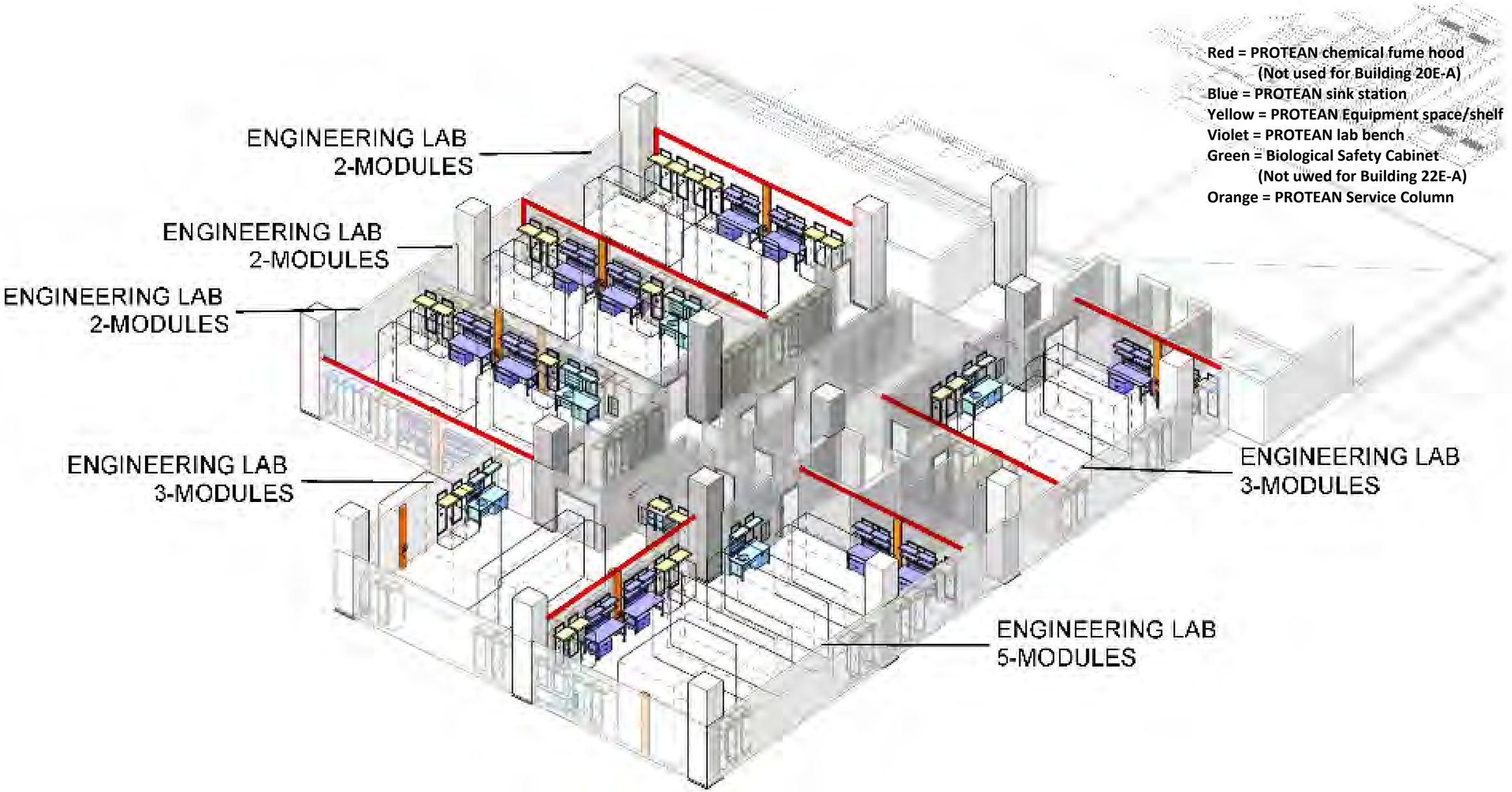
Green = Engineering Lab Suite

PLATFORM BUILDING 22E-A

Lab Schematic Design

Axonometric 1

Typical First Floor



Red = PROTEAN chemical fume hood
(Not used for Building 20E-A)
Blue = PROTEAN sink station
Yellow = PROTEAN Equipment space/shelf
Violet = PROTEAN lab bench
Green = Biological Safety Cabinet
(Not uwed for Building 22E-A)
Orange = PROTEAN Service Column

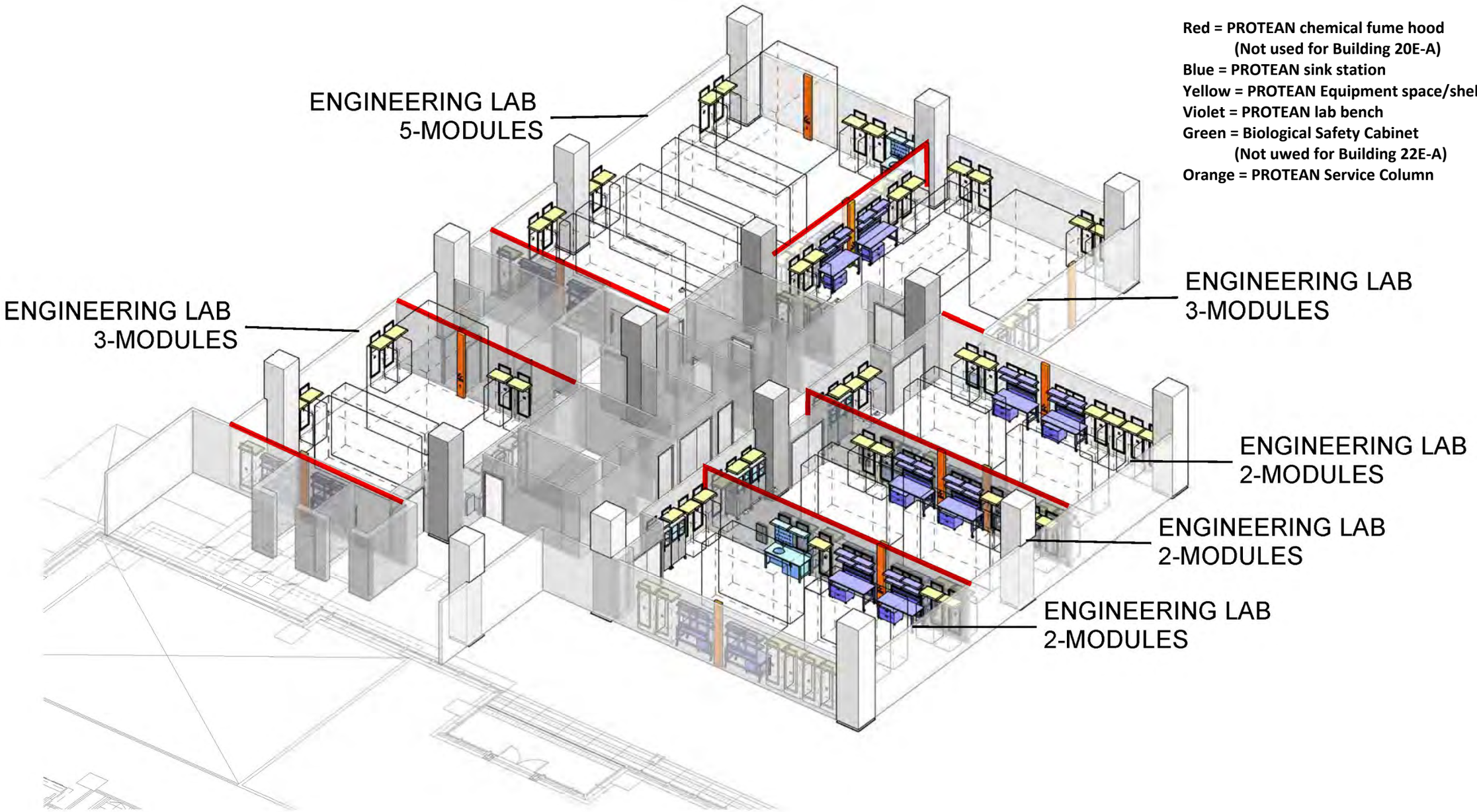
PLATFORM BUILDING 22E-A

Lab Schematic Design

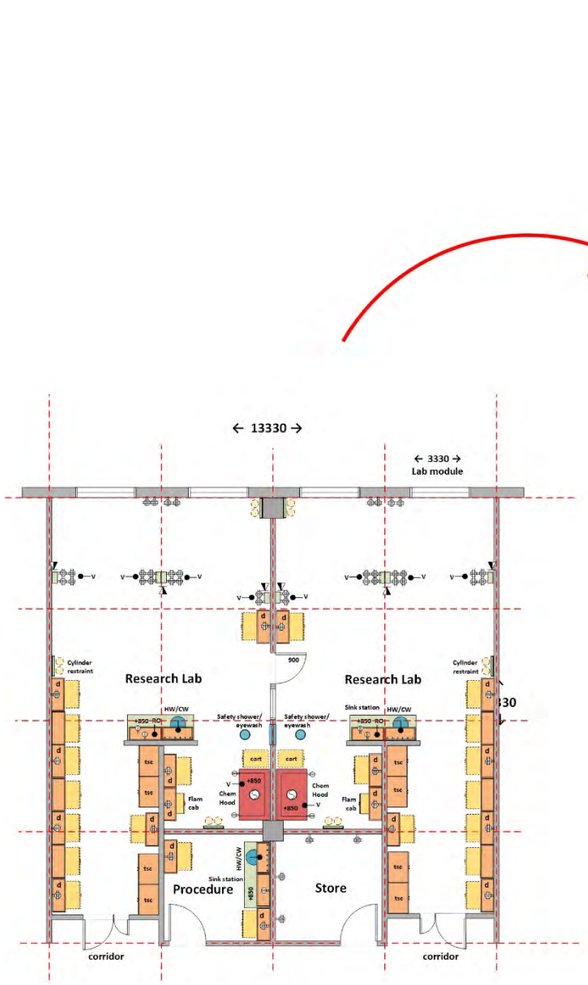
Axonometric 1

Typical First Floor

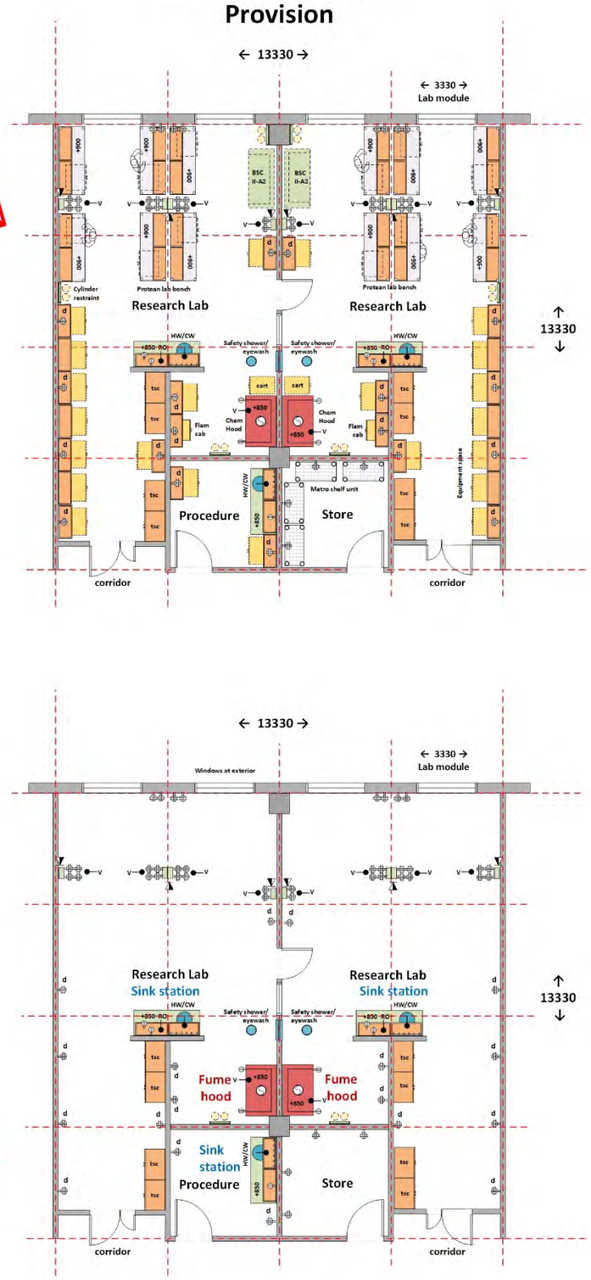
Red = PROTEAN chemical fume hood
(Not used for Building 20E-A)
Blue = PROTEAN sink station
Yellow = PROTEAN Equipment space/shelf
Violet = PROTEAN lab bench
Green = Biological Safety Cabinet
(Not uwed for Building 22E-A)
Orange = PROTEAN Service Column



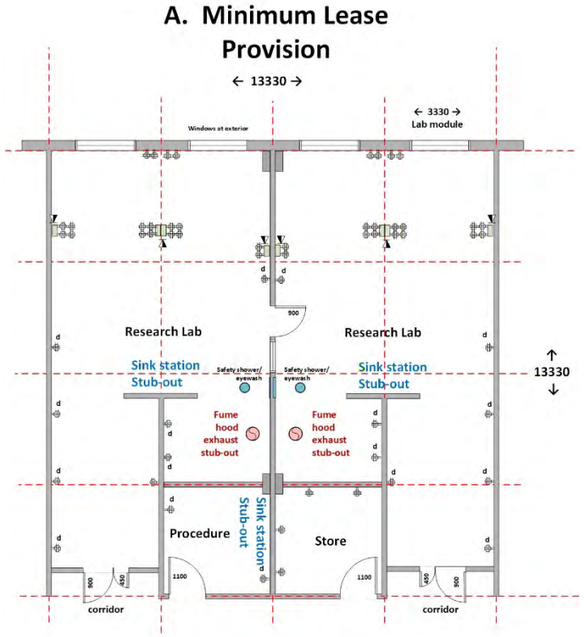
SECTION 4
LAB LEASE OPTIONS

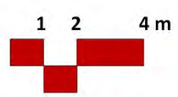


C. Medium Lease Provision



B. Basic Lease Provision





LAB LEASE OPTIONS

In anticipation of labs being leased to various scienctific groups with varying needs and lab programmes, it is advantageous to consider options for how lab space can be leased. Some lab occupants may want minimal amenities inside the lab space, whilst they provide the majority of the lab equipment and furnishings. Other lease tenants may want some basic amenities such as fume hoods and sink stations. Other may want a full build out of lab space, with the understanding that their lab lease rates will be higher than other options with fewer amenities.

These illustrations take a basic science research suite and show how it can be leased out in different configurations of lab furnishings and equipment.

A. Minimum Lease Provision

- **Power is provided at lab bench and wall locations.**
- **Central gas (air, CO2. Vacuum, nitrogen gas) piped to equipment locations**
- **Exhaust for fume hood is stubbed-out in each lab unit.**
- **Sink drain, water supply, and vent is stubbed-out at each potential sink location.**
- **Safety shower/eyewash units installed with floor drain below**

B. Basic Lease Provision

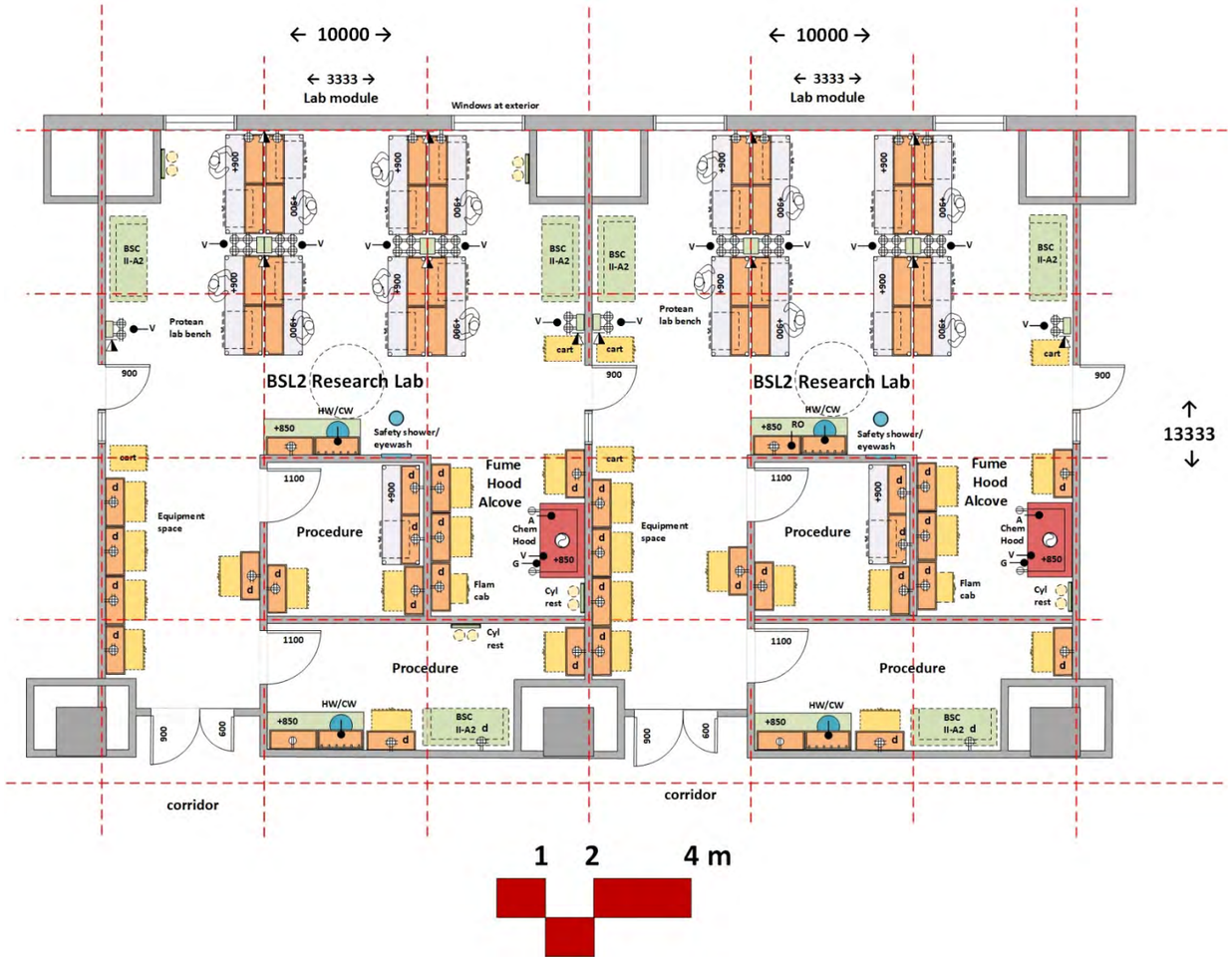
- **All elements of Minimum level plus:**
- **Fume hoods are installed.**
- **Sinks stations are installed.**
- **Tall storage cabinets are installed.**

C. Medium Lease Provision

- **All elements of Basic level plus:**
- **Unistrut shelves at equipment locations installed**

D. Maximum Lease Provision

- **All elements of Medium level plus:**
- **Protean lab benches installed**



SECTION 5
SCHEMATIC DESIGN
BSL2 LAB

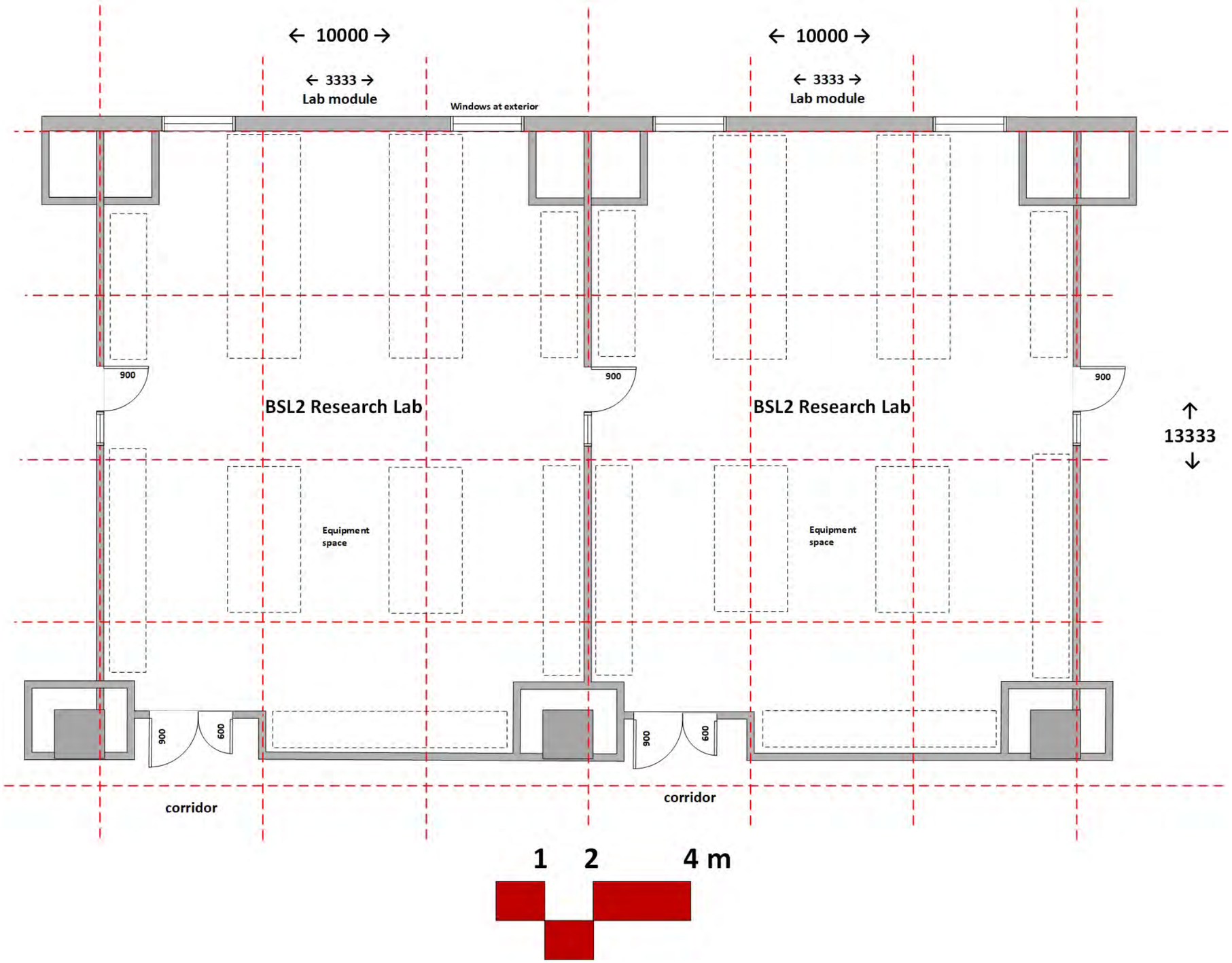
Building 12W-A
Similar for BSL2 in Building 16E-A
Similar for Plodium Building 20E-A, if any

TYPICAL BSL2 LAB

Typical Floor Building 12W-A

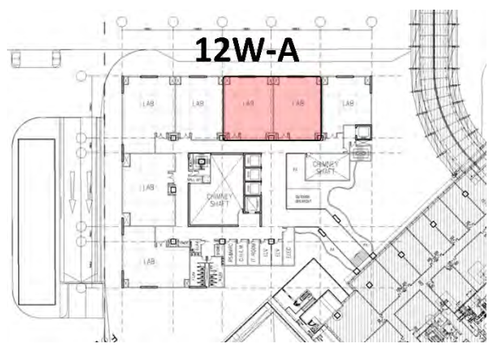
Lab Progression #1

Perimeter Lab Walls only



- Illustration represents perimeter walls of lab units only- which represents initial construction by general contractor.
- Mechanical, plumbing, and electrical services to be stubbed out to lab units:
  - Standby power
  - Electrical power
  - Emergency lighting
  - Fire sprinkler system
  - Drain stub outs for sinks
  - Vent stub outs for sinks
  - Fume hood exhaust stub out
  - Vacuum stub out
  - Compressed air stub out
  - CO2 stub out
  - Nitrogen gas stub out
  - RO water stub out
  - Security card reader at doors

Location Key- Typical for other labs

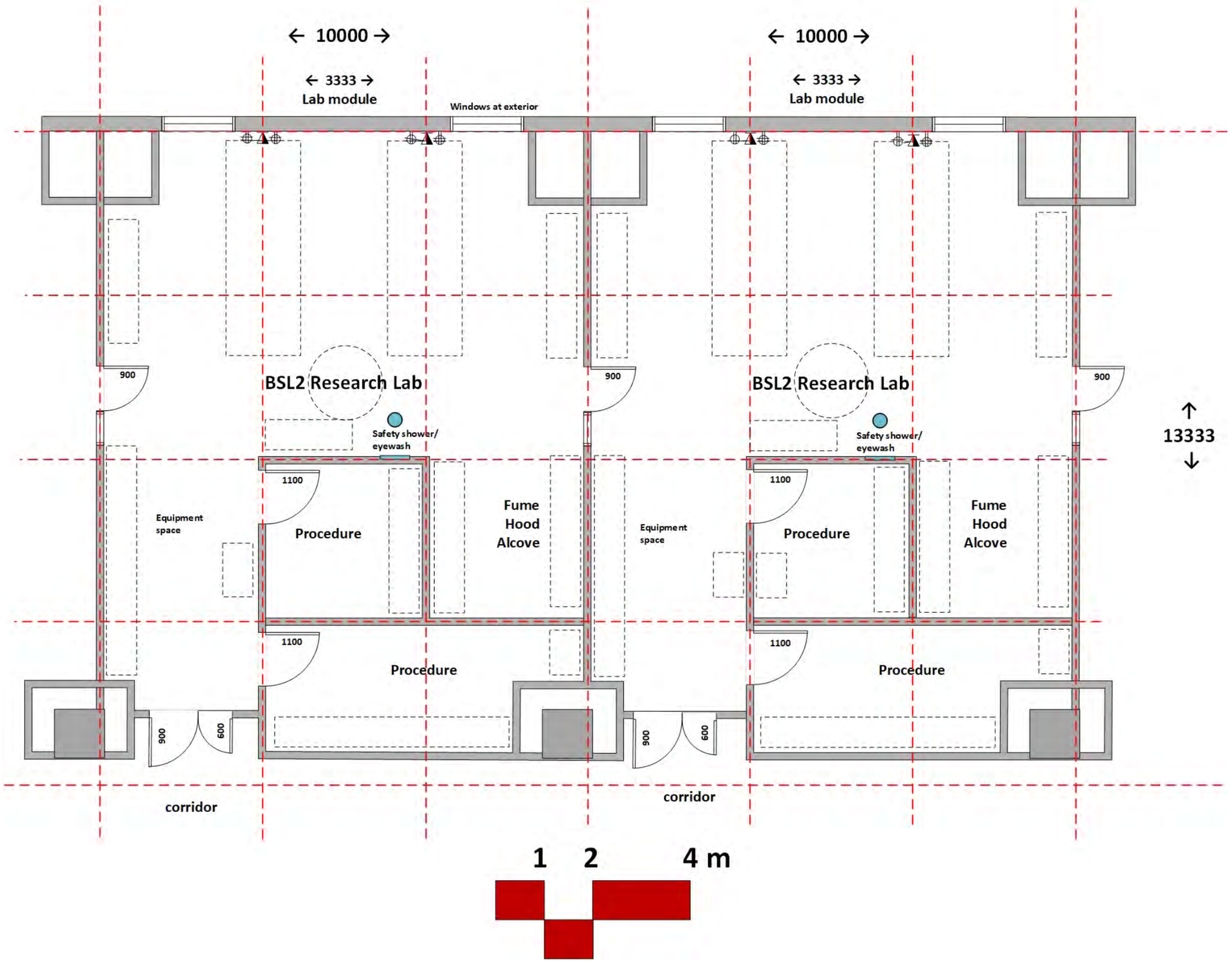


TYPICAL BSL2 LAB

Typical Floor Building 12W-A

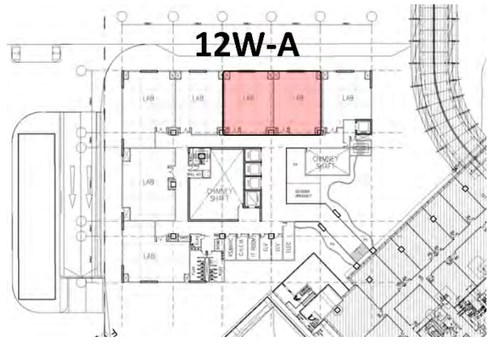
Lab Progression #2

Perimeter Lab Walls and Interior Lab Walls, Safety shower



- Illustration represents perimeter walls of lab units with interior lab wall, and safety shower only. Interior walls can be located based on lab tenant requirements, within reason.
- Includes all of Lab Progression #1 plus:
  - Interior walls
  - Safety Shower with tepid water output
  - Interior lab doors

Location Key- Typical for other labs



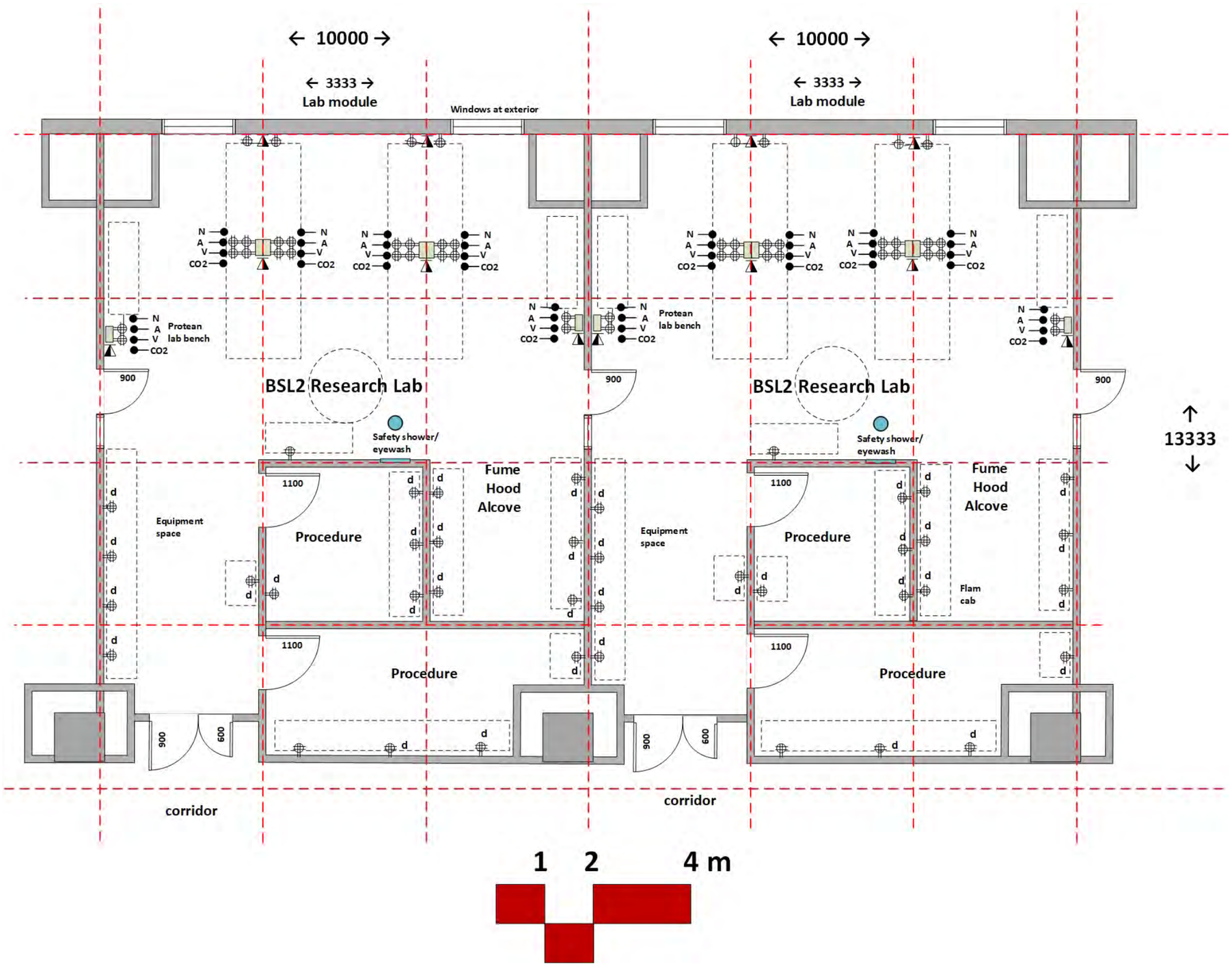
TYPICAL BSL2 LAB

Typical Floor Building 12W-A

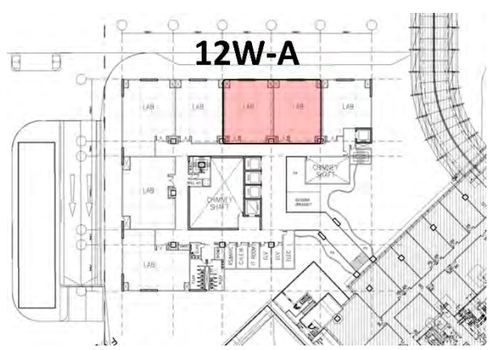
Lab Progression #3

Perimeter Walls, Interior Walls, Safety shower, Electrical outlets, Plumbing valves

- Illustration represents perimeter walls of lab units, interior lab walls, safety shower, and fit out of plumbing valves and electrical outlets.
- Includes all of Lab Progression #2 plus:
  - Electrical outlets at walls and service columns- dedicated circuits typical (noted with “d”)
  - Plumbing valves for compressed air, CO2, nitrogen gas, and vacuum at walls and service columns



Location Key- Typical for other labs



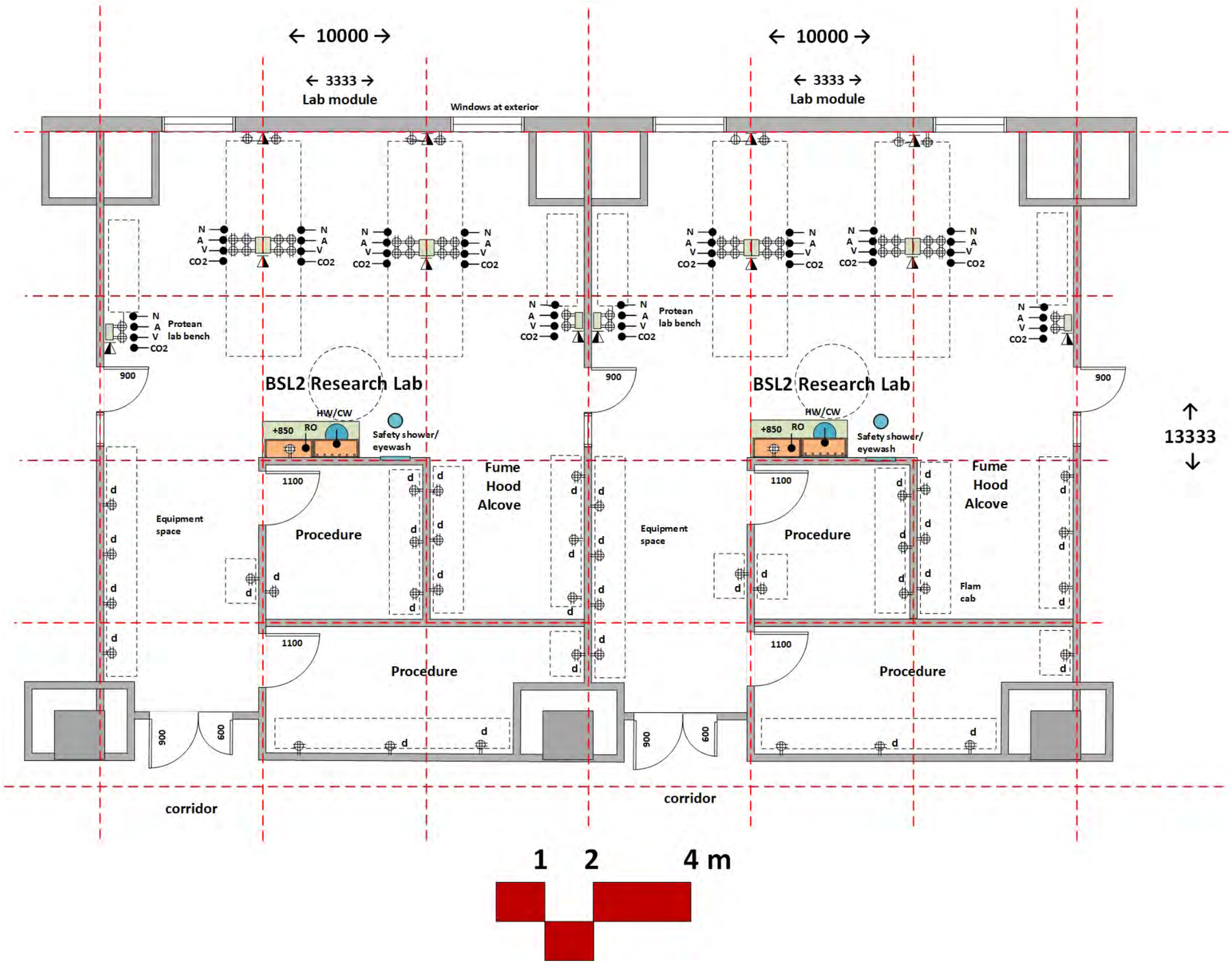
TYPICAL BSL2 LAB

Typical Floor Building 12W-A

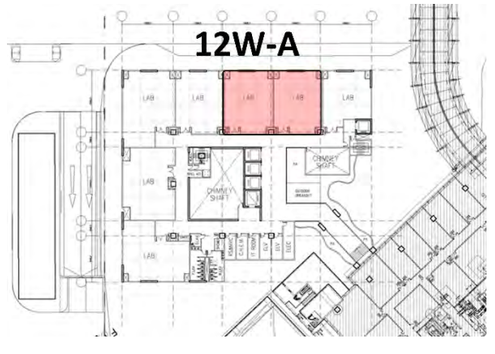
Lab Progression #4

Perimeter Walls, Interior Walls, Safety shower, Electrical outlets, Plumbing valves, Sink unit

- Illustration represents perimeter walls of lab units, safety shower, electrical outlets and plumbing valves, and sink unit stations.
- Includes all of Lab Progression #3 plus:
  - Sink units with RO water feed for point-of-use water polisher provided by lab tenant



Location Key- Typical for other labs

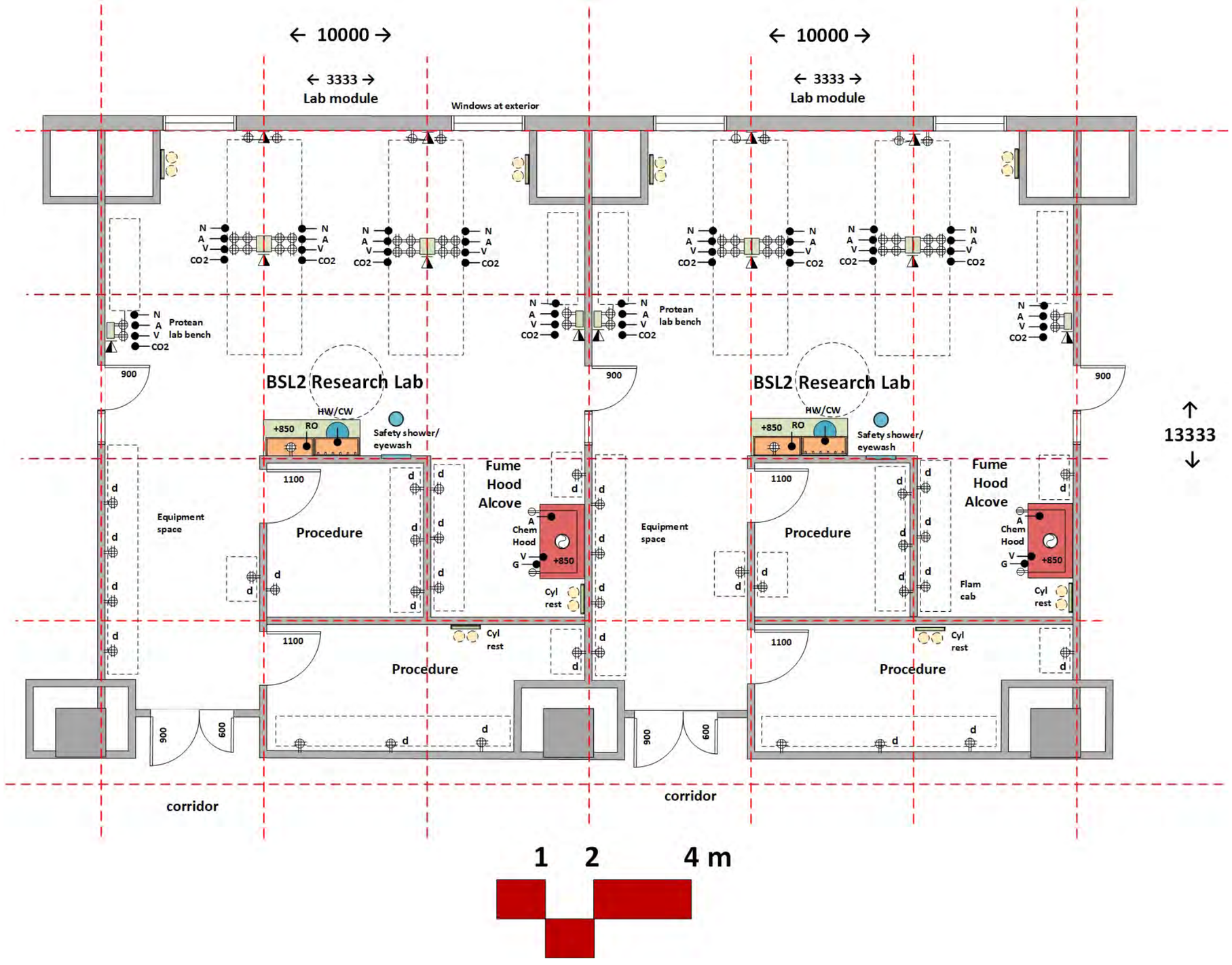


TYPICAL BSL2 LAB

Typical Floor Building 12W-A

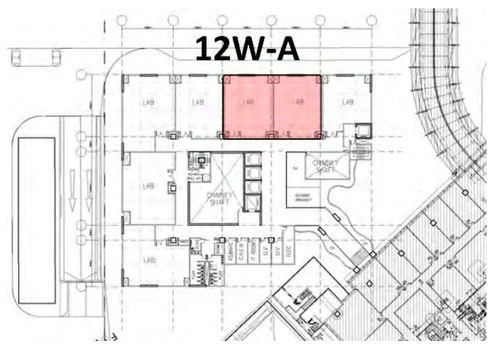
Lab Progression #5

Perimeter Walls, Interior Walls, Safety Shower, Electrical outlets, Plumbing valves, Sink unit, Fume Hoods, Cylinder restraints



- Illustration represents walls, safety shower, electrical outlets, plumbing valves, sink stations, cylinder restraints and chemical fume hoods.
- Includes all of Lab Progression #4 plus:
  - Cylinder restraints for lab tenant furnished inert gas cylinders (Argon, Helium)
  - Chemical fume hoods

Location Key- Typical for other labs

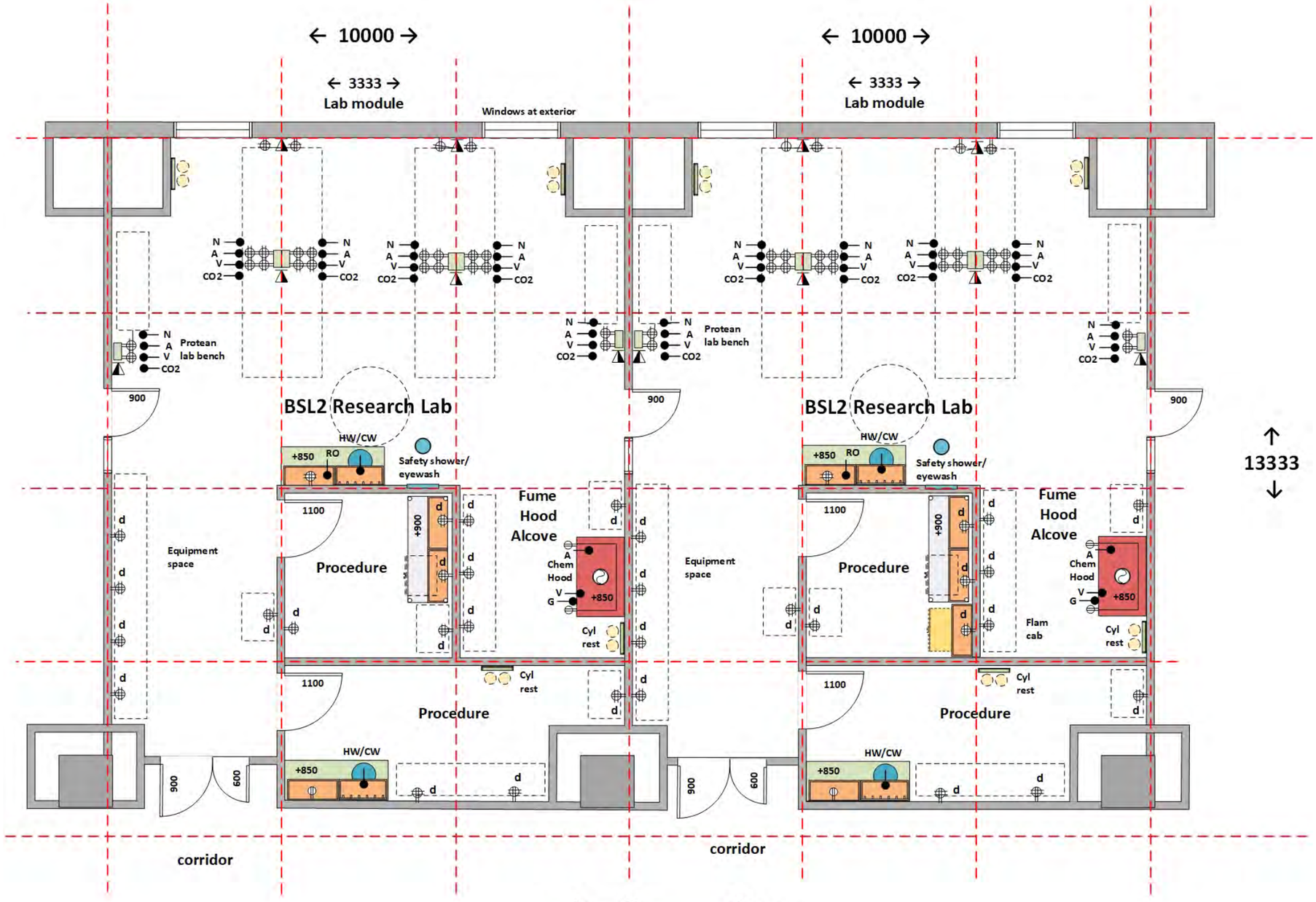


TYPICAL BSL2 LAB

Typical Floor Building 12W-A

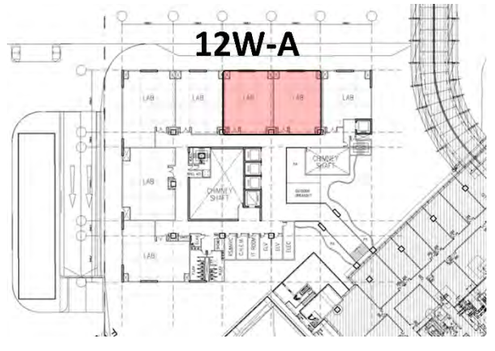
Lab Progression #6

Perimeter Walls, Interior Walls Electrical outlets, Plumbing valves, Sink unit, Fume Hoods, Cylinder restraints, 2nd Sink Unit



- Illustration represents walls, safety shower, electrical outlets, plumbing valves, sink stations, cylinder restraints, chemical fume hoods, and 2nd sink unit.
- Includes all of Lab Progression #5 plus:
  - 2nd sink unit in each lab

Location Key- Typical for other labs



TYPICAL BSL2 LAB

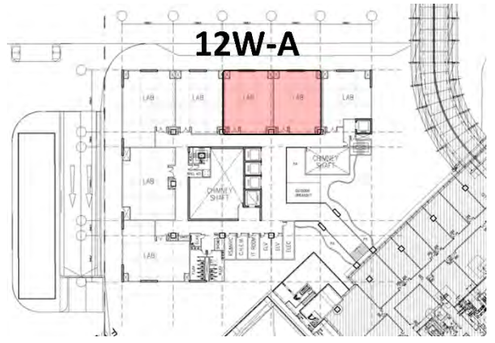
Typical Floor Building 12W-A

Lab Progression #7

Perimeter Walls, Interior Walls Electrical outlets, Plumbing valves, Sink unit, Fume Hoods, Cylinder restraints, 2nd Sink Unit, Biological Safety Cabinets

- Illustration represents walls, safety shower, electrical outlets, plumbing valves, sink stations, cylinder restraints, chemical fume hoods, sink units, and biological safety cabinets (tenant furnished).
- Includes all of Lab Progression #6 plus:
  - Biological Safety Cabinets (Tenant furnished)

Location Key- Typical for other labs

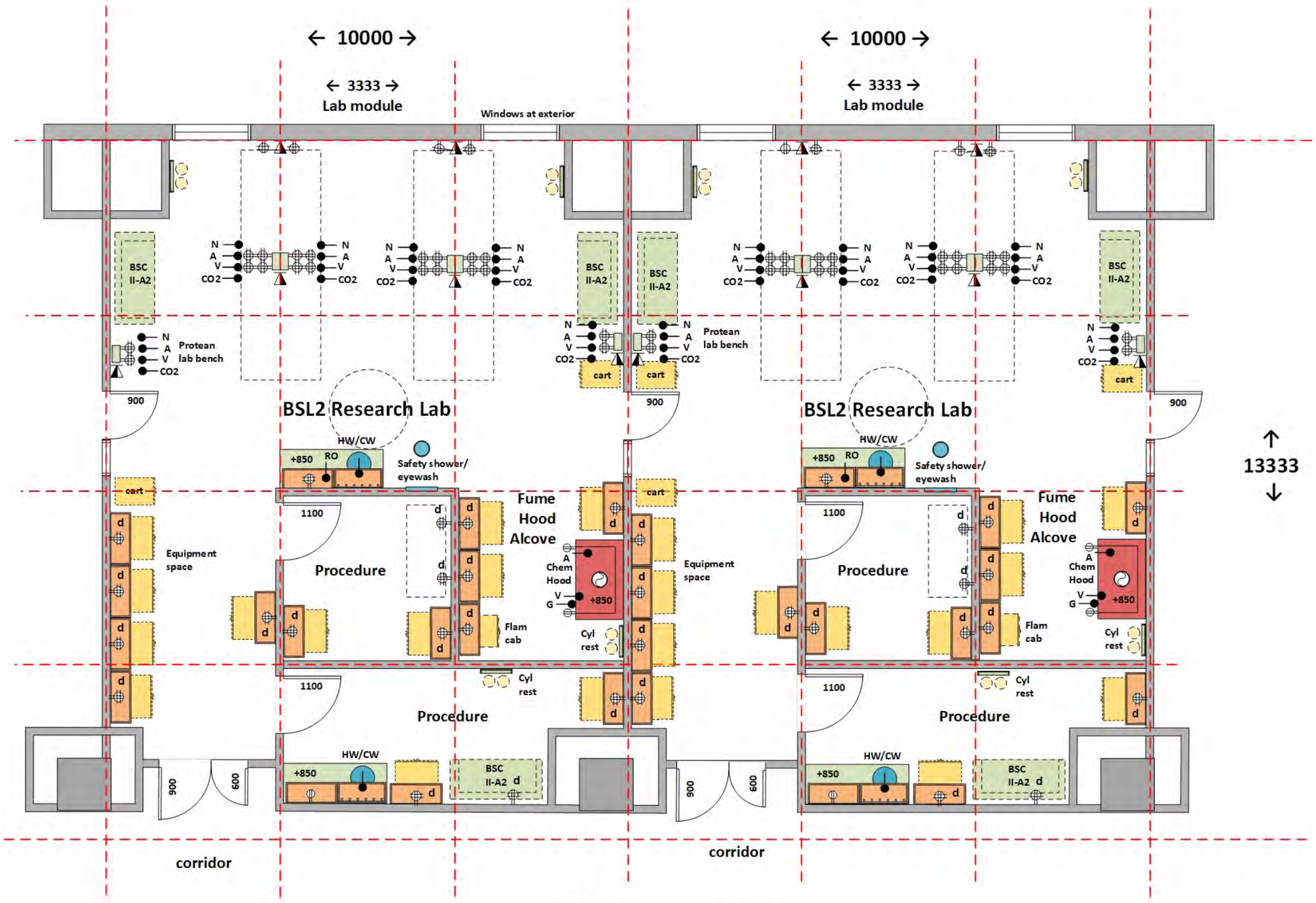


TYPICAL BSL2 LAB

Typical Floor Building 12W-A

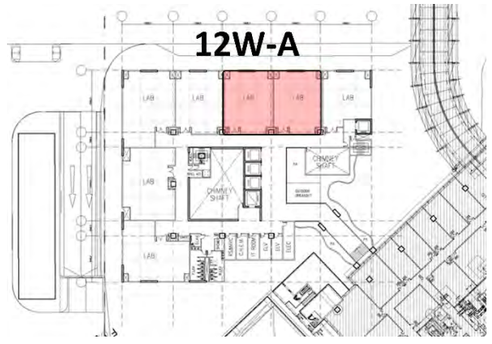
Lab Progression #8

Perimeter Walls, Interior Walls Electrical outlets, Plumbing valves, Sink unit, Fume Hood, 2nd Sink Unit, Biological Safety Cabinets, Equipment Shelf Units



- Illustration represents walls, safety shower, electrical outlets, plumbing valves, sink stations, cylinder restraints, chemical fume hoods, sink units, biological safety cabinets (tenant furnished), and Equipment shelf units.
- Includes all of Lab Progression #7 plus:
  - Equipment shelf units. Each lab has an extra 7.5 square meters of storage area with the use of the wall equipment shelf units as shown.
  - Carts (tenant furnished).

Location Key- Typical for other labs

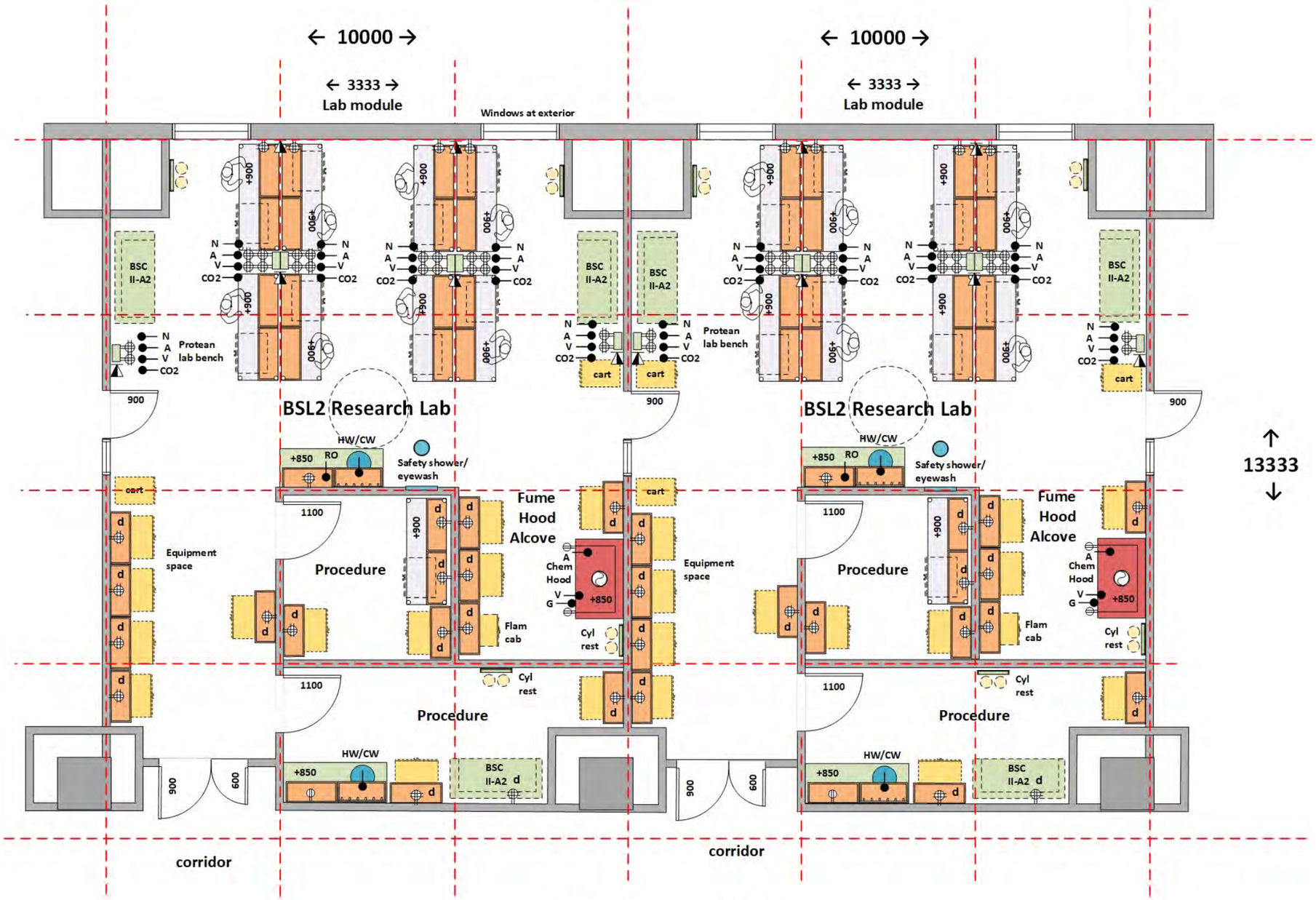


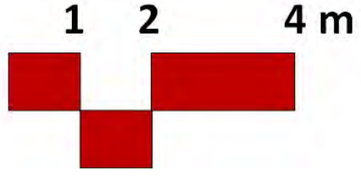
TYPICAL BSL2 LAB

Typical Floor Building 12W-A

Lab Progression #9- full build out

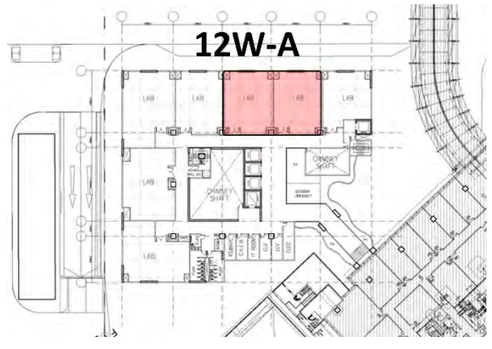
Perimeter Walls, Interior Walls Electrical outlets, Plumbing valves, Sink unit, Fume Hoods, Cylinder restraints, 2nd Sink Unit, Biological Safety Cabinets, Equipment Shelf Units, Protean Lab benches





- Illustration represents walls, safety shower, electrical outlets, plumbing valves, sink stations, cylinder restraints, chemical fume hoods, sink units, biological safety cabinets (tenant furnished), Equipment shelf units, and Protean shelf units.
- Includes all of Lab Progression #8 plus:
  - Protean lab benches.

Location Key- Typical for other labs

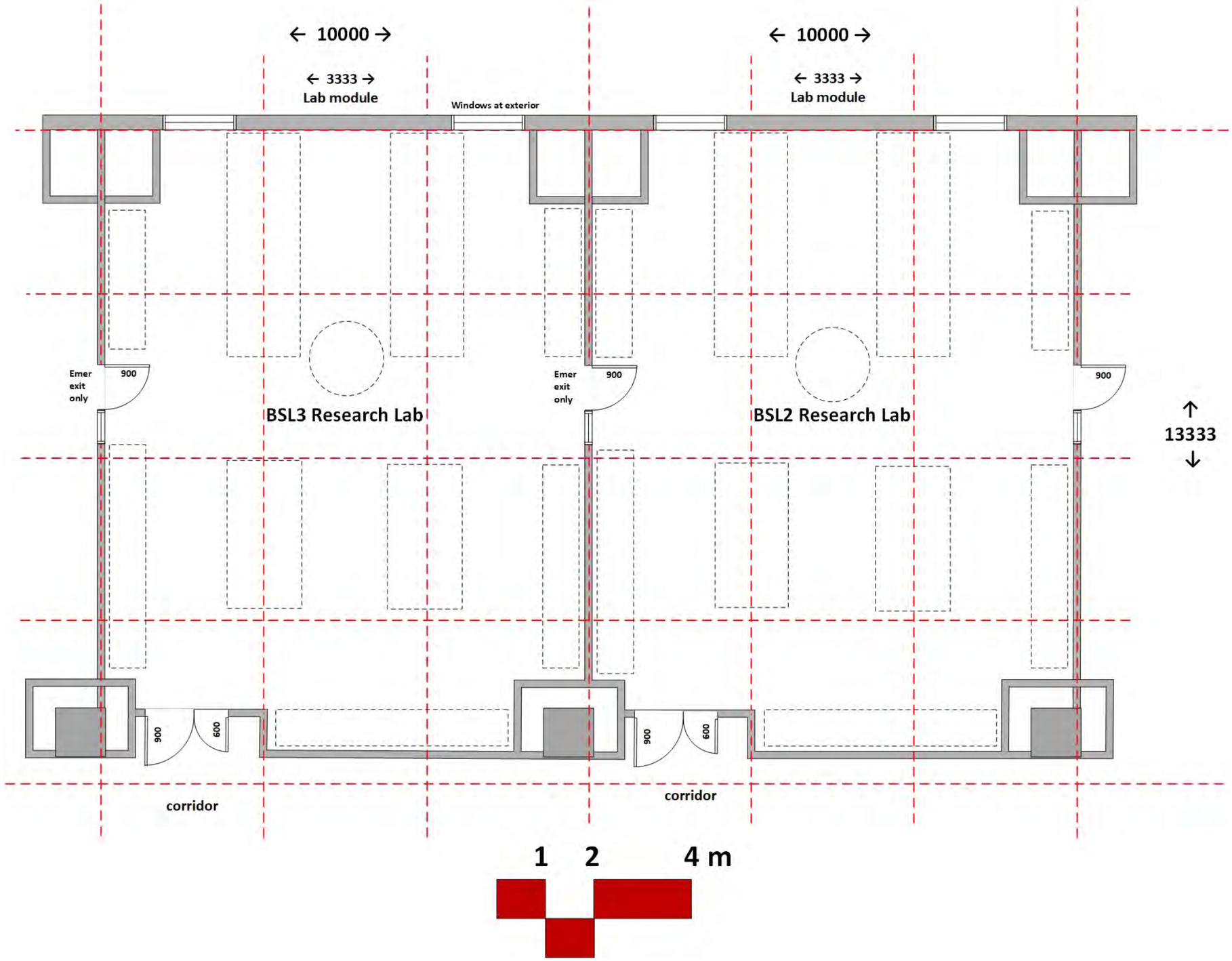


SECTION 6
SCHEMATIC DESIGN

BSL3 LAB

Building 12W-A

Similar for BSL3 in Building 16E-A, if any

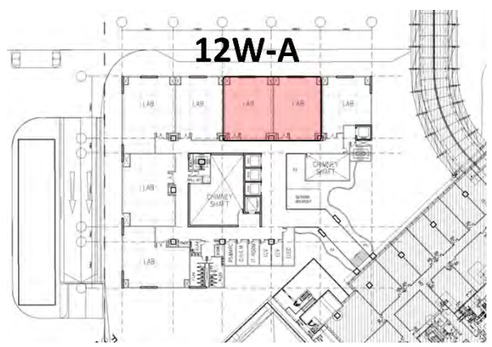


TYPICAL BSL3 LAB

Typical Floor Building 12W-A
Shown with adjacent BLS2 Lab
Lab Progression #1
Perimeter Lab Walls only

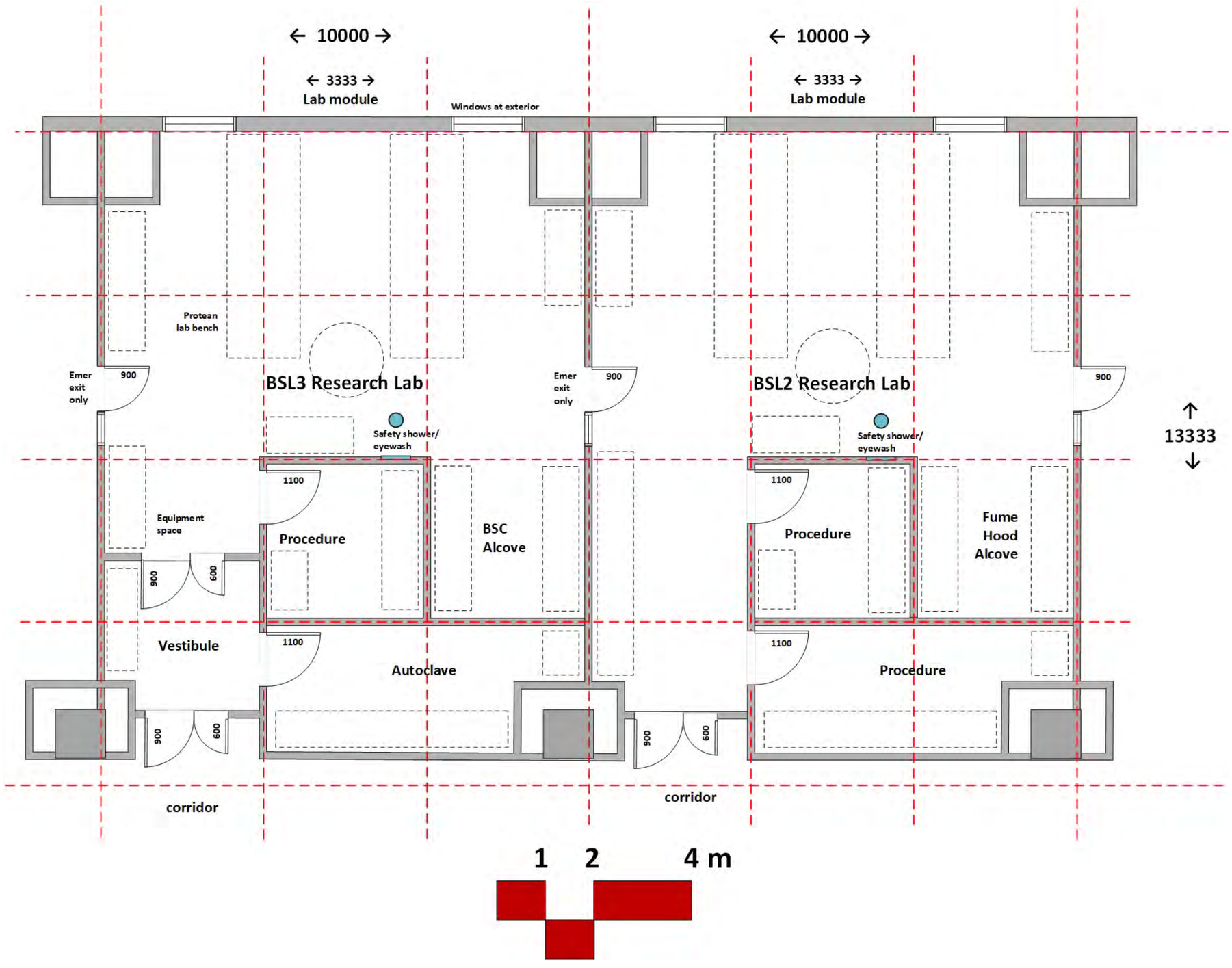
- Illustration represents perimeter walls of lab units only- which represents initial construction by general contractor.
- Mechanical, plumbing, and electrical services to be stubbed out to lab units:
  - Standby power
  - Electrical power
  - Standby power
  - Emergency lighting
  - Fire sprinkler system
  - Drain stub outs for sinks
  - Vent stub outs for sinks
  - Fume hood exhaust stub out in BSL2
  - Thimble exhaust stub out in BSL3 for biological safety cabinet
  - Dedicated exhaust to roof for BLS3 lab suite
  - Vacuum stub out
  - Compressed air stub out
  - Carbon Dioxide stub out
  - Nitrogen gas stub out
  - Pure water (Type II) stub out
  - Security card reader at doors

Location Key- Typical for other BSL3/BSL2 labs



TYPICAL BSL3 LAB

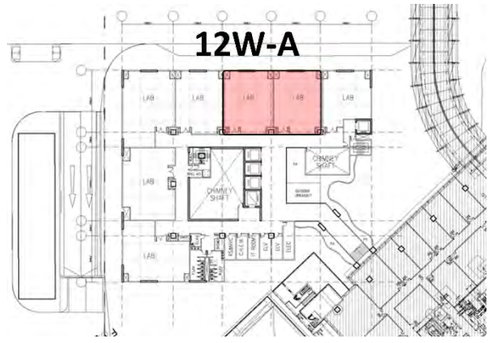
Typical Floor Building 12W-A
Shown with adjacent BLS2 Lab
Lab Progression #2
Perimeter Lab Walls and Interior Lab Walls, Safety shower



- Illustration represents perimeter walls of lab units with interior lab wall, and safety shower only. Interior walls can be located based on lab tenant requirements, within reason.

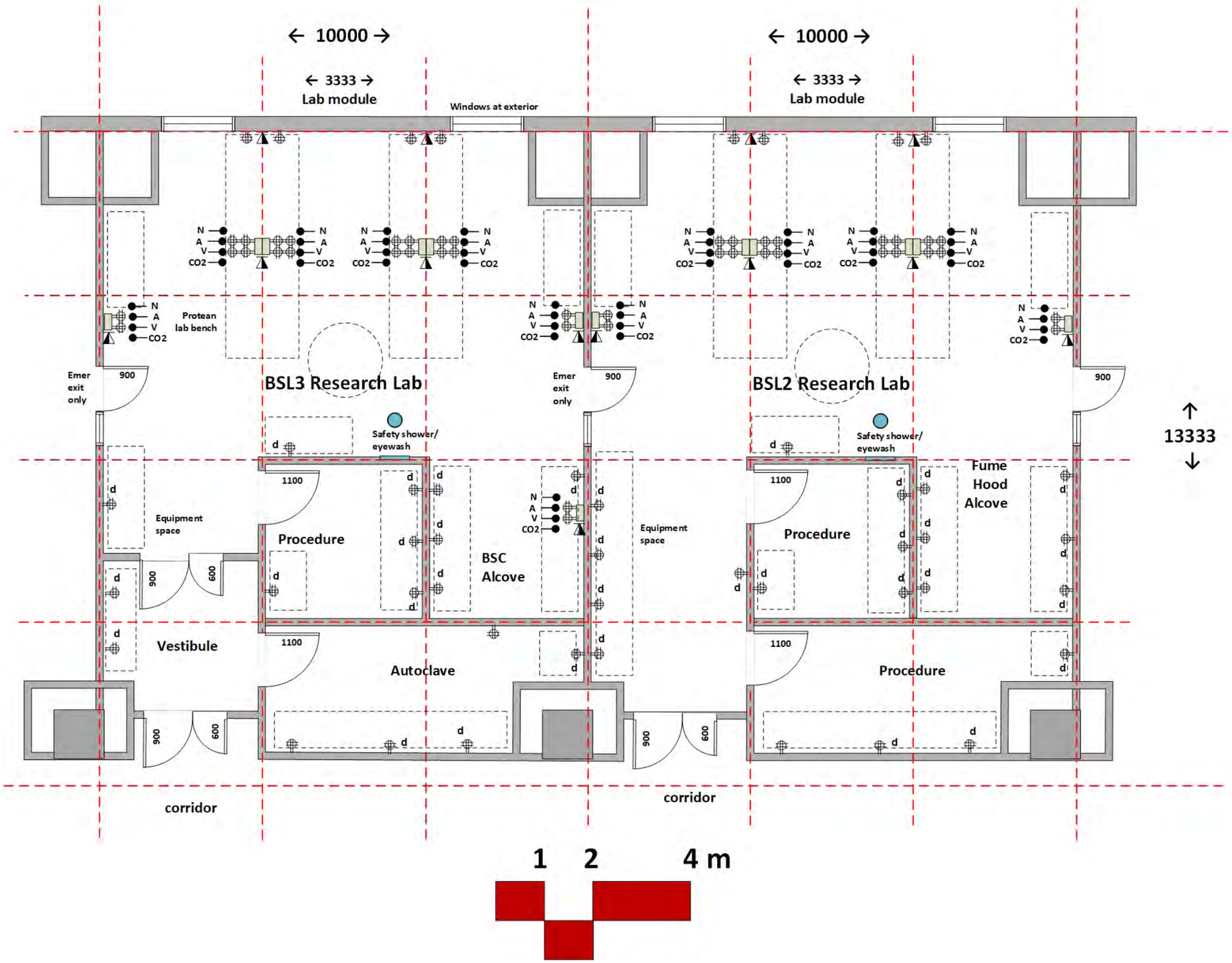
- Includes all of Lab Progression #1 plus:
  - Interior walls
  - Safety Shower with tepid water output
  - Interior lab doors
  - Vestibule for BSL3 Lab

Location Key- Typical for other BSL3/BSL2 labs



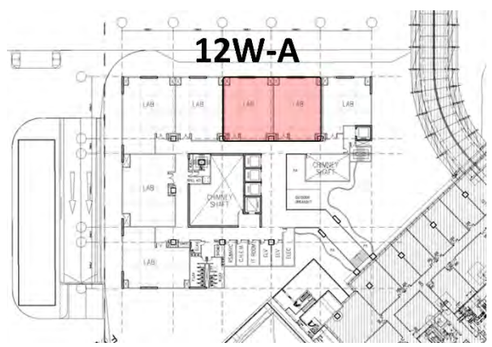
TYPICAL BSL3 LAB

Typical Floor Building 12W-A
Shown with adjacent BLS2 Lab
Lab Progression #3
Perimeter Walls, Interior Walls, Safety shower, Electrical outlets, Plumbing valves



- Illustration represents perimeter walls of lab units, interior lab walls, safety shower, and fit out of plumbing valves and electrical outlets.
- Includes all of Lab Progression #2 plus:
  - Electrical outlets at walls and service columns- dedicated circuits typical (noted with “d”)
  - Plumbing valves for compressed air (A), vacuum (V), Nitrogen gas (N), and Carbon Dioxide (CO2) at walls and service columns.

Location Key- Typical for other BSL3/BSL2 labs

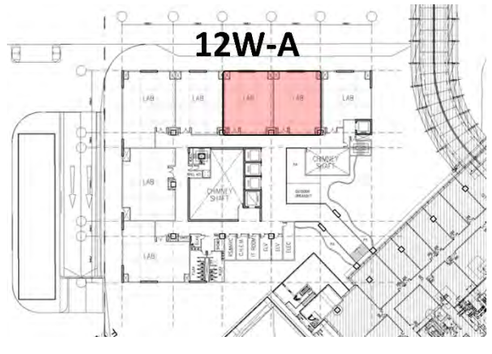


TYPICAL BSL3 LAB

Typical Floor Building 12W-A
Shown with adjacent BLS2 Lab
Lab Progression #4
Perimeter Walls, Interior Walls, Safety shower, Electrical outlets, Plumbing valves, Sink unit

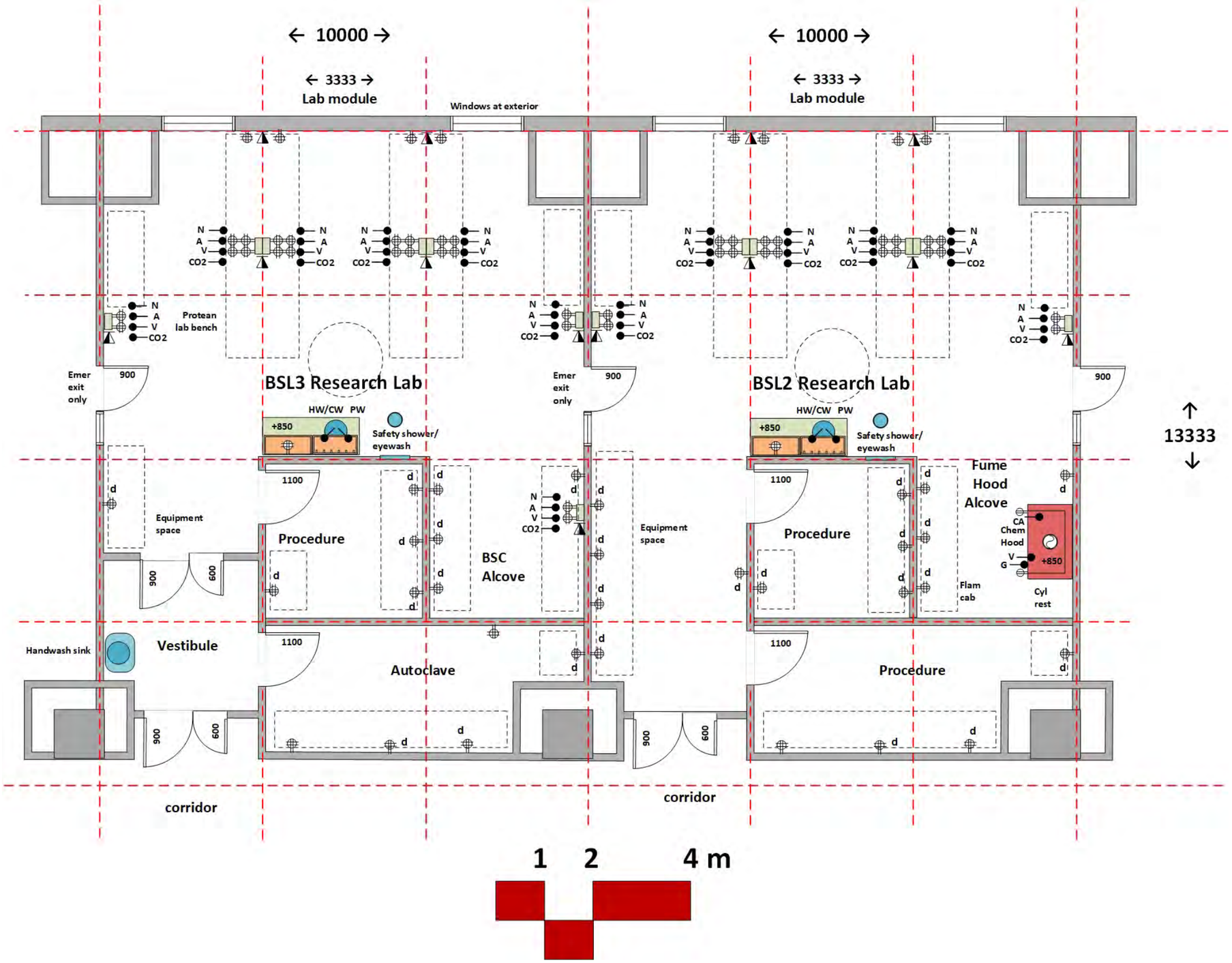
- Illustration represents perimeter walls of lab units, safety shower, electrical outlets and plumbing valves, and sink unit stations.
- Includes all of Lab Progression #3 plus:
  - Sink units with hot/cold water (HW/CW) and type II pure water (PW). Pure water to be on recirculating loop, unpigmented polypropylene piping.

Location Key- Typical for other BSL3/BSL2 labs

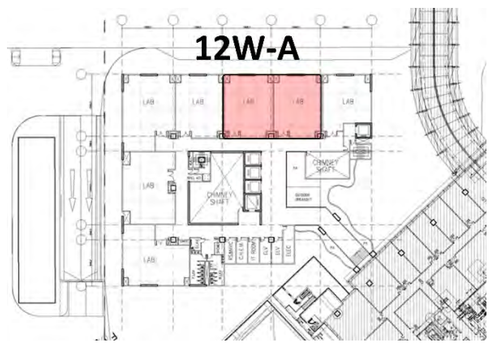


TYPICAL BSL3 LAB

Typical Floor Building 12W-A
Shown with adjacent BLS2 Lab
Lab Progression #5
Perimeter Walls, Interior Walls, Safety Shower, Electrical outlets, Plumbing valves, Sink unit, Chemical Fume Hoods,



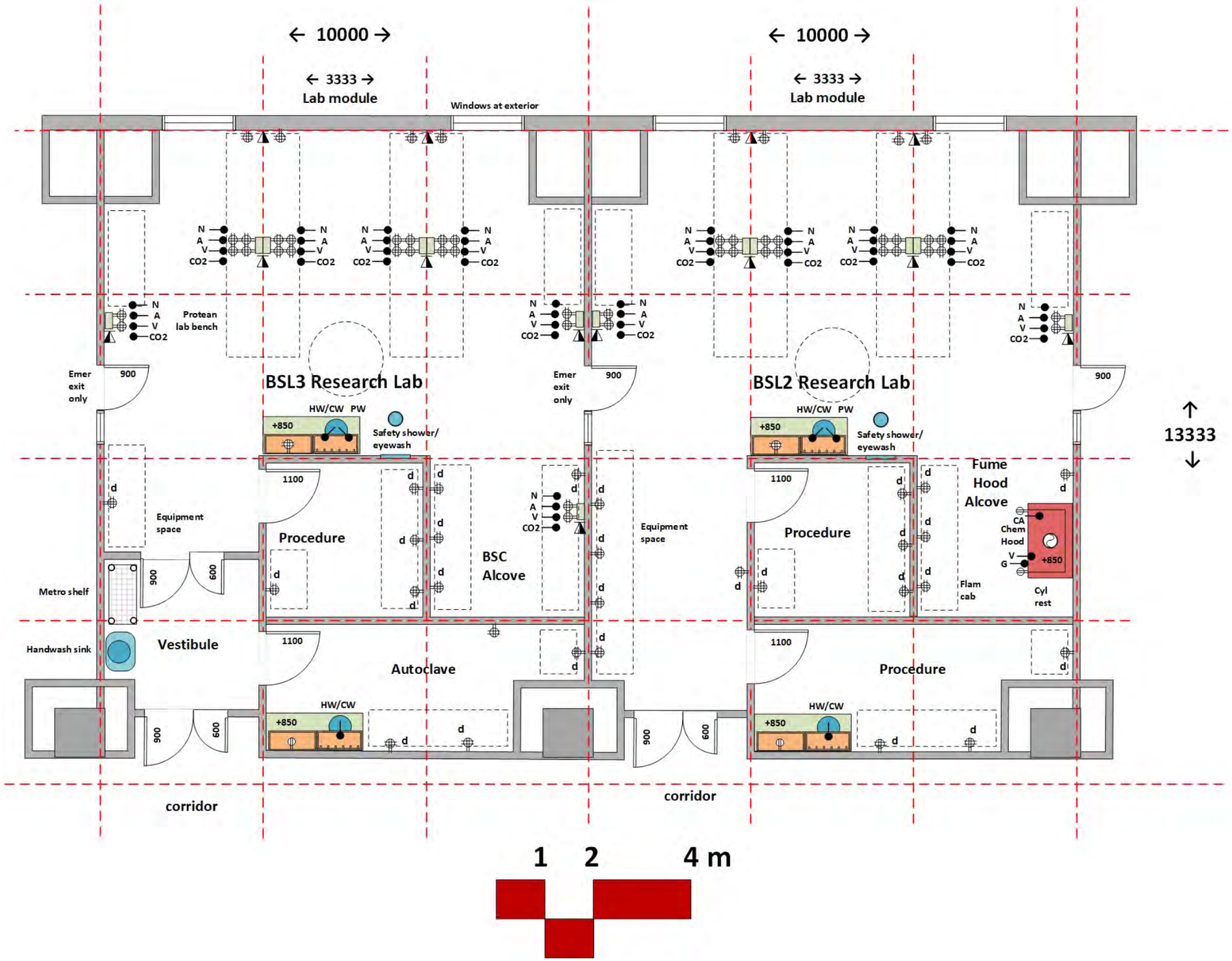
Location Key- Typical for other labs



- Illustration represents walls, safety shower, electrical outlets, plumbing valves, sink stations, cylinder restraints and chemical fume hoods.
- Includes all of Lab Progression #4 plus:
  - Chemical fume hoods in BSL2 Lab Suite

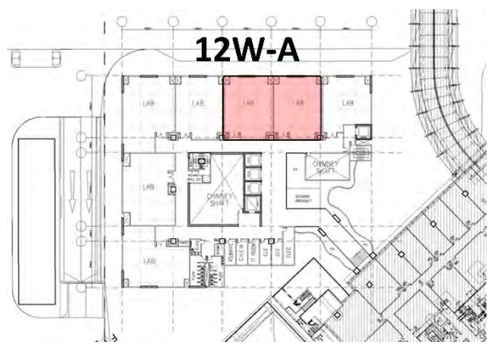
TYPICAL BSL3 LAB

Typical Floor Building 12W-A
Shown with adjacent BLS2 Lab
Lab Progression #6
Perimeter Walls, Interior Walls Electrical outlets, Plumbing valves, Sink unit, Fume Hoods, 2nd Sink Unit



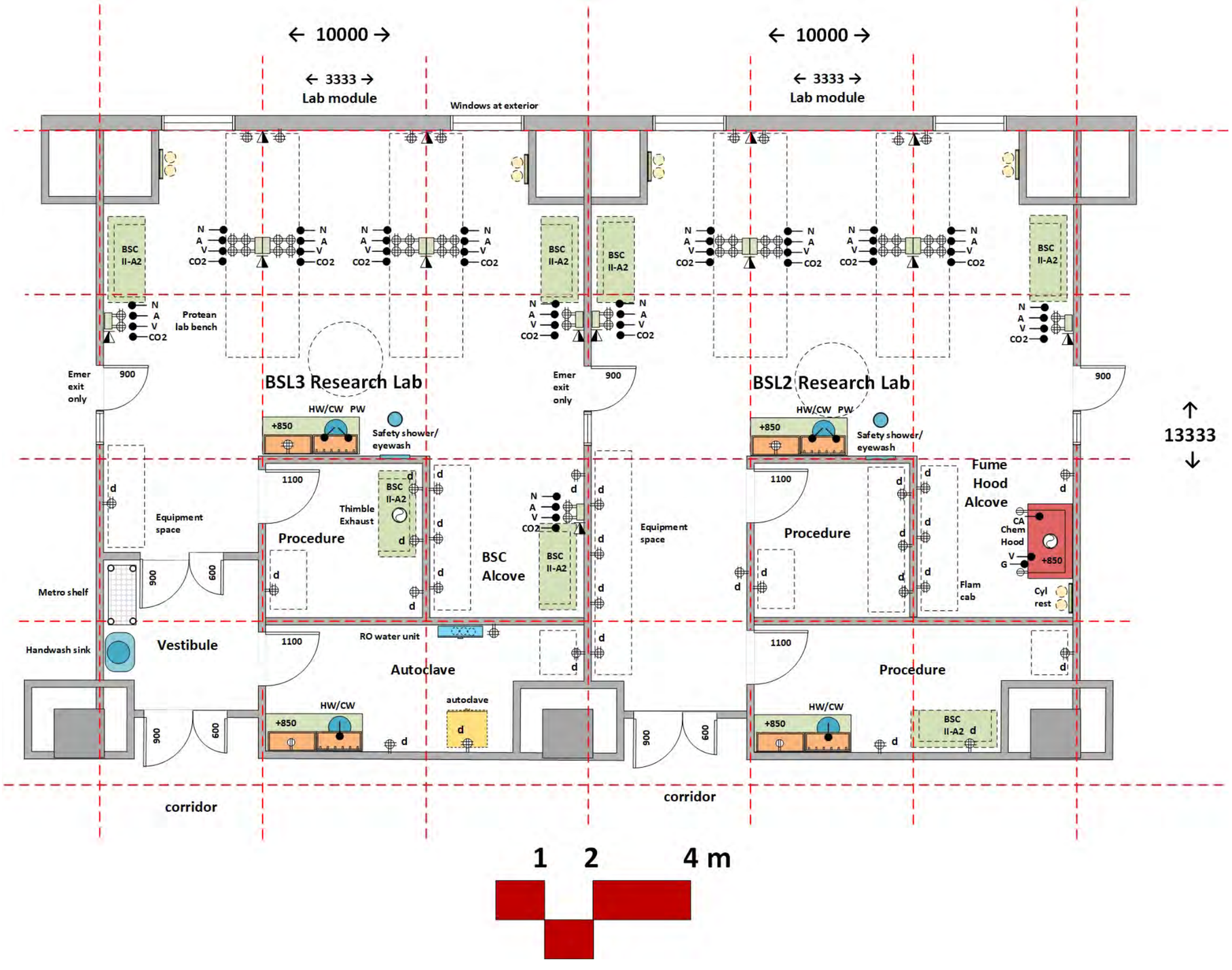
- Illustration represents walls, safety shower, electrical outlets, plumbing valves, sink stations, chemical fume hoods, and 2nd sink unit.
- Includes all of Lab Progression #5 plus:
  - 2nd sink unit in each lab

Location Key- Typical for other labs



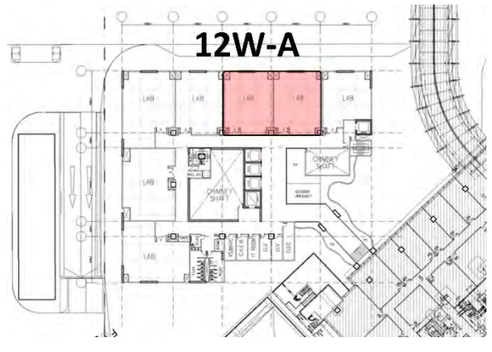
TYPICAL BSL3 LAB

Typical Floor Building 12W-A
Shown with adjacent BLS2 Lab
Lab Progression #7
Perimeter Walls, Interior Walls Electrical outlets, Plumbing valves, Sink unit, Fume Hoods, 2nd Sink Unit, Biological Safety Cabinets, Cylinder restraints



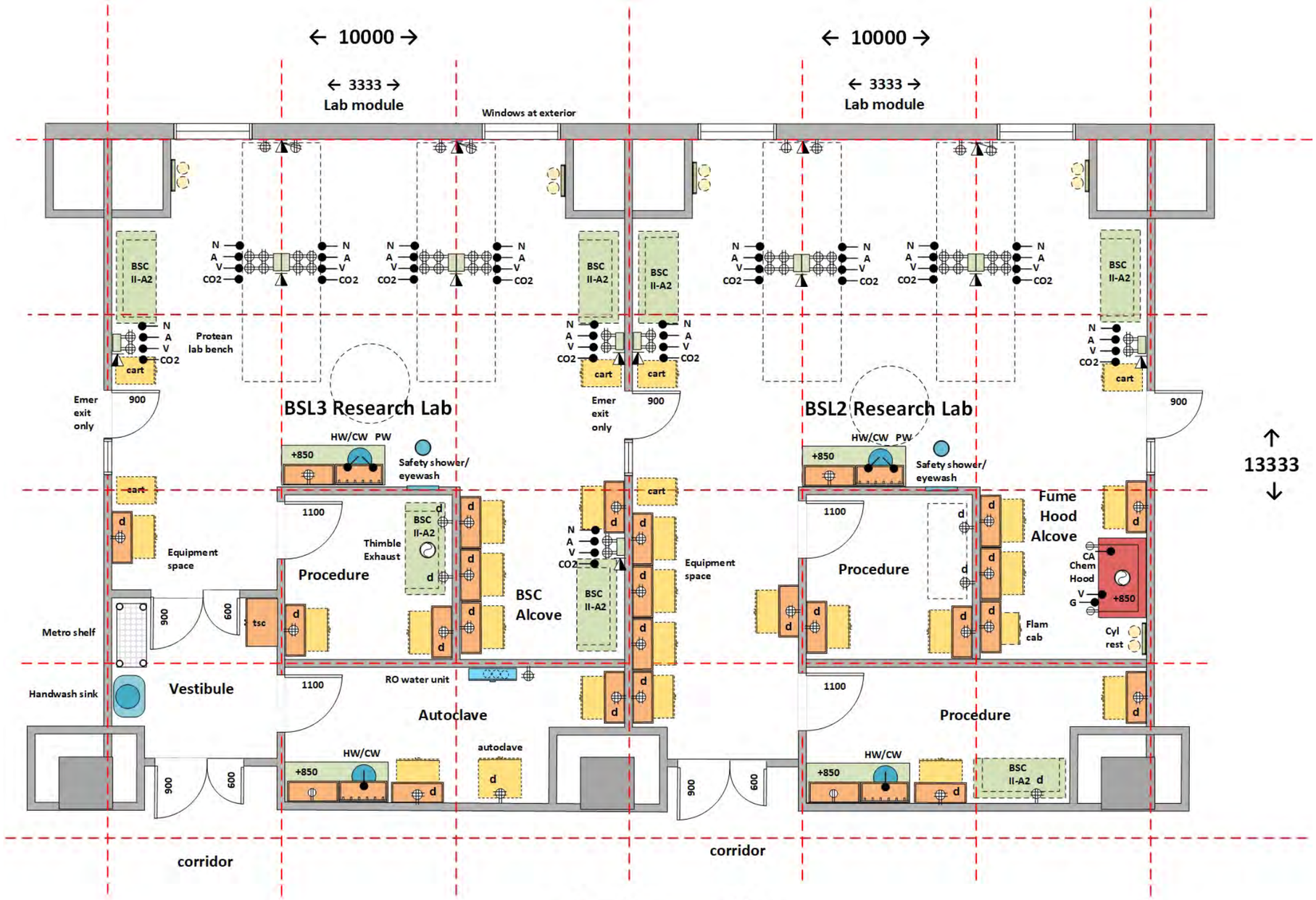
- Illustration represents walls, safety shower, electrical outlets, plumbing valves, sink stations, cylinder restraints, chemical fume hoods, sink units, and biological safety cabinets (tenant furnished).
- Includes all of Lab Progression #6 plus:
  - Biological Safety Cabinets (Tenant furnished).
  - Biological Safety Cabinet inside Procedure Room in the BSL3 Suite has thimble exhaust with dedicated exhaust to roof.
  - Cylinder restraints for inert specialty gases such as helium, argon

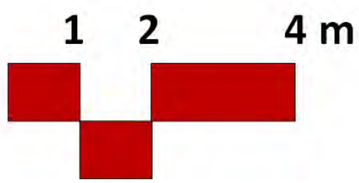
Location Key- Typical for other labs



TYPICAL BSL3 LAB

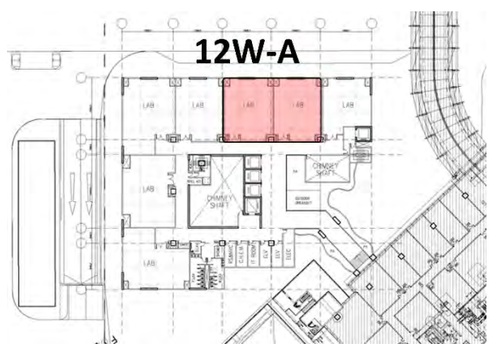
Typical Floor Building 12W-A
Shown with BSL2 adjacent
Lab Progression #8
Perimeter Walls, Interior Walls Electrical outlets, Plumbing valves, Sink units, Fume Hood, 2nd Sink Unit, Biological Safety Cabinets, Cylinder Restraints, Equipment Shelf Units





- Illustration represents walls, safety shower, electrical outlets, plumbing valves, sink stations, cylinder restraints, chemical fume hoods, sink units, biological safety cabinets (tenant furnished), and Equipment shelf units.
- Includes all of Lab Progression #7 plus:
  - Equipment shelf units. Each lab has an extra 7.5 square meters of storage area with the use of the wall equipment shelf units as shown.

Location Key- Typical for other labs



TYPICAL BSL3 LAB

Typical Floor Building 12W-A Shown with BSL2 adjacent

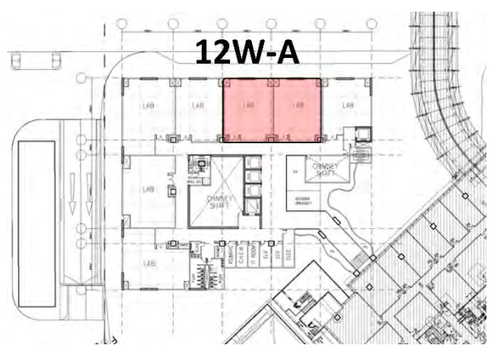
Lab Progression #9- full build out

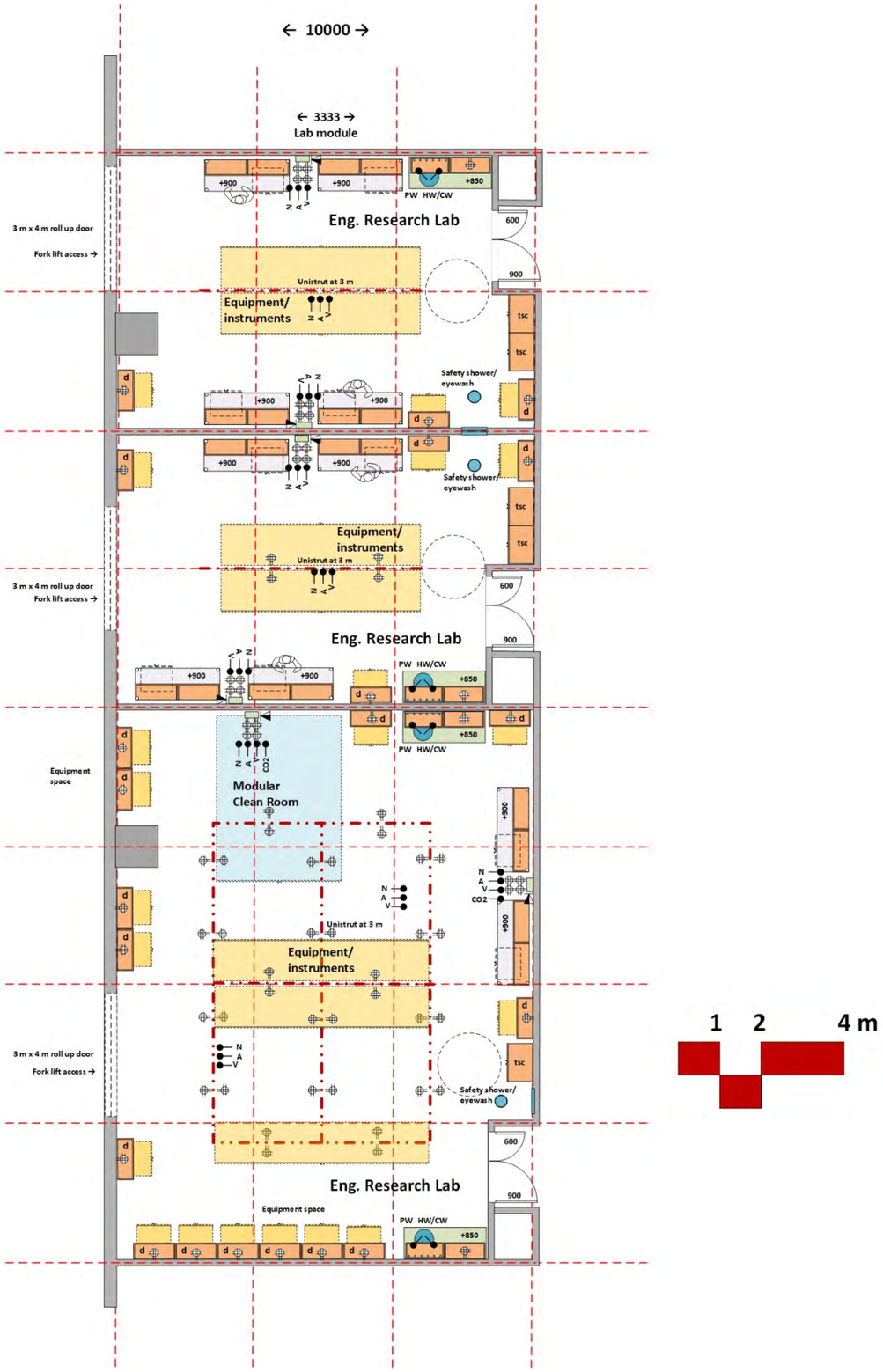
Perimeter Walls, Interior Walls Electrical outlets, Plumbing valves, Sink units, Fume Hoods, Cylinder restraints, Biological Safety Cabinets, Equipment Shelf Units, Protean Lab benches

- Illustration represents walls, safety shower, electrical outlets, plumbing valves, sink stations, cylinder restraints, chemical fume hoods, sink units, biological safety cabinets (tenant furnished), Equipment shelf units, and Protean shelf units.

- Includes all of Lab Progression #8 plus:
  - Protean lab benches.

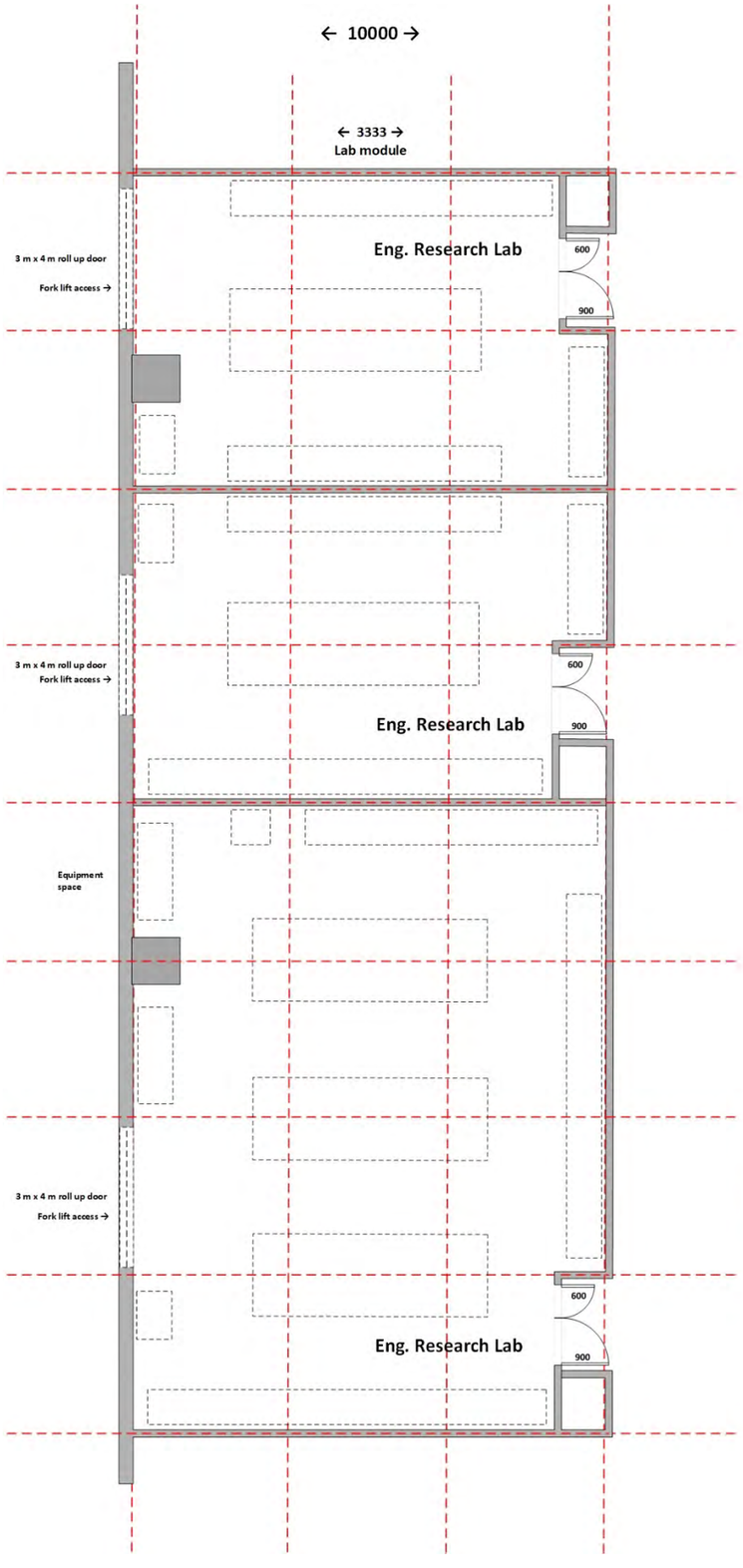
Location Key- Typical for other labs

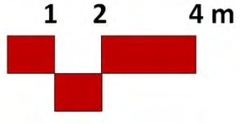




SECTION 7
SCHEMATIC DESIGN
ENGINEERING LAB

Ground Floor Building 20E-A
Similar for Building 22E-A
Similar for Building 12W-A,
Ground & 1st Floor





TYPICAL ENGINEERING LAB

Typical Floor Building 20E-A

Lab Progression #1

Perimeter Lab Walls only

- **Engineering lab units are considered "dry", meaning that they are not designed to accommodate chemical use and chemical storage. The engineering labs do not have provision for chemical fume hoods nor biological safety cabinets. Point-of-use exhaust snorkel devices with integral filters may be used for small amounts of chemicals, such as soldering for electrical devices.**

- **Illustration represents perimeter walls and doors of lab units only- which represents initial construction by general contractor.**

- **Mechanical, plumbing, and electrical services to be stubbed out to lab units:**
  - **Electrical power**
  - **Standby power**
  - **Emergency lighting**
  - **Fire sprinkler system**
  - **Drain stub outs for sinks**
  - **Vent stub outs for sinks**
  - **Vacuum stub out**
  - **Compressed air stub out**
  - **Nitrogen gas stub out**
  - **Pure water (Type II) stub out**
  - **Security card reader at doors**

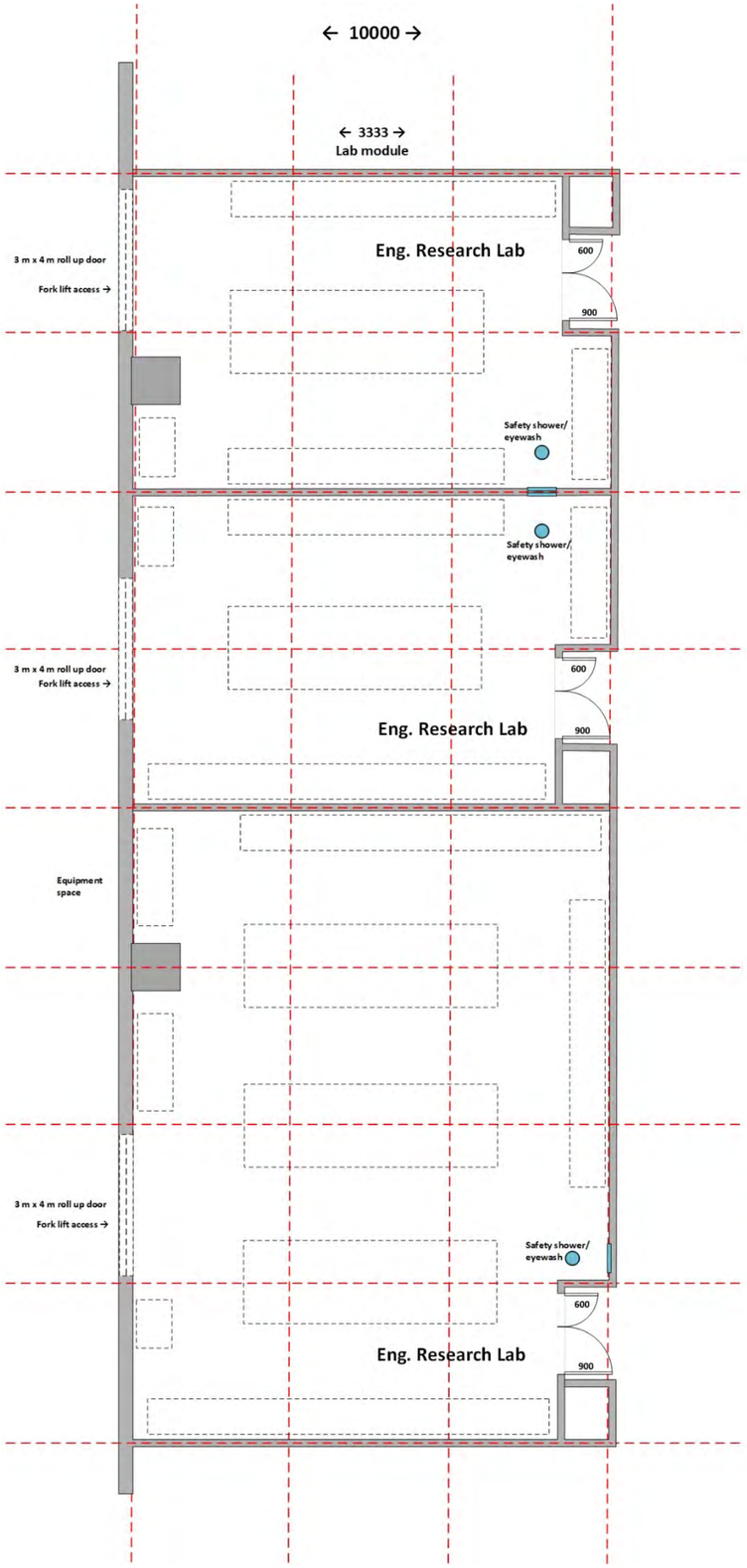
Location Key- Typical for other Engineering labs

TYPICAL ENGINEERING LAB

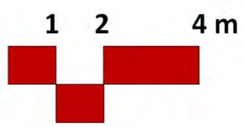
Typical Floor Building 20E-A

Lab Progression #2

Perimeter Lab Walls and Safety shower



- Illustration represents perimeter walls and doors of lab units and safety shower only. Interior walls can be located based on lab tenant requirements, within reason.
- Includes all of Lab Progression #1 plus:
  - Safety Shower with tepid water output



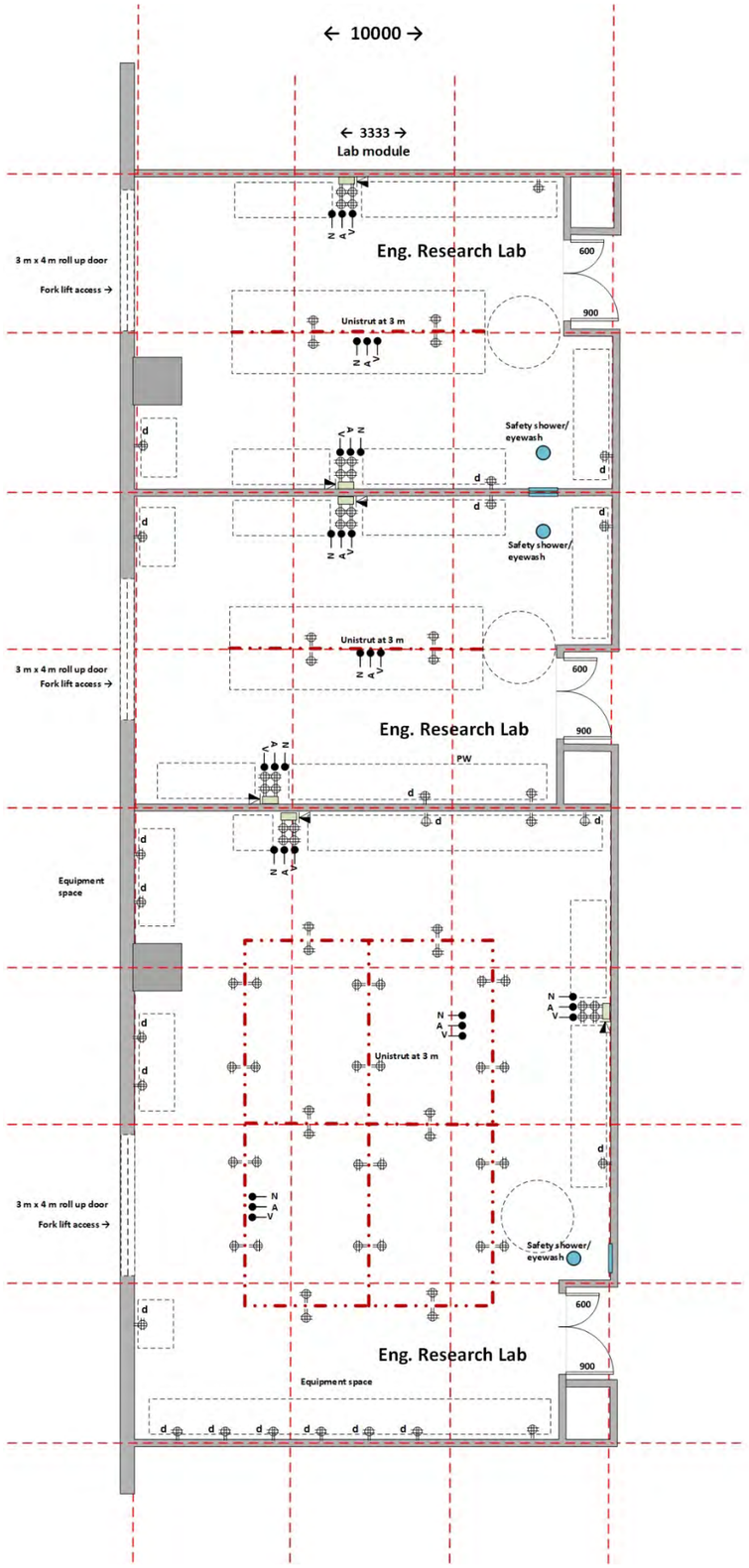
Location Key- Typical for other Engineering labs

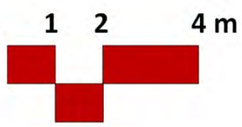
TYPICAL ENGINEERING LAB

Typical Floor Building 20E-A

Lab Progression #3

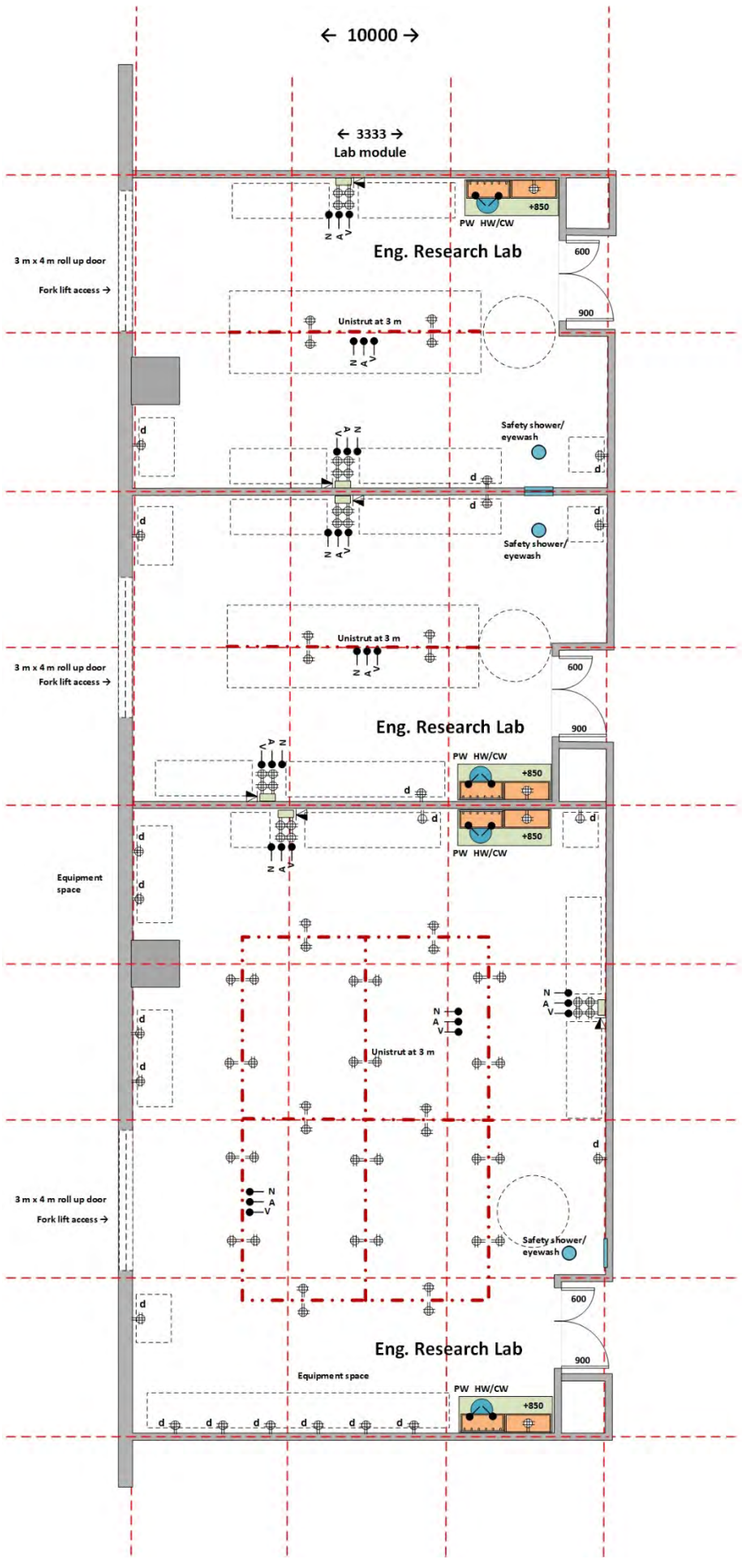
Perimeter Walls, Safety shower, Overhead Unistrut, Electrical outlets, Plumbing valves

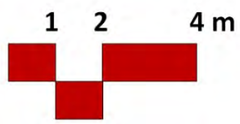




- Illustration represents perimeter walls of lab units, safety shower, overhead Unistrut, and fit out of plumbing valves and electrical outlets.
- Includes all of Lab Progression #2 plus:
  - Overhead unistrut
  - Electrical outlets at walls and service columns- dedicated circuits typical (noted with “d”)
  - Plumbing valves for compressed air (A), vacuum (V), and Nitrogen gas (N) at walls and service columns.

Location Key- Typical for other Engineering labs





TYPICAL ENGINEERING LAB

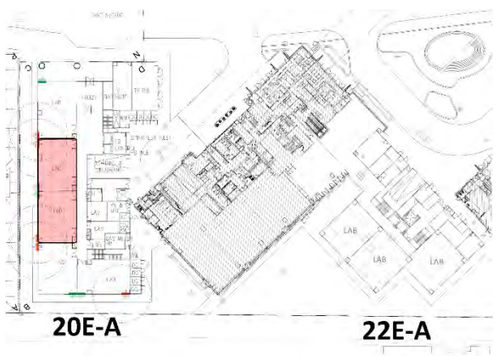
Typical Floor Building 20E-A

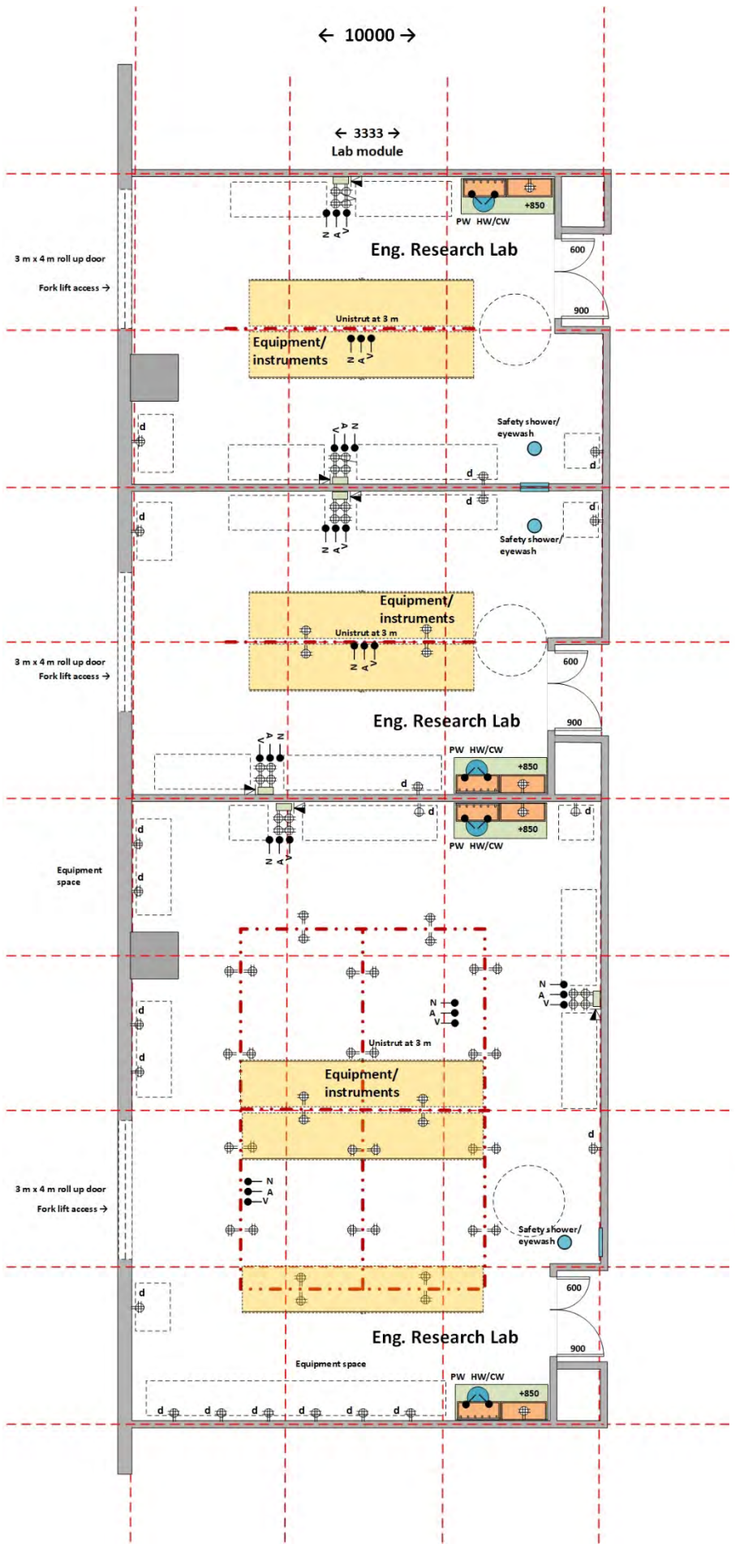
Lab Progression #4

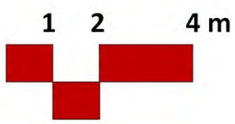
Perimeter Walls, Safety shower, Electrical outlets, Overhead Unistrut, Plumbing valves, Sink units

- Illustration represents perimeter walls of lab units, safety shower, overhead unistrut, electrical outlets and plumbing valves, and sink unit stations.
- Includes all of Lab Progression #3 plus:
  - Sink units with hot/cold water (HW/CW) and type II pure water (PW). Pure water to be on recirculating loop, unpigmented polypropylene piping.

Location Key- Typical for other Engineering labs







TYPICAL ENGINEERING LAB

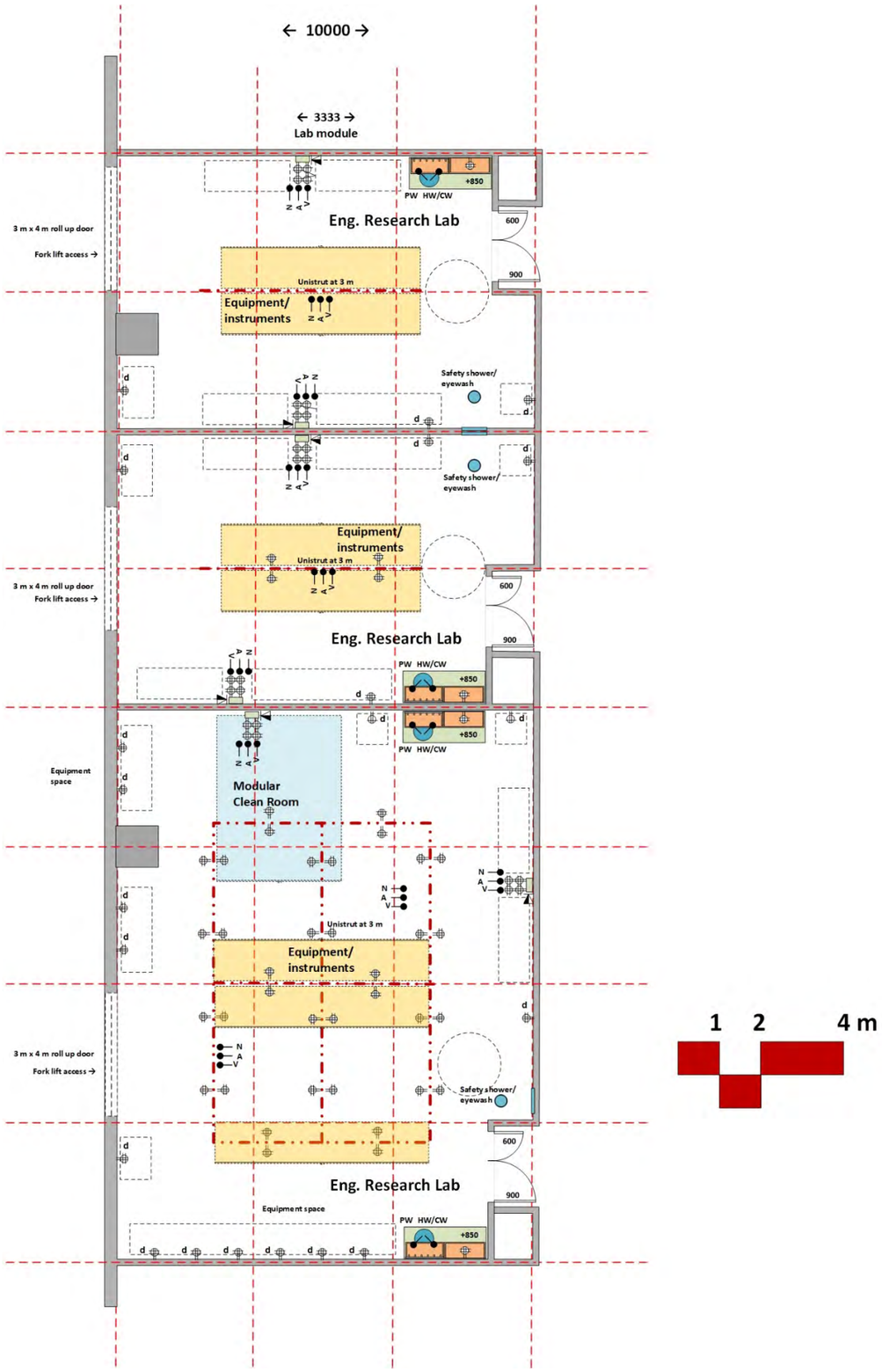
Typical Floor Building 120E-A

Lab Progression #5

Perimeter Walls, Safety Shower, Overhead Unistrut Electrical outlets, Plumbing valves, Sink units, Equipment & Instruments

- Illustration represents walls, safety shower, electrical outlets, plumbing valves, sink stations, and equipment and instruments (furnished by lab tenants).
- Includes all of Lab Progression #5 plus:
  - Tenant furnished Equipment & Instruments

Location Key- Typical for other Engineering labs



TYPICAL ENGINEERING LAB

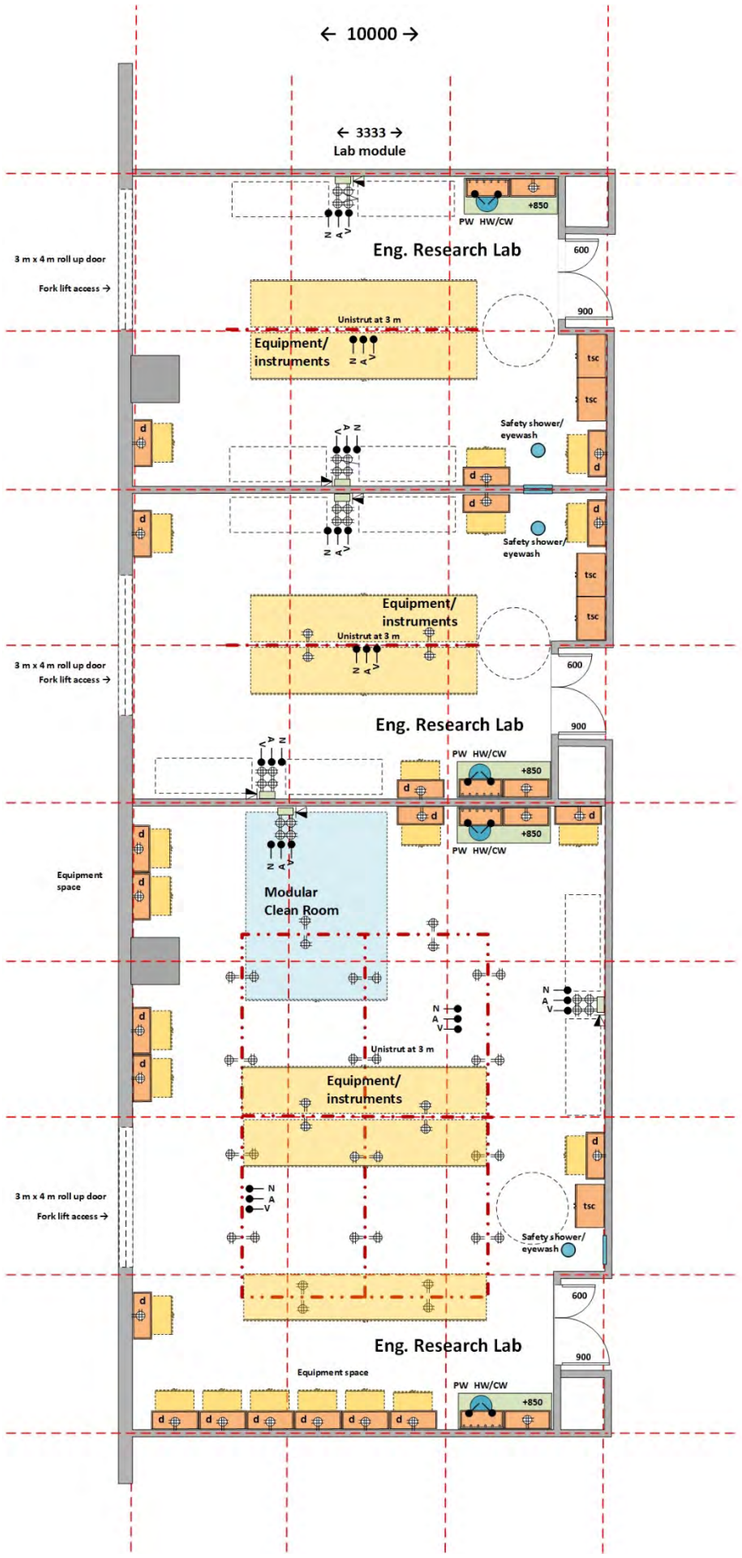
Typical Floor Building 20E-A

Lab Progression #6

Perimeter Walls, Overhead Unistrut, Electrical outlets, Plumbing valves, Sink units, Equipment & Instruments, Modular Clean Room

- Illustration represents walls, safety shower, electrical outlets, plumbing valves, sink stations, equipment & instruments, modular clean room (tenant furnished).
- Includes all of Lab Progression #6 plus:
  - Tenant furnished modular clean rooms

Location Key- Typical for other Engineering labs



TYPICAL ENGINEERING LAB

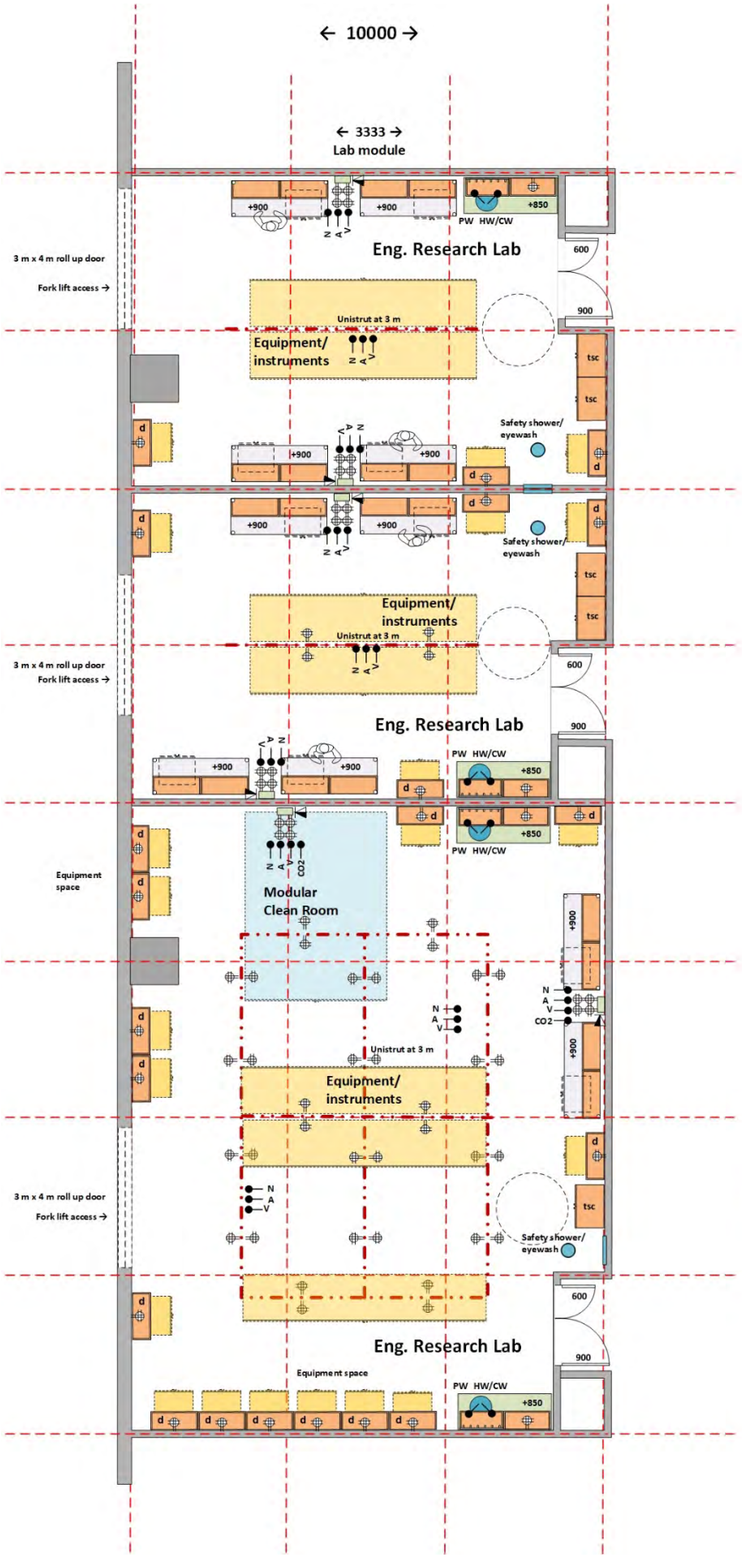
Typical Floor Building 20E-A

Lab Progression #7

Perimeter Walls, Interior Walls Electrical outlets, Plumbing valves, Sink units, Equipment Shelf Units, Tall Storage Cabinets

- Illustration represents walls, safety shower, overhead Unistrut, electrical outlets, plumbing valves, sink stations, equipment shelf units, and tall storage cabinets.
- Includes all of Lab Progression #7 plus:
  - Equipment shelf units. Each lab has an extra 7.5 square meters of storage area with the use of the wall equipment shelf units as shown.
  - Tall storage cabinets. Each tall storage cabinets provides 4 square meters of storage shelf area.

Location Key- Typical for other Engineering labs



TYPICAL ENGINEERING LAB

Ground Floor Building 20E-A

Lab Progression #8- full build out

Perimeter Walls, Safety Shower, Overhead Unistrut, Electrical outlets, Plumbing valves, Sink units, Equipment Shelf Units, and Protean Lab benches

- Illustration represents walls, safety shower, overhead Unistrut, electrical outlets, plumbing valves, sink stations, tall storage cabinets, and equipment shelf units.
- Includes all of Lab Progression #8 plus:
  - Protean lab benches.

Location Key- Typical for other labs

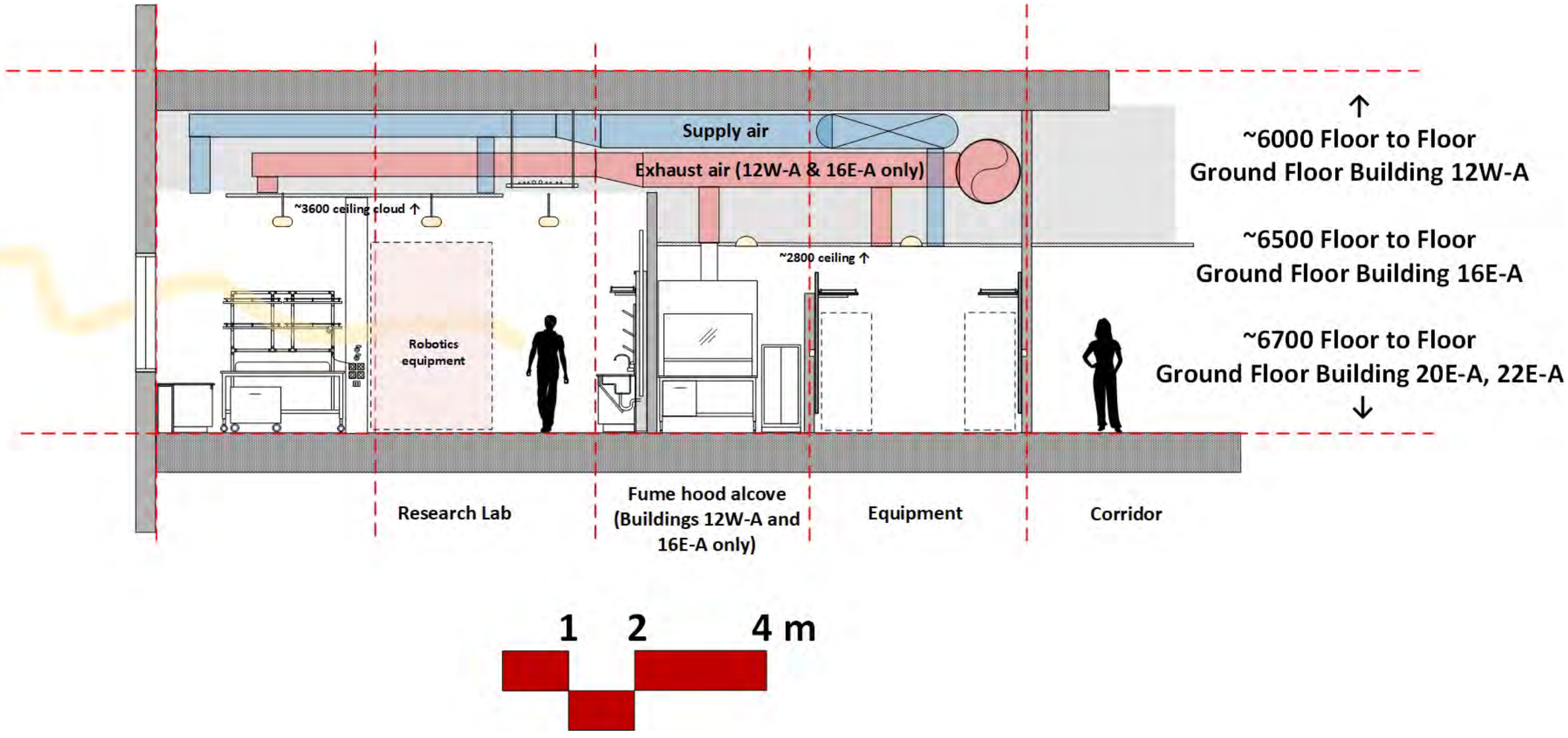
Ecology Research Laboratory
California Academy of Sciences
San Francisco, California

SECTION 8
SCHEMATIC DESIGN
LAB CONCEPT SECTIONS

Ground Floors
Upper Floors 12W-A, 16E-A
BSL3 Labs 12W-A

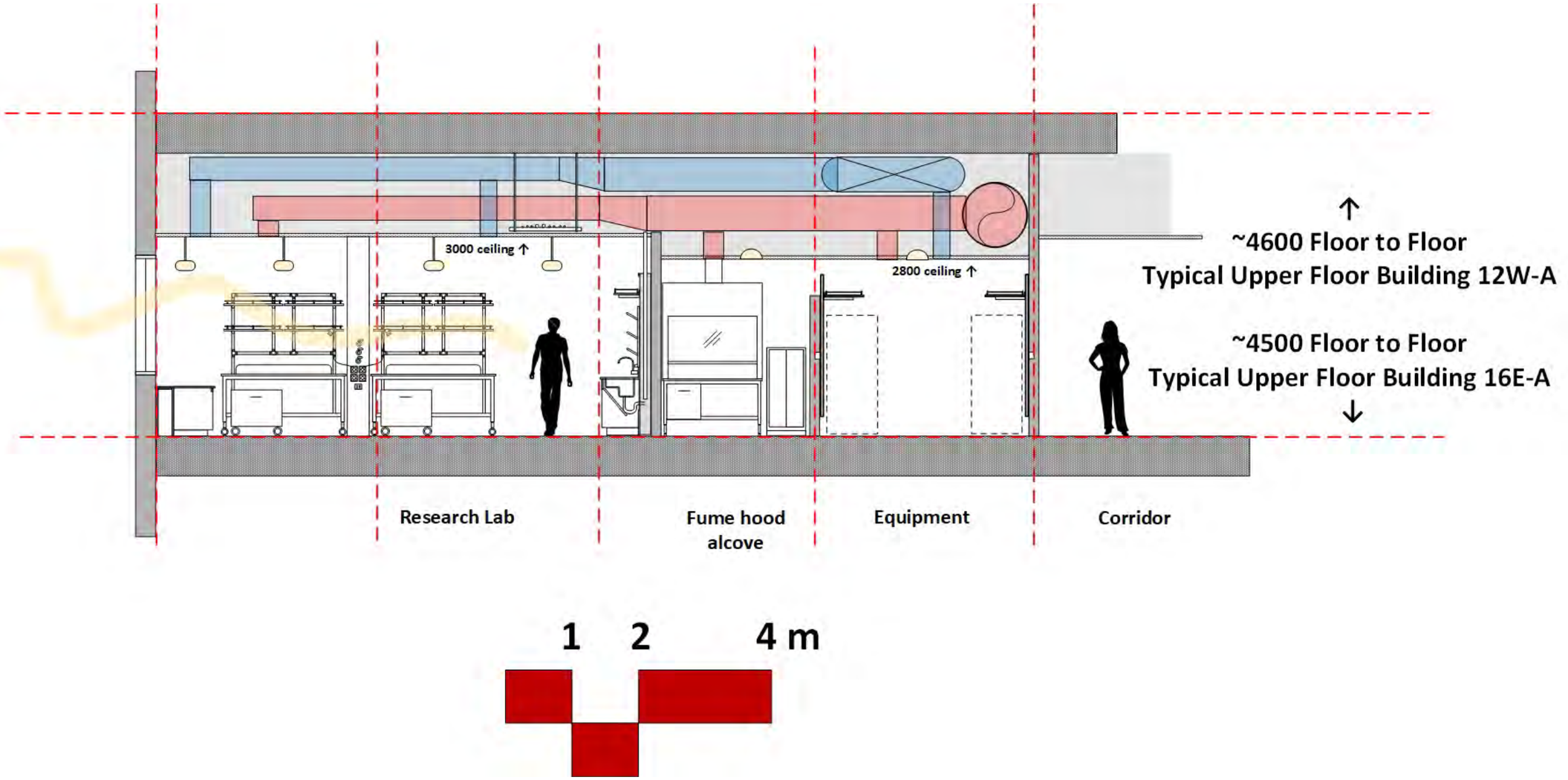
LAB CONCEPT SECTION A

Ground Floors



LAB CONCEPT SECTION B

Typical Upper Floors
Building 12W-A; 16E-A

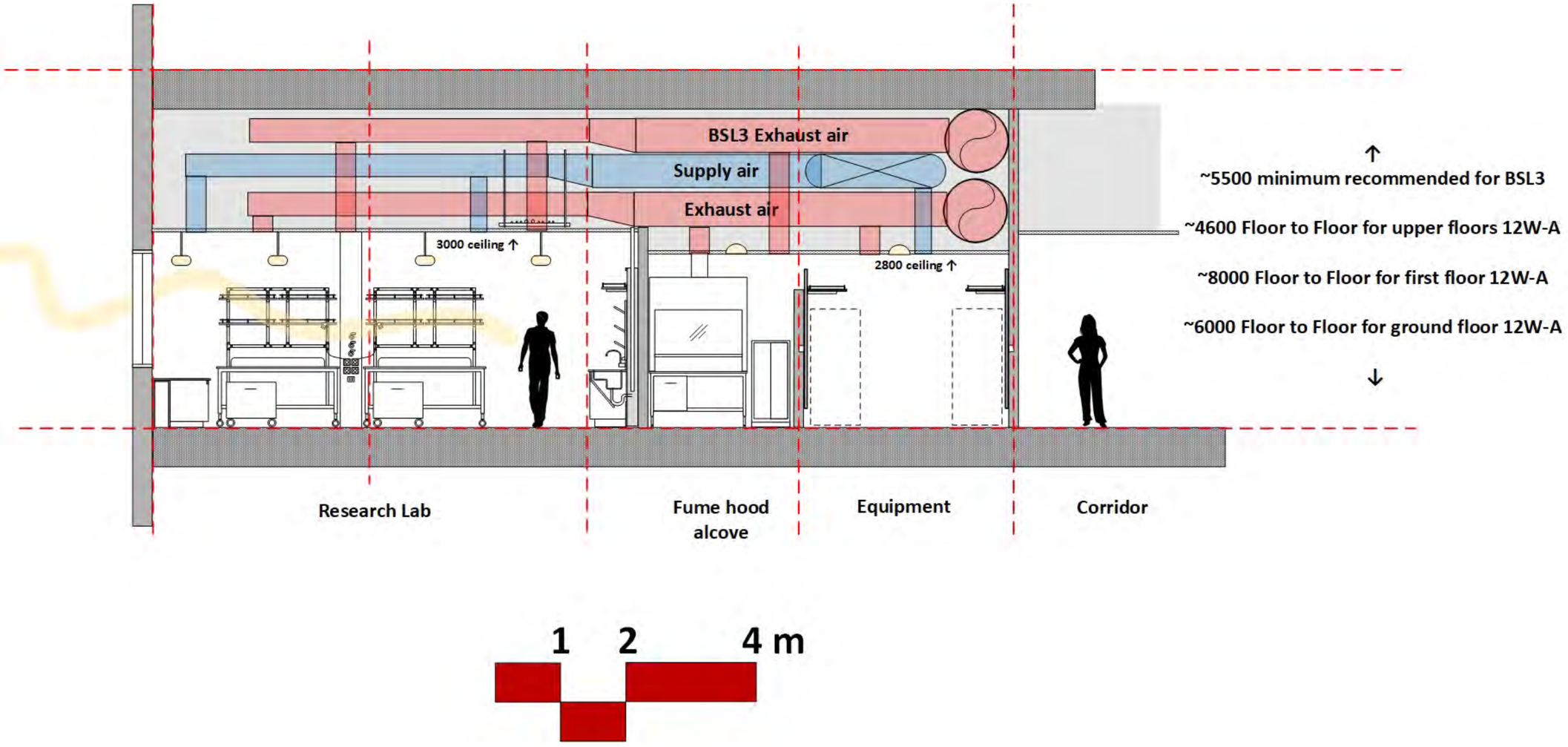


LAB CONCEPT SECTION C

Building 12W-A only

BSL3 Labs

BSL3 Labs require higher than average floor to floor height due to the dedicated exhaust requirement.



Bioengineering Laboratory
University of California, Santa Barbara

SECTION 9

PROTEAN LAB CONCEPTS

Contractor Furnished Equipment

PROTEAN LAB CONCEPT

What is it?

In Greek mythology, Proteus, son of Poseidon, is a god of the oceans and rivers. Being made of water, he can elude his enemies by changing form. The adjective, PROTEAN, connotes adaptable, flexible, versatile. PROTEAN labs can adapt and change as the context of the science building changes. Design for Change is the keystone of lab planning and design.

Over the ~50 to 100 year life span of a science building, the personnel, technology, and research missions will change many times over. The ability to adapt to the unforseen changes is the key objective of PROTEAN lab design philosophy and approach. Elements of change include Mechanical/Electrical/Plumbing systems and laboratory furniture systems. A plug-in/plug-out system will provide the ability to adapt over time as needs and requirements change. Today's BSL2 lab unit is tomorrow's bioengineering lab unit; today's engineering lab is tomorrow's basic science research lab. The ability to change applies to both the physical features of the lab as well as the intended use of the lab.

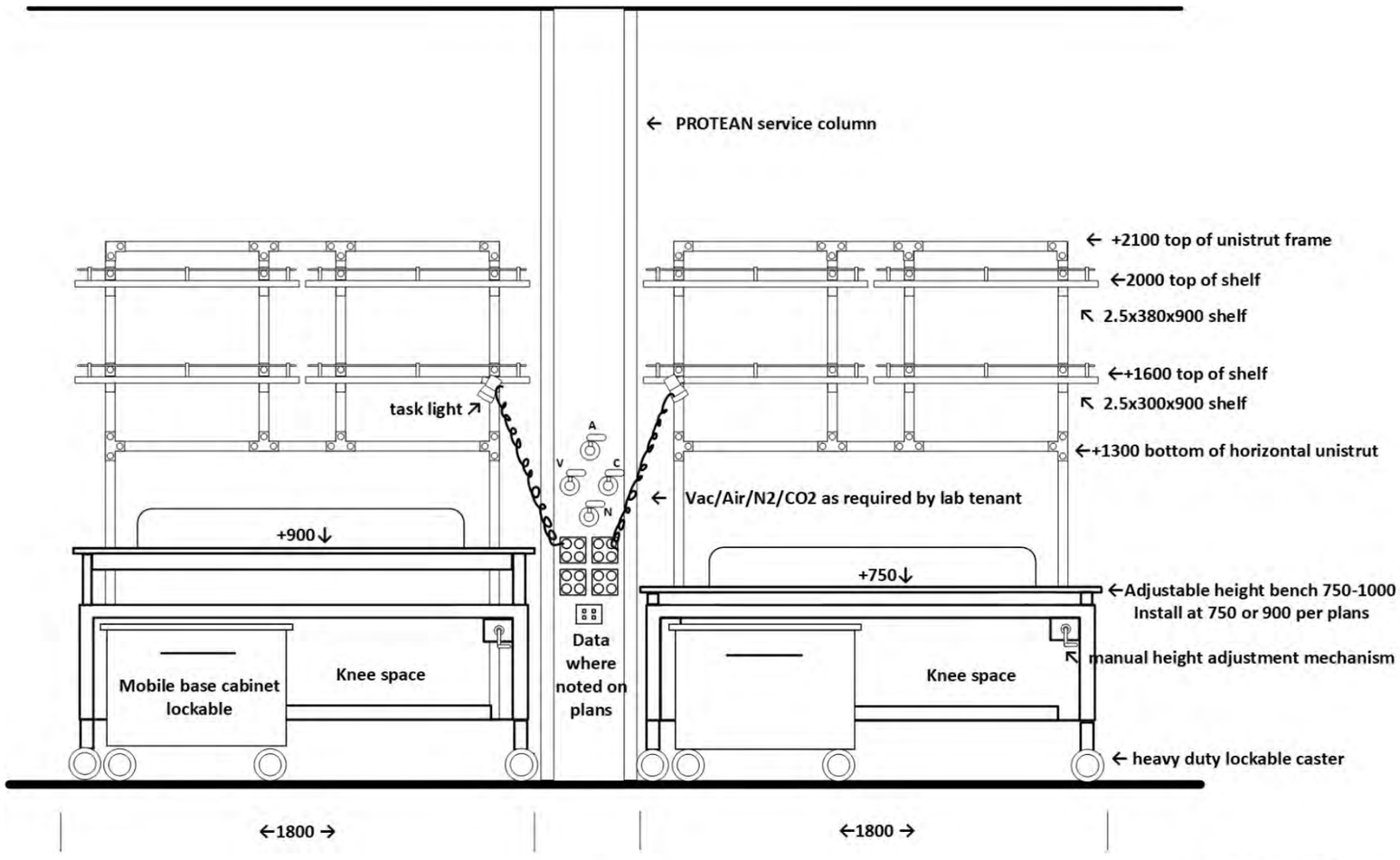
The PROTEAN lab elements illustrated on the following pages are non-proprietary. The lab furniture systems noted are not of any specific manufacturer. They PROTEAN system is designed to be non-proprietary so that multiple approved laboratory furniture and fume hood manufacturers can competivitley bid on the lab systems, thereby providing HKSP with a competive, fair bid for the lab furniture systems.

"If there is anything we know, it is that we do not know what we will be doing ten years from now."
Dr. H. H. Race
General Electric Research Laboratory

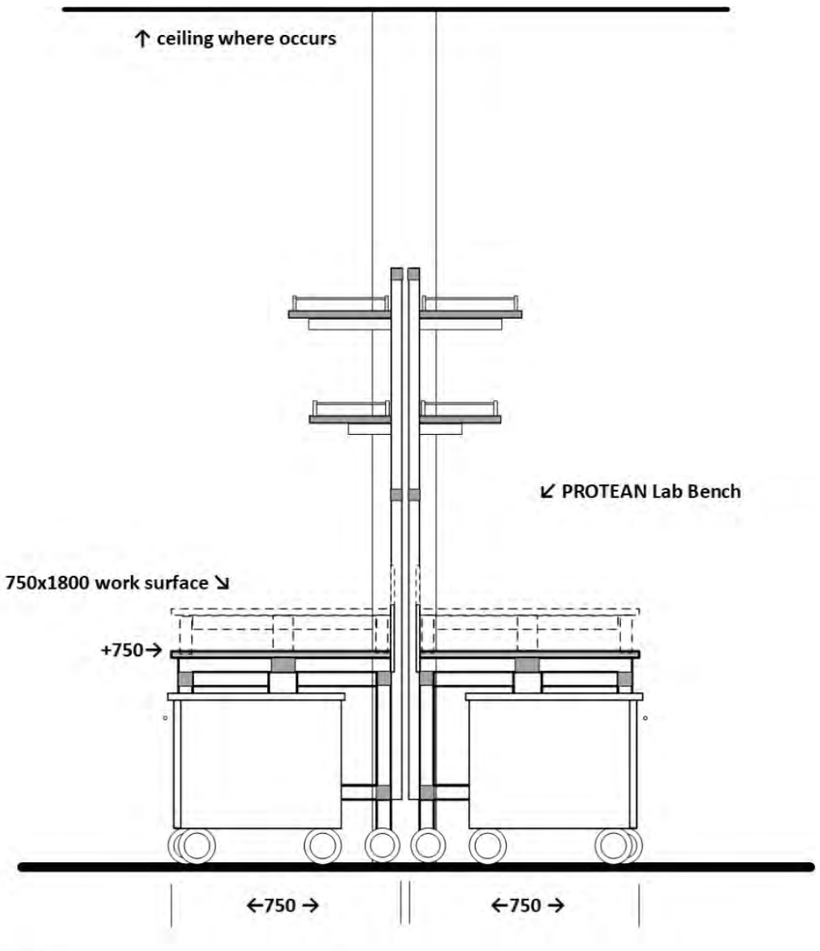
PROTEAN LAB BENCH

PROTEAN lab bench can be provided by HKSP as part of the building construction, and/or provided by lab lease tenants as part of their own equipment procurement for their lab(s).

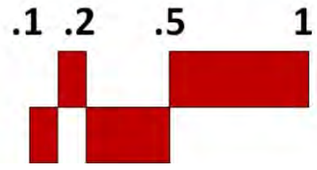
The PROTEAN lab bench can be manufactured by multiple laboratory casework manufacturers, as it is not a proprietary brand name product.



Elevation

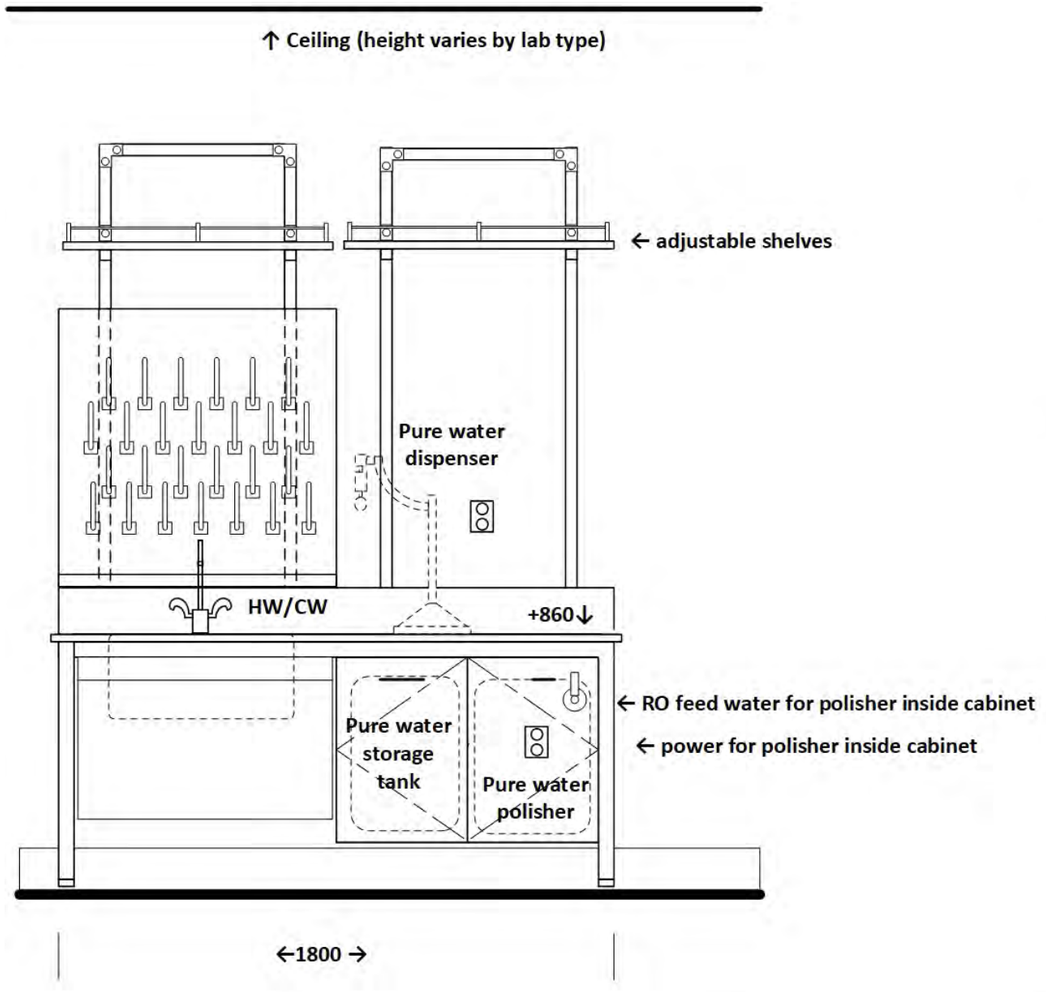


Section

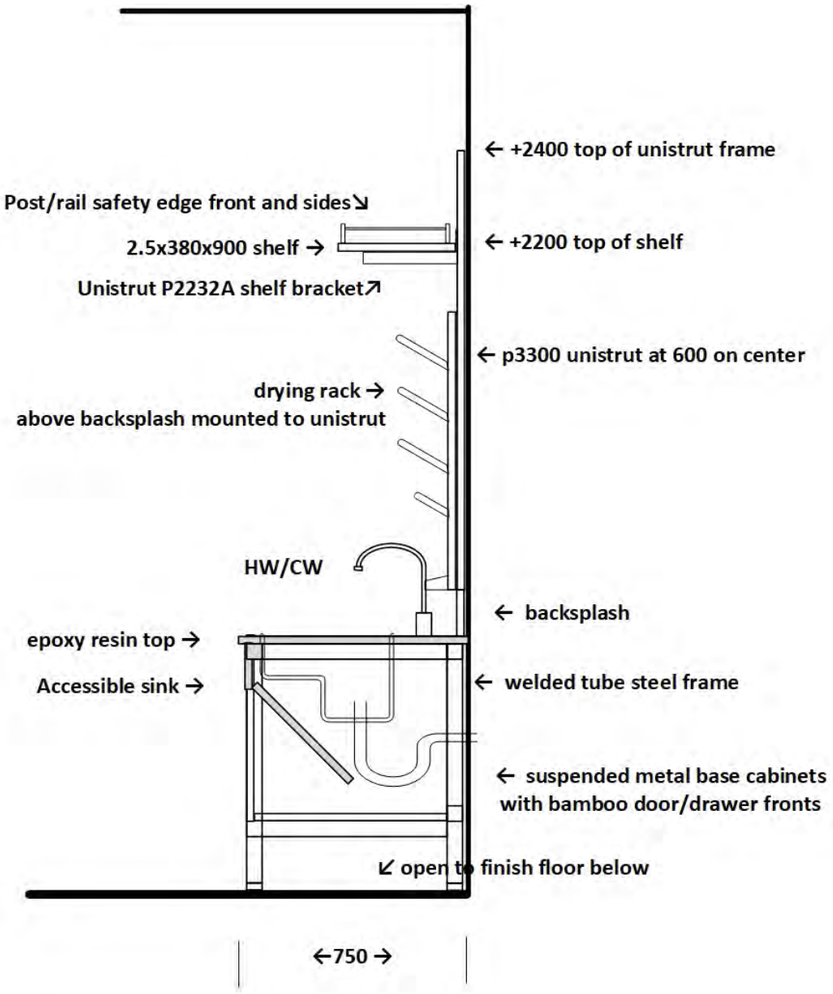


PROTEAN SINK STATION

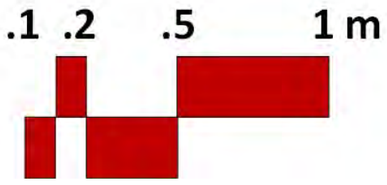
The PROTEAN sink station is designed as one complete integral unit that can be relocated to other labs as required. The designated sink locations on the lab design drawings will have stub-out for drain, vent, Hot/Cold water and RO feed water for the point-of-use water polisher.



Elevation

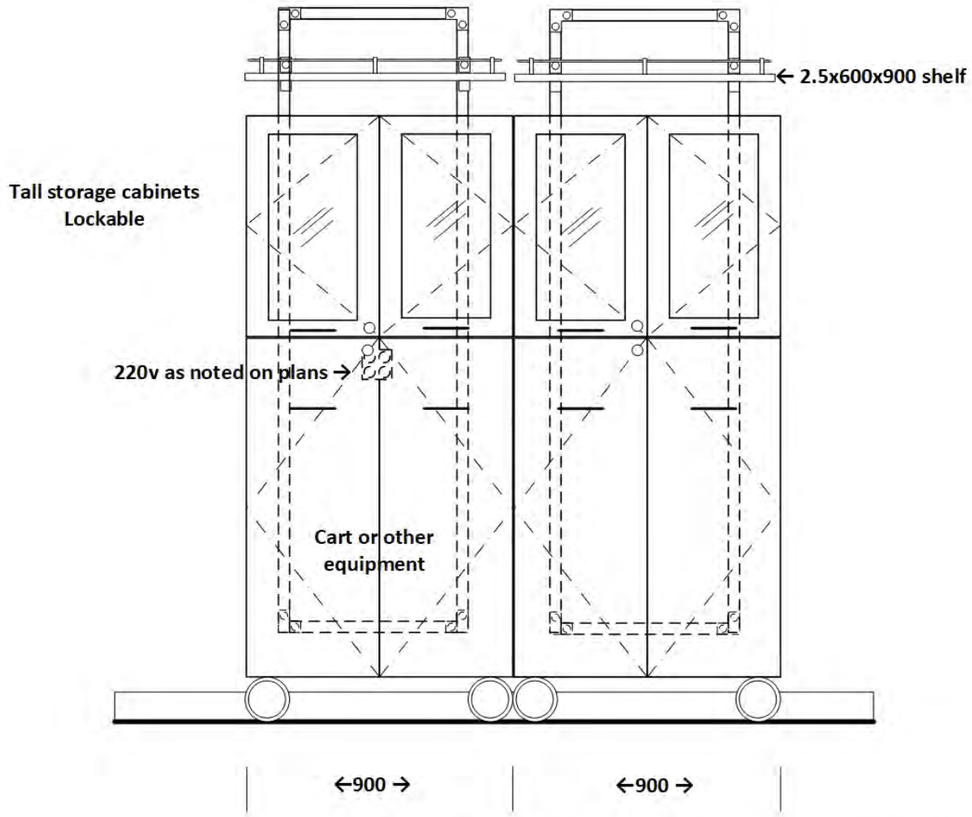


Section

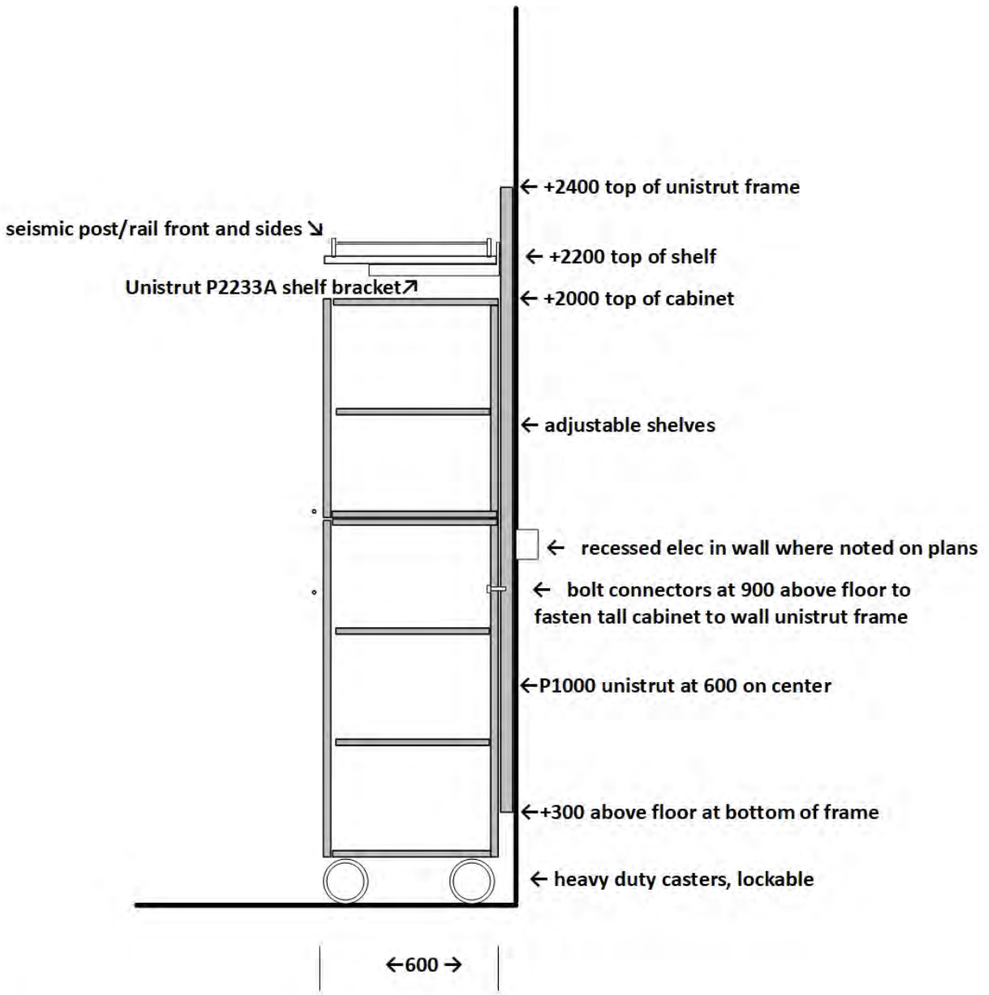


PROTEAN TALL CABINET

The PROTEAN tall cabinets is designed to be moveable and relocated when needed. The tall cabinet is attached to unistrut at the wall. When moved, the vacant space can be used for lab equipment.



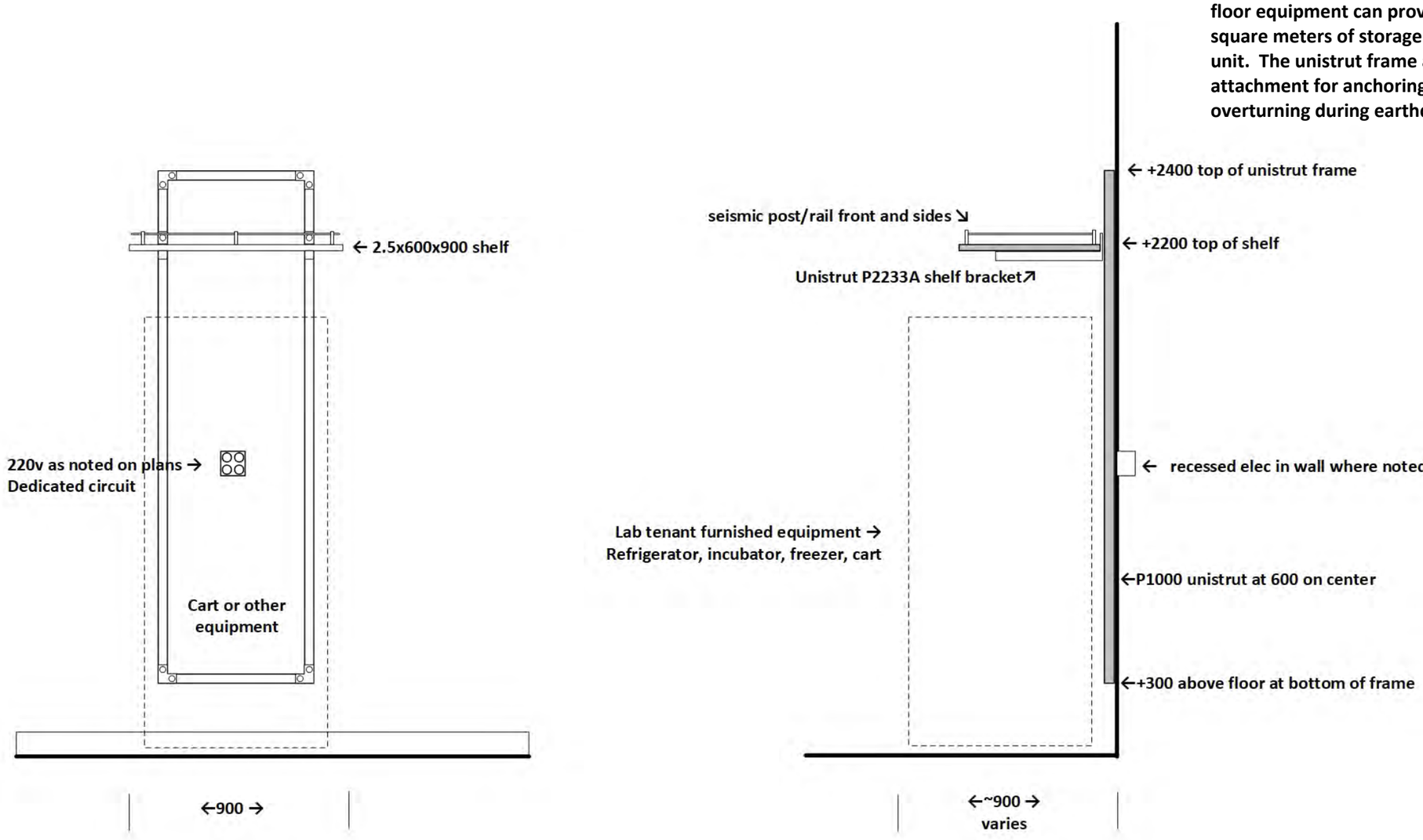
Elevation



Section

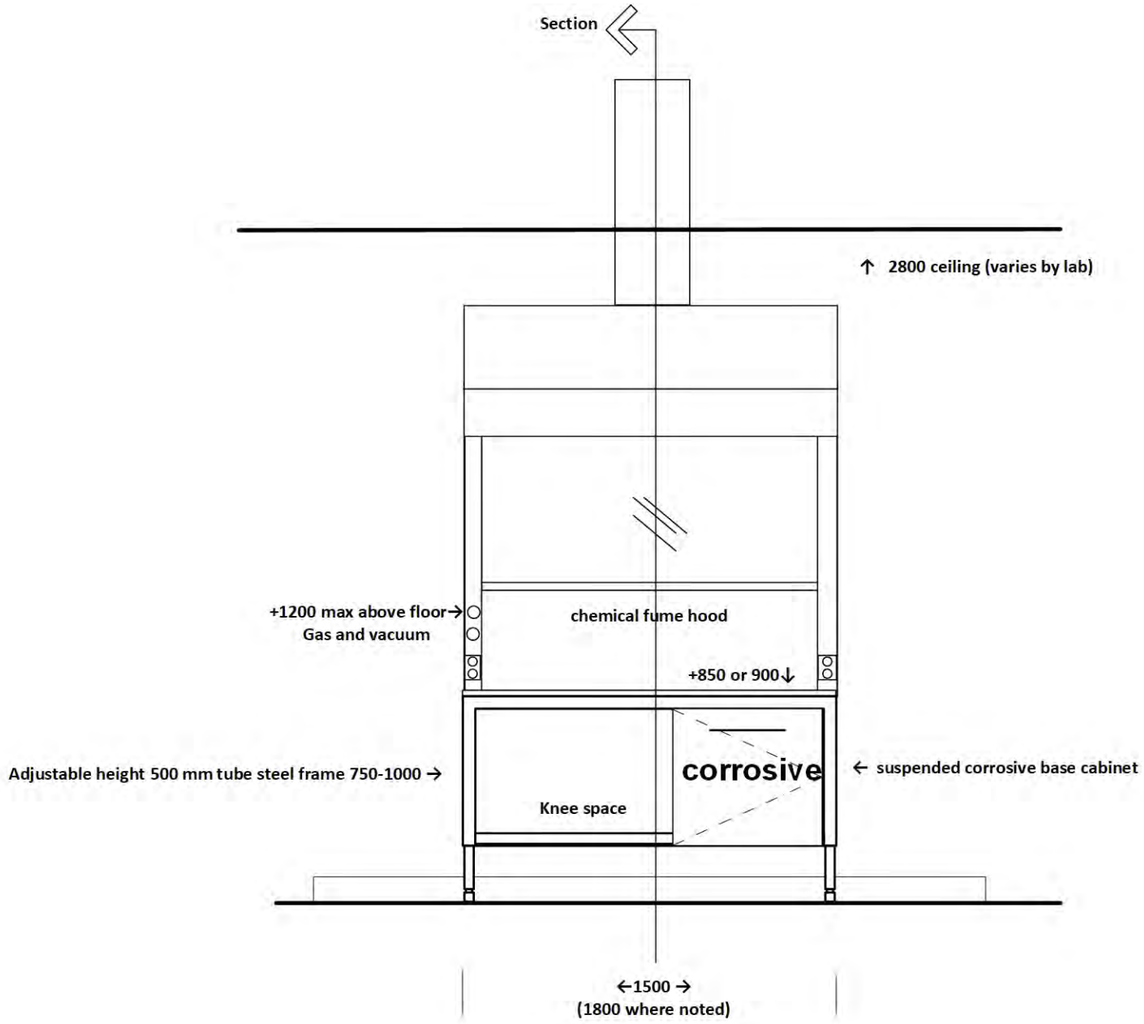
PROTEAN EQUIPMENT SPACE

The PROTEAN equipment space is designed to take advantage of the vertical wall space in labs that is often underutilized. The upper shelf above the floor equipment can provide an additional 10 square meters of storage shelf space in each lab unit. The unistrut frame at the wall provides attachment for anchoring equipment to prevent overturning during earthquake.

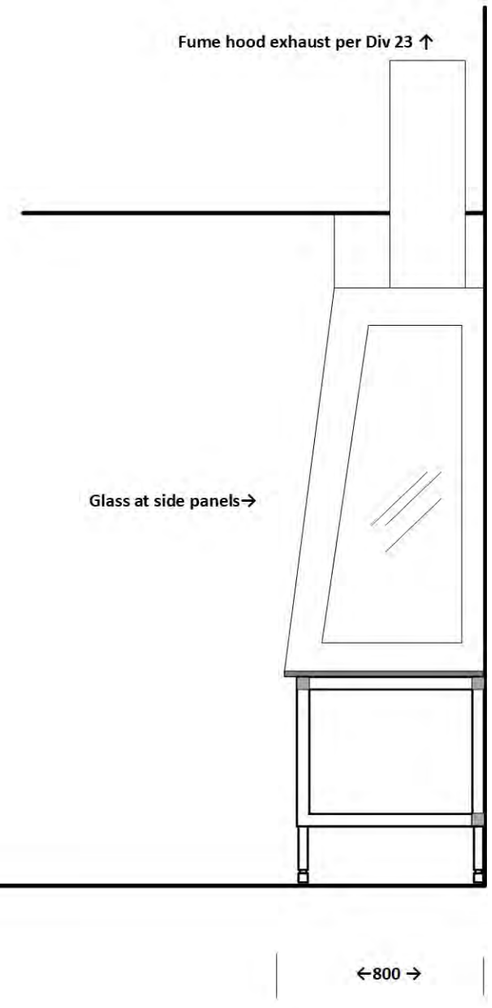


PROTEAN FUME HOOD

The PROTEAN fume hood is designed to be adjustable in height. It can be relocated to other lab locations where exhaust stub out occurs.



Elevation



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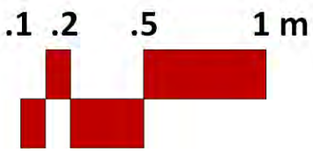
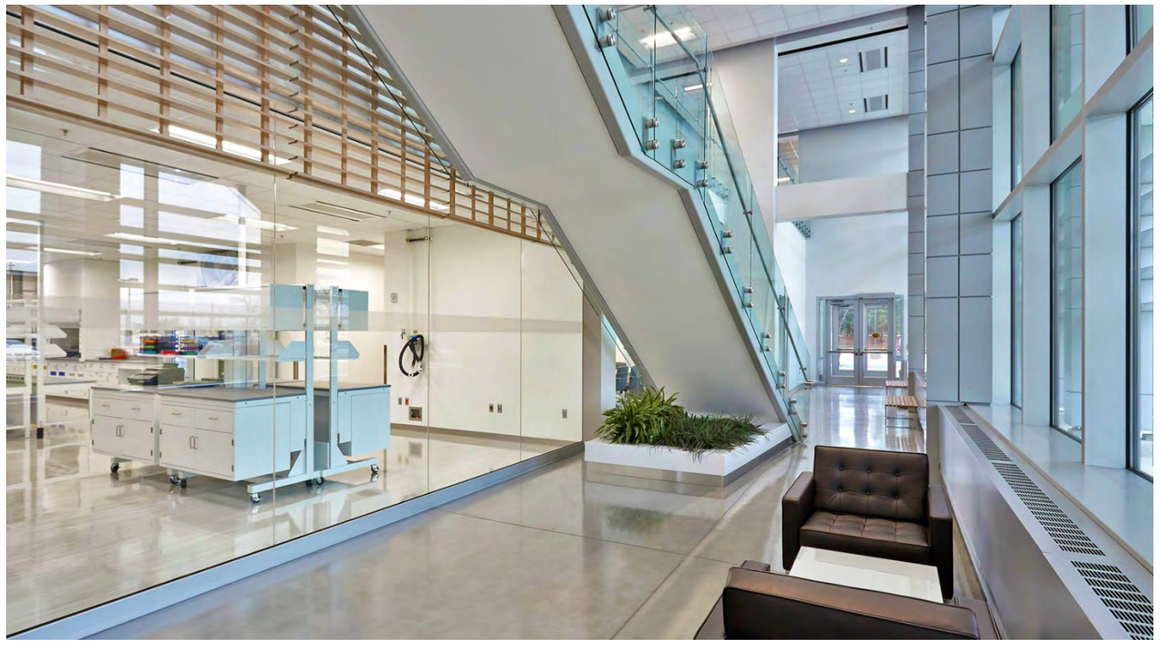




Roche Diagnostics
Indianapolis, Indiana

SECTION 10
EQUIPMENT CUT SHEETS
Contractor Furnished Equipment

CHEMICAL FUME HOOD CUT SHEET

Density varies by lab type
Majority of labs will have one hood per Lab Unit
23 cmm exhaust at 1800 hood

Protector® ClassMate® Laboratory Hoods

with Combination Horizontal-Sliding/Vertical-Rising Sashes

All models feature:

- ❄ High performance hood per SEFA 1 definition
- ❄ Patented* design
- • By-pass airflow design
- • Glacier white powder-coated steel frame
- ❄ Ergonomic, low-profile air foil with aerodynamic Clean-Sweep** openings and spill trough
- • Clear, 1/4" thick, tempered safety glass sides, back, baffle and viewing panel
- • Combination horizontal-sliding/ vertical-rising sashes that allow the operator to use the hood with sashes half open either horizontally or vertically
- • Sash stop at 14" height from work surface (50% vertical opening). Can be field modified to 18" from work surface
- • 5° angled stationary viewing panel and sash
- • Chain-driven sash with anti-racking shaft and powder-coated steel frames
- ❄ 3-piece glass baffle pivots for cleaning
- ❄ Powder-coated steel sash handle with aerodynamic Clean-Sweep** airflow openings

❄ Labconco exclusive feature

- ❄ Cord-Keeper™ slots on left and right side of air foil
- • Pre-wired LED lighting, light switch and blower switch
- • Powder-coated stainless steel tissue screen located below exhaust outlet
- • Removable front panel, side panels and interior cover plates for access to plumbing and electrical wiring
- • Powder-coated stainless steel 12.8" ID exhaust connection

Standards conformance & regulations:

- • CFR 29, Part 1910
- • SEFA 1
- • NFPA 45
- • ASHRAE 110
- • ANSI Z9.5
- • UL 61010-1
- • CAN/CSA C22.2 No. 61010.1
- • UL 1805
- • SEFA 8

Fixtured models may feature:

- • Two pre-plumbed service fixtures with forged brass valves, lower right side with brass tubing for gas and lower left side with copper tubing for cold water. Components for converting either or both fixtures to air and vacuum are provided. **Inlet tubing is not provided**
- • One pre-wired GFCI electrical duplex receptacle on lower right side

Required accessories (not included):

- • Remote blower
- • Ductwork
- • Work surface. See page 9
- • Base cabinet

Optional accessories for on-site installation include (see page 10):

- • Distillation Grid Kits
- • Guardian Airflow Monitors
- • Upper Rear Finish Panel Kits
- • Electrical Receptacle Kits
- • Dual Exhaust Adapter
- • Service Fixtures. See manual

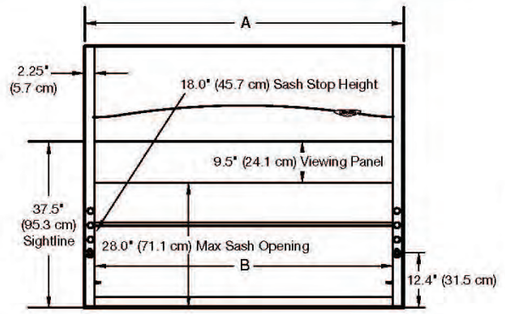
Intertek

*U.S. Design Patent No. 472,645
**U.S. Patent No. 6,461,233

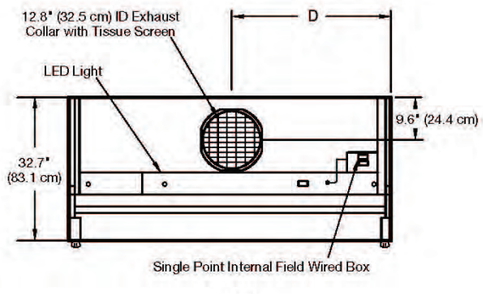
Heights of switches, electrical receptacles and service fixtures meet requirements of ADA.

Dimensional Data

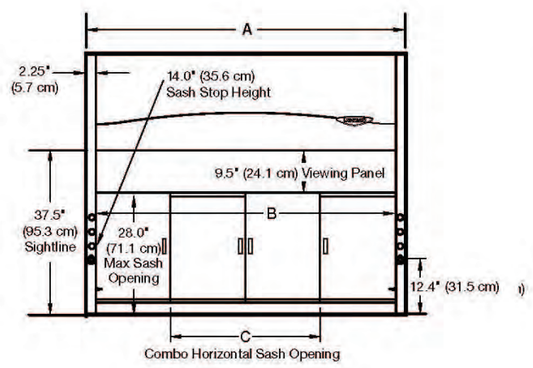
	A*	B*	C*	D*
4' Hood	48.0" (121.9 cm)	43.5" (110.5 cm)	20.5" (52.2 cm)	24.0" (61.0 cm)
5' Hood	60.0" (152.4 cm)	55.5" (141.0 cm)	26.5" (67.3 cm)	30.0" (76.2 cm)
6' Hood	72.0" (182.9 cm)	67.5" (171.5 cm)	32.5" (82.6 cm)	36.0" (91.4 cm)



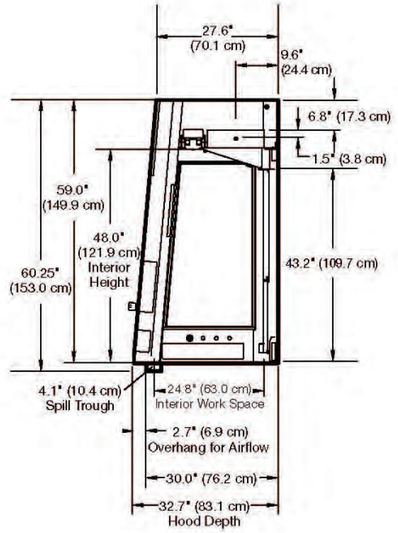
FRONT
(Vertical-Rising Sash Models)



TOP
(All Models)



FRONT
(Combination Sash Models)



SIDE
(All Models)

SNORKEL EXHAUST CUT SHEET

Density varies by lab type

2.2 cmm exhaust per unit

MOVEX® TERFU

TERFU Model

Standard version of Terfu with polypropylene joints and anodized aluminum tubes.

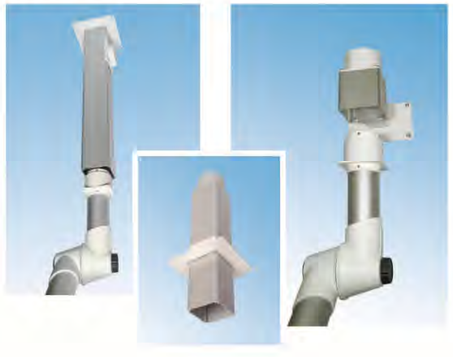
The standard version of Terfu is suitable for evacuation of most types of airborne contaminants from laboratories, schools, hospitals, pharmaceutical industry, nail salons and light industrial applications.

Polypropylene(PP)version of Terfu with joints and tubes in recyclable PP. All metal parts that come in contact with the airstream are made from acid resistant stainless steel (SS 2343).
The PP version of Terfu is primarily used for evacuation of extremely corrosive contaminants in high concentrations for certain laboratories, pharmaceutical and chemical industries.
When using a ceiling mounted PP extractor, recommend using an MTI ceiling bracket with internal and external powder coating.

TERFU Maximum flexibility

Terfu joint. The large frictional diameter together with the single grip adjusting knob provide a rigid, stable joint with a smooth easily adjustable function without requiring the application of excessive force or tools. The joint has reinforced side pieces. Ball bearings that isolate the adjusted friction level allow the arm to move up and down without locking the joint or loosing stability and function.

Appealing stable brackets

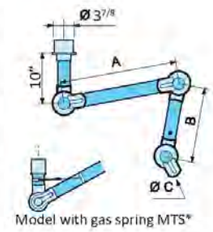


All Terfu extractors have a standard full-swivel that allows 360° of rotation without the need for special sleeves or double wall mountings. Both ceiling and wall brackets consist of a special anodized aluminum profile that provide an appealing, functional installation. The ceiling bracket also acts as the extraction channel, thus avoiding the need for expensive external channeling and additional holes in the finished ceiling.
Installation is simple and stable. The ceiling bracket is available in eight standard lengths from 10 to 80 inches. Lengths greater that 80 inches can be supplied to order. The ceiling mount can be provided with internal epoxy coating for use in aggressive environments.

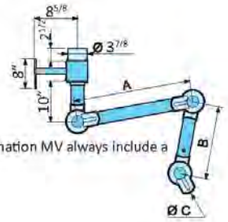
Ceiling mount		Size (inch)				Weight
Designation		A	B	Total length	C	lb
MT 1000-75	PP	16	12	40	3	5.0
MT 1300-75	PP	22	18	51	3	5.7
MT 1500-75	PP	30	18	60	3	6.0
MT 2000-75	-	40	26	80	3	7.1
MTS 1500-75	PP	30	18	60	3	6.0
MTS 2000-75	PP	40	26	80	3	7.1

Wall mount		Size (inch)				Weight
Designation		A	B	Total length	C	lb
MV 1000-75	PP	16	12	40	3	9.7
MV 1300-75	PP	22	18	51	3	10.4
MV 1500-75	PP	30	18	60	3	10.7
MV 2000-75	-	40	26	80	3	11.8
MVS 1500-75	PP	30	18	60	3	10.7
MVS 2000-75	PP	40	26	80	3	11.8

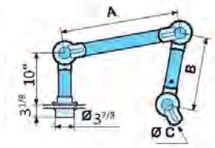
Table mount		Size (inch)				Weight
Designation		A	B	Total length	C	lb
MB 1000-75	PP	16	12	40	3	5.0
MB 1300-75	PP	22	18	51	3	5.7
MB 1500-75	PP	30	18	60	3	6.0



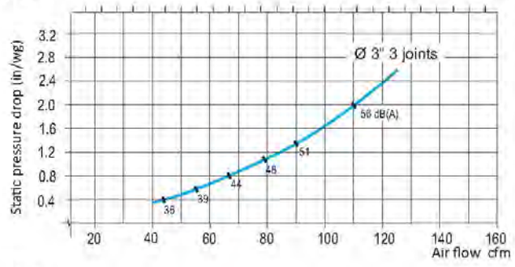
Model with gas spring MTS*



Terfu extractors with designation MV always include a wall bracket



Pressure drop diagram



The static pressure drop is measured in accordance with ISO-standard 5167-1. The noise level is measured in accordance with ISO-standard 3741.

Project planning advice

Typical values Terfu

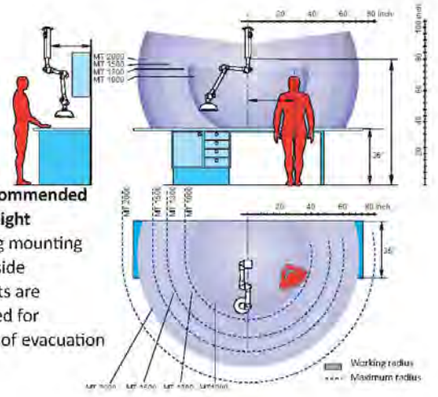
Function	Air flow
Laboratory Schools	70-85 cfm 70-85 cfm

Recommended mounting height

Designation	H inch
MT 1000	64-76
MT 1300	72-84
MT 1500	76-88
MT 2000	84-96

Recommended side displacement in relation to workplace

Designation	S inch
MT 1000	12-24
MT 1300	16-24
MT 1500	20-32
MT 2000	28-40



Range at recommended mounting height
The following mounting heights and side displacements are recommended for optimization of evacuation

SAFETY SHOWER/EYEWASH CUT SHEET

One per Lab Unit

Unit 2150 will be specified.

Requires drain inside wall cavity for eyewash per Division 22.

Provide drain at floor for shower.

Recessed Laboratory Units

Application: ColorTech recessed laboratory units are recess mounted into a finished wall. They conserve valuable floor space, while eliminating the clutter and obstruction created by conventional eye wash and shower equipment. Units can be installed in either a corridor or a lab room, close to where accidents might occur. In an emergency, units are easily located and activated.

ADA Compliance: When installed at recommended mounting heights, units comply with ADA requirements for accessibility by handicapped persons (maximum height and reach, minimum knee clearance and distance from obstructions).

Certification: All ColorTech safety equipment is third-party certified to meet the requirements of ANSI Z358.1 - 1998 ("Emergency Eye Wash and Shower Equipment").

Finish: Units are supplied with a powder coated finish on all exposed brass components. Specify finish when ordering: white, gray, tan, polished chrome with clear epoxy or satin chrome with clear epoxy.

Shower Head: 8" diameter cast brass. Furnished with vertical supply pipe and ceiling escutcheon for mounting shower head at desired height below finished ceiling.

Shower Valve: 1" IPS brass stay-open ball valve with stainless steel "panic bar". Pulling bar down activates shower; shower remains in operation until bar is returned to original closed position. Furnished with stainless steel access panel and 1" IPS unions for valve.

Cover/Drain Pan: Eye/face wash section of unit has stainless steel cover. Opening cover pulls outlet head assembly down from vertical to horizontal position and activates water flow. Horizontal grab bar is easily grasped and pulled in an emergency. While unit is in operation, waste water is collected by drain pan and returned into unit for drainage. Unit remains in operation until cover is returned to closed position.

Outlet Head Assembly: Two FS-Plus spray heads mounted on supply arms. Each spray head has internal flow control and filter to remove impurities from water.

Eye/Face Wash Valve: 1/2" IPS brass stay-open ball valve.

Mounting: Entire unit is contained in an 18 gauge stainless steel cabinet with flanged rim for recessed mounting in wall. Combination cover and drain pan is 18 gauge stainless steel. Unit fits in standard 3-1/2" deep wall.

Pipe and Fittings: All pipe and fittings are brass.

Supply: 1" IPS female inlet.

Waste: 1-1/2" OD chrome plated brass tube.

Sign: Furnished with ANSI-compliant identification sign.

Quality Assurance: Unit is completely assembled and water tested prior to shipment.

U.S. Patent: 5,768,721

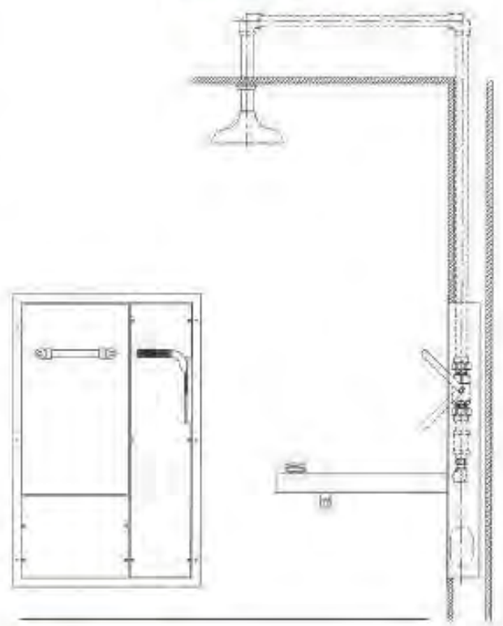
Available Options:

AP280-220 Electric Light and Alarm Horn. Flashing light is mounted on wall above unit. Alarm horn is recess mounted in wall next to light. Light is illuminated and horn sounds when either eye/face wash or shower is activated. See page 87 for complete information.

AP3800 Thermostatic Mixing Valve. Mixing valve precisely blends hot and cold water to deliver warm (tepid) water to eye/face wash and shower station as required by ANSI Z358.1 - 1998. Warm water prevents possibility of thermal shock. See page 86 for complete information.

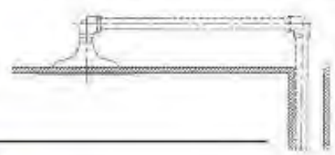
CTSSBF2150

Recessed Safety Station with Drain Pan



CTSSBF2160

Same as above except with recess mounted shower head.



CTSSBF2170

Same as above except with wall mounted shower head.

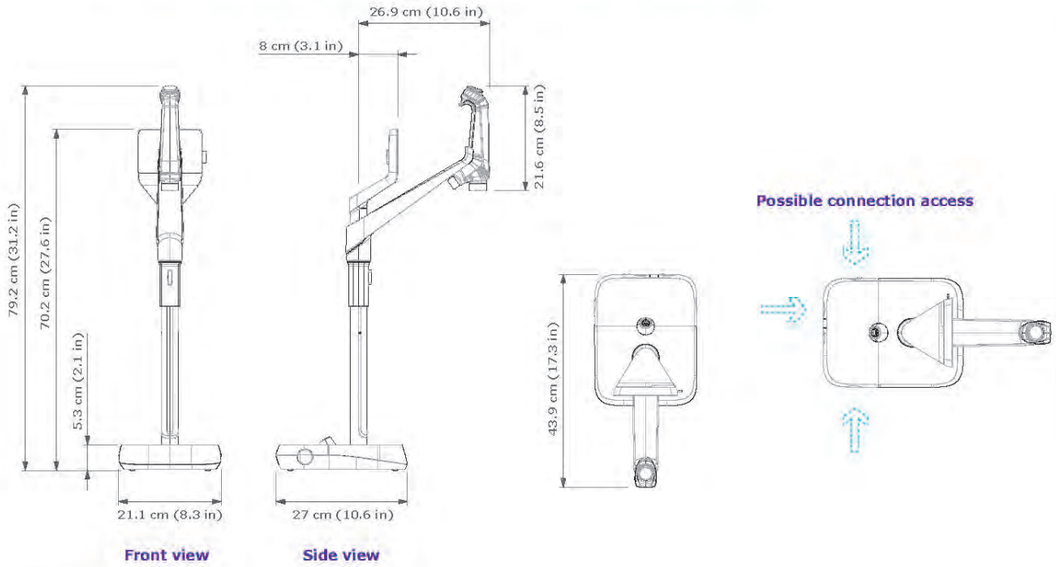
WaterSaver Faucet Co. 312.666.5500 Voice 312.666.8597 Fax wsflab.com

POINT-OF-USE WATER POLISHER CUT SHEET

One per Lab Unit

Can be either HKSP Furnished or Tenant Furnished

E-POD® dispenser specifications



Tubing and port requirements

Parameter	Description
Dispenser tubing length	0.92 m (36.22 in)
Distance from purification unit to POD dispenser	Maximum 5 m (16.4 ft)
Distance between two POD dispensers (Maximum 2 dispensers connected in series)	Maximum 5 m (16.4 ft)
POD dispenser data connection with unit	Ethernet
Electrical connection	Powered by purification unit (24–28 VDC)
Foot pedal port	3.3 V

Weights

	Dry weight	Shipping weight	Operating weight
E-POD®	4.7 kg (10.4 lb)	7.2 kg (15.9 lb)	5.5 kg (12.1 lb)

Screen description and functionalities

Parameter	Description
Capacitive touchscreen	Size: 5 in; Resolution: 800 x 480
USB port	USB 2.0 Highspeed standard
Speaker	Impedance: 8 Ω/max output power: 0.5 W
Display in 9 languages	Chinese/English/French/German/Italian/Japanese/ Portuguese/Russian/Spanish

Water specifications

Feed water requirements	
Feed water	Potable tap water
Pressure	1–6 bar
Temperature	5–35 °C (41–95 F)
Conductivity	<2000 µS/cm at 25 °C
Dissolved CO_2	<30 ppm
Free chlorine	<3 ppm
Fouling Index	<10
pH	4–10
Total Organic Carbon (TOC)	<2 ppm
Langlier Saturation Index (LSI)	<0.3
Hardness (as $CaCO_3$)	<300 ppm
Silica	<30 ppm

Pure, Type 2 water specifications[1]	
Resistivity at 25 °C[2]	>5 MΩ·cm; typically 10–15 MΩ·cm
Conductivity at 25 °C	0.2 µS/cm; typically 0.1 µS/cm
TOC	≤30 ppb
Production flow rate	3 L/h (Milli-Q® IX 7003) 5 L/h (Milli-Q® IX 7005) 10 L/h (Milli-Q® IX 7010) 15 L/h (Milli-Q® IX 7015)

From an E-POD® dispenser with final filter, the following water quality specifications are achieved:[1]	
Particulates[3]	No particles with size >0.22 µm
Bacteria[4]	≤10 cfu/L
Pyrogens (endotoxins)[5]	<0.001 EU/mL
RNases[6]	<1 pg/mL
DNases[6]	<5 pg/mL
Proteases[6]	<0.15 µg/mL
Flow rate	Up to 2 L/min

1. These values are typical and may vary depending on the nature and concentration of contaminants in the feed water.
2. Resistivity can also be displayed non-temperature-compensated as required by USP.
3. With Millipak® or Millipak® Gold filter.
4. With Millipak® or Millipak® Gold filters or Biopak® polisher when installed and used in a laminar flow hood.
5. With Biopak® polisher when installed and used in a laminar flow hood.
6. With Biopak® polisher.

SteamScrubbers®
Features & Benefits

Ideal washer for cleaning beakers and other general purpose labware

MIRROR BRIGHT TYPE 304 STAINLESS STEEL INTERIOR
The shiny, non-porous finish provides a corrosion-resistant surface which reduces contaminant carry over during wash and rinse cycles.

UPPER AND LOWER ROTATING WASH ARMS WITH ADJUSTABLE HEIGHT CENTER TOWER
Distribute up to 60 gallons (227 liters) of water per minute. Wash arms clean with a 360° revolving motion. The lower arm pumps water upward through the bottom rack while the upper arm propels water down across glassware below and up through the top rack. The center telescoping tower has a locking pin that adjusts the upper arm to 2 positions to accommodate various glassware heights.

BUILT-IN FORCED AIR DRYING SYSTEM
Dries glassware with hot, dry air.

STEAM GENERATOR
Produces hot vapor to penetrate and soften dried residue allowing detergent and hot water to work effectively.

DUAL HEATERS
Boost water and glassware temperatures to enhance washing and drying results by applying heat during all cycles. Models for operation on 115 volts have 1450 watts of heating power; 230 volt models have 2150 watts. With a minimum inlet temperature of 120° F (49° C), the sump heater elevates water temperature approximately 20° F (11° C) on 115 volt models and 60° F (33° C) on 230 volt models.

PARTICLE FILTER
One-piece stainless steel screen filters fine particles, protecting the pump from broken glass and debris.

MELAMINE-COVERED TOP
On mobile and freestanding models, the high-density particleboard top is melamine-coated on all sides to repel moisture.

QUIET, ENERGY EFFICIENT OPERATION AT 62 DECIBELS
Aluminum-backed, sound-deadening material is strategically placed throughout the washer to absorb noise. An insulation blanket optimizes internal tank temperature while conserving energy.

STAINLESS STEEL TOP AND BOTTOM RACKS
Accommodates a variety of accessory inserts and the broadest range of glassware. Two rows of factory-installed rollers on the sides of the washer's interior guide the top rack and allow placement of the rack in two positions to accommodate various glassware heights.

DISPENSER FOR NEUTRALIZING SOLUTION
Allows addition of mildly acidic rinse solution to alter pH and eliminate alkaline detergent carry over.

BUILT-IN PURIFIED WATER PUMP
Draws from a storage tank or pressurized system to deliver purified water during final two rinses.

EASY INSTALLATION
To begin operation, tap and purified water, a drain and electricity are required. Mobile models feature a quick-disconnect attachment for tap water and drain. Undercounter and freestanding models have straight-line plumbing and electrical connections accessible from the front. Higher built-in drain location prevents self-draining and plumbing errors.

DRY OR LIQUID DETERGENT DISPENSER
Detergent compartments release a premeasured amount (135 ounces or 40 ml) ensuring clean labware.

FULL ONE YEAR WARRANTY
Is provided against defects in materials and workmanship.

Exclusive feature

DRAW LATCH
Securely locks the door energizing the electronic controls.

INTERNATIONAL ELECTRICAL CONFIGURATIONS AVAILABLE
All 230 volt models conform to the CE (European Community) requirements for electrical safety and electromagnetic compatibility.

TYPE 304 STAINLESS STEEL DOOR
Front door is sleek brushed stainless steel. Mobile and freestanding models also have brushed stainless steel sides and epoxy-coated steel backs.

ETL LISTED
Washer carries the ETL Testing Laboratories seal in the U.S. and ETL-C seal in Canada, signifying it meets or exceeds all minimum requirements of UL Standard 3101-1 and CAN/CSA C22.2 No. 1010.1.

Undercounter SteamScrubbers

24.0" w x 26.4" d x 34.3" h minimum to 36.3" h maximum (60.9 x 67.1 x 87.1 to 92.1 cm). Shipping weight 142 lbs. (64 kg). Includes one 3/8" IPS inlet fitting for tap water, one fitting for 3/4" ID hose for purified water, one Top Rack, one Bottom Rack, and leveling feet.

Catalog Number	Electrical Requirements	Options: High Heat	Options: Window	Required (not included)
44003-00	115 v, 60 Hz, 16 amps			hardwiring to a 20 amp dedicated circuit 1 1/2" vent trap or drain air gap
44003-01	230 v, 50/60 Hz, 13 amps	•		hardwiring to a 20 amp dedicated circuit 1 1/2" vent trap or drain air gap
44003-10	115 v, 60 Hz, 16 amps		•	hardwiring to a 20 amp dedicated circuit 1 1/2" vent trap or drain air gap
44003-11	230 v, 50/60 Hz, 13 amps	•	•	hardwiring to a 20 amp dedicated circuit 1 1/2" vent trap or drain air gap

Freestanding SteamScrubbers

24.5" w x 26.7" d x 35.1" h minimum to 37.1" h maximum (62.2 x 67.8 x 89.2 to 94.2 cm). Shipping weight 189 lbs. (86 kg). Includes melamine-covered top, stainless steel front and side panels, epoxy-coated steel back panel, 3/8" IPS inlet for tap water, one fitting for 3/4" ID hose for purified water, one Top Rack, one Bottom Rack, and leveling feet.

Catalog Number	Electrical Requirements	Options: High Heat	Options: Window	Required (not included)
44004-00	115 v, 60 Hz, 16 amps			hardwiring to a 20 amp dedicated circuit 1 1/2" vent trap or drain air gap
44004-01	230 v, 50/60 Hz, 13 amps	•		hardwiring to a 20 amp dedicated circuit 1 1/2" vent trap or drain air gap
44004-10	115 v, 60 Hz, 16 amps		•	hardwiring to a 20 amp dedicated circuit 1 1/2" vent trap or drain air gap
44004-11	230 v, 50/60 Hz, 13 amps	•	•	hardwiring to a 20 amp dedicated circuit 1 1/2" vent trap or drain air gap

BUILT-IN AUTOCLAVE CUT SHEET
BSL2 and/or BSL3 Lab Suites

CONSOLIDATED STERILIZER SYSTEMS

Consolidated Sterilizers
Designed to Transform Your Laboratory

Models	
SSR-2A (16" x 16" x 26")	
SSR-3A (20" x 20" x 38")	
SR-24A (24" x 24" x 36")	
SR-24B (24" x 24" x 48")	
SR-26A (26" x 26" x 39")	

Small Lab Series Steam Sterilizers General Specifications

General Specification

Steam Sterilizer, Radial-Arm Door(s), Hinged, Single Chamber, Double Wall

Consolidated Small Lab Series Sterilizers are designed to sterilize at temperatures between 212° F and 275° F (100° C and 135° C) through the use of steam. Choose from a variety of sizes and programmable control options for pre-vacuum or gravity operation. Consolidated sterilizers offer a range of performance options to meet the most demanding applications in clinical, animal and life science, biotechnology, pharmaceutical, and commercial/industrial applications.

Table of Contents

- Model Sizes and Weights.....2
- Sterilizer Construction.....2
- X1 Controller.....5
- Sterilization Cycles.....6
- Options & Accessories.....8
- Validation.....9
- Site Preparation and Utilities.....10
- Installation.....10
- Footprint Drawings.....11
- Utility Information.....13

Features and Benefits

Simplified Maintenance, Low Cost of Ownership.
All Consolidated sterilizers are manufactured in the USA and built from commonly available parts to allow quick and cost effective field-level service and maintenance.

Serviceability.
Easy access to replaceable components, local component availability and common electrical and plumbing parts permit qualified facility or area service companies to maintain the sterilizer.

Control Flexibility.
A choice of programmable controllers allows a broad range of performance functions, complete with alarm, monitoring and communications required for internal or third-party compliance.

Performance Cycles—Basic to Advanced.
The fully jacketed sterilizer design permits vacuum and pressure control when configured for pre-vacuum, post-vacuum, and more sophisticated functions such as air-over-pressure. Consolidated sterilizers are ideal for sterilizing wrapped and unwrapped goods, liquids, waste, and other applications.

Green and Environmentally Friendly.
Unique, new technologies reduce water and energy consumption without compromising performance.

Cloud-Enabled.
Consolidated sterilizers can be connected to the internet and can be pre-configured for cloud-based monitoring, alerting and data collection.

Consolidated Small Lab Series Sterilizers are available in single door, pass-thru and dual (tower) models. A versatile control system offers a range of performance options to meet the most demanding applications in life science, biotechnology, pharmaceutical, and commercial/industrial applications. Model PT-SR-24A-X1 shown with X1™ control system.

Table 3. Power and Steam Usage

Model	Chamber Dimensions (w x h x f-b)	Air Removal Method	Electrically Heated					Steam Heated		
			Generator Size (kW)[2]	Generator Current (amps)[3]				Steam Consumption		
				208V	240V	380V	480V	Peak (lb/hr)	Per Cycle[1] (lb/cycle)	Idle (lb/hr)
SSR-2A	16" x 16" x 26" 40.6 x 40.6 x 66 cm	Gravity	25	69	60	37	30	180	17	5
		Vacuum	25	69	60	37	30	180	25	5
SSR-3A	20" x 20" x 38" 50.8 x 50.8 x 96.5 cm	Gravity	25	69	60	37	30	180	20	7
		Vacuum	25	69	60	37	30	180	35	7
SR-24A	24" x 24" x 36" 61 x 61 x 91.4 cm	Gravity	25	69	60	37	30	180	30	7
		Vacuum	30	83	72	46	36	180	50	7
SR-24B	24" x 24" x 48" 61 x 61 x 122 cm	Gravity	25	69	60	37	30	180	35	9
		Vacuum	30	83	72	46	36	180	55	9
SR-26A	26" x 26" x 39" 66 x 66 x 99 cm	Gravity	25	69	60	37	30	180	35	9
		Vacuum	30	83	72	46	36	180	55	9

[1] Assuming 30 minute sterilizing time at 250° F (121° C) and 20 minute drying time.
[2] If current draw for 25kW is too high contact Consolidated for 20kW generator.
[3] Current drawn by generator. Local codes and regulations may affect breaker size.
Note: For dual (tower) models contact Consolidated for additional information.

Table 4. Water Feed Requirements, Carbon-Steel Steam Generators[4]

Characteristic	Recommended Condition	Maximum Condition
Temperature	As Supplied	140° F (60° C)
Total Hardness	0–17 mg/L	85 mg/L
Alkalinity	50–180 mg/L	350 mg/L
Total Dissolved Solids	0–150 mg/L	250 mg/L
pH	7.5–8.5	7.5–9.0
Total Silica	0.1–1.0 mg/L	2.5 mg/L
Resistivity	2,000–6,000 ohms/cm	26,000 ohms/cm[5]

[4] Stainless-steel generators require deionized water >1 MΩ/cm.
[5] If water supplied is greater than 26,000 Ω/cm contact Consolidated for recommendation.

Typical Utility Requirements

General.
- Steam (S): ¾" NPT, 50-80 psi dynamic.
- Electrical (E1, E3): 110V, AC or 220V, AC, 1-phase, 15 amps—dedicated and isolated.
- Water (W2): ½" NPT, 45 psi dynamic minimum.
- Drain (D): open drain to funnel connection in floor, diameter 3" minimum.
- Backflow preventer not provided.

Optional Vacuum Systems (maximum one per unit).
- Economy, Post-Vac (W3): ½" NPT, 45 psi minimum.
- Hi-Vacuum with Water Ejector (W3): 1¼" NPT, 45 psi minimum.
- Hi-Vacuum with Vacuum Pump (W3): ½" NPT, 45 psi minimum.

Electric Steam Generator Utilities:
- Power Supply (E2): available in 208/240/380/480V, single or three phase.
- Generator Feedwater (W1): hot/treated water, ½" NPT, 60 psi dynamic minimum.

Model: SSR-3A
Pre Vacuum
Interior Chamber dimensions: 500W x500Hx960D

480v power with disconnect

Integral electric steam generator

Steam canopy above

Floor sink

Requires RO water feed

Mobile Autoclave Cut Sheet

BSL2 and/or BSL3 Lab Suites
Can be HKSP furnished or Lab Tenant Furnished

Model 5075 ELVC-G
Includes integral electric steam generator

Mobile autoclave can be provided by Lab Tenant or HKSP as lab enhancement

Autoclaves with Built-in Steam Generator

ELVC-G models & ELC-G models

Vertical and Benchtop laboratory autoclaves with built-in steam generators provide fast & efficient heat-up and complete drying. Chamber sizes from 28 to 160 liters.

Vertical Top Loading Models - Technical Data

D-Line Model	Chamber Dimensions ØxD (mm)	Chamber Volume (Liter)	External Dimensions WxHxD (mm)
3850 ELVC-G	380 X 500	65	730 x 1000 x 700
3870 ELVC-G	380 X 690	85	730 x 1000 x 700
5050 ELVC-G	500 X 500	110	870 x 1090 x 770
5075 ELVC-G	500 X 750	160	870 x 1090 x 770

3850 ELVC-G
3870 ELVC-G

5050 ELVC-G
5075 ELVC-G

LAB TENANT FURNISHED EQUIPMENT

Provided by each Lab Tenant

Biological Safety Cabinet Class II Type A2

Centrifuge

The following lab equipment can be furnished by each Lab Tenant:

- **Regrigerators**
- **Freezers**
- **Incubators**
- **Centrifuges**
- **Biological Safety Cabinets- Class II Type A2**
- **Laminar Flow Hoods**
- **Reach-in Controlled Environment Chambers**
- **Reach-in Growth Chambers**
- **Benchtop Instruments**
- **Computers**
- **Modular Clean Rooms (ISO 3, 4, 5, 6, 7, 8)**
- **Robotics Equipment**
- **Rodent Cage Racks and Cages**
- **Zebra Fish Aquaria**

Protean Lab Benches can be either Lab Tenant provided and/or HKSP Owner provided.

Incubator

Ultra low freezer

Modular Clean Rooms

SECTION 11
DESIGN CRITERIA

General
Structural
Mechanical
Electrical
Plumbing
BSL2 Labs
BSL3 Labs
Engineering Labs

LAB GENERAL DESIGN CRITERIA

Cellular & Molecular Biology Research Lab
University of California, San Diego

Walls/Doors/Security:

The Laboratory shall be completely separted from outside areas (must be bound by four walls). Having enclosed laboratores will help contain spills, and keep unauthorized personnel from entering areas where hazardous operations are performed.

The laboratory shall have means of securing specifically regulated materials such as controlled substances, select agents, and radioactive material. Having secured hazardous materials storage will keep unauthorized personnel from gaining access to them.

Operable windows are generally not provided in modern, state-of-the-art science buildings. If the laboratory has windows that open, they must be fitted with insect screens. Insects, particularly flies, are known to be potential carrier of disease. To keep insects out of the lab, the doors must be closed while an experiment is in progress, and window must be screened if they are capable of being opened. This applies to laboratories containing biological materials, but should be applied to all lab types.

Flooring:

Floors for general research, engineering and robotics, and chemistry can be rubber tile, vinyl tile, or sealed concrete.
Labs for BSL2, BSL3, and vivaria must be non-pervious, one piece, and with covings to the wall. Sheet vinyl may be used for BSL2
Trowelled on epoxy is appropriate for BSL3 and vivaria floors.

Floors in storage areas for corrosive liquids shall be of liquid tight construction.

Sinks:

Each laboratory must contain a sink for wandwashing.

Laboratory Furniture:

All lab furniture must be sturdy. All work surfaces must be impervious to chemicals. Epoxy resin or phenolic resin are appropriate work surfaces in labs.

Aisle Widths:

Lab aisle widths shall be ~1500 mm wide thoughout the lab. No less than 1200 mm shall be allowed for aisle widths in any fixed casework/equipment location.

Laboratory Doors:

Laboratory doors shall be automatic self-closing. Lab doors shall be openable (push or pull) with a minimum of 2.8 kPa pressure. Laboratory doors shall swing in the direction of egress (out from room).

Chemical Fume Hoods:

Fume hoods should be located away from activities or facilities which produce air currents or turbulence. Locate fume hoods away from high traffic areas, air supply diffusers, doors, and operable windows (if any). Fume hoods should not be located adjacent to a single means of access to an exit. Fume hoods should be located no less than 3 meters from any door or doorway.

Fume hoods shall conform to NFPA 45, Standard on Fire Protection for Laboratories Using Chemicals.

Laboratory fume hoods shall be Variable Air Volume (VAV) type which allow for reduced energy consumption. The air volume control shall be via sash sensors.

LAB GENERAL DESIGN CRITERIA (continued)

Laboratory fume hood exhausts shall be manifolded by floor. Each floor manifold exhaust shall run to the roof, there the lab floors are manifolded into one central fan exhaust system with N+1 redundancy.

Fume hood velocity shall be no less than 22 meters per second, and no greater than 30 meters per second.

Laboratory fume hood exhaust shall run continously, 24/7/365. Emergency power back up shall be provided for the fume hood exhaust system, in addition to other life safety features of the lab buildings. Emergency power back-up for fume hoods shall provide no less than half of the normal fume hood operating exhaust air. Laboratory fume hoods shall not have on/off switch control.

Laboratory shut-off valves for piped services (such as compresse air, vacuum, etc.) shall be located at each fume hood and shall be visible and accessible for valve closurer in the event of an emergency or fume hood repair/maintenance.

Light fixtures in fume hoods shall be LED type, and shall be replaceable from outside the fume hood superstructure. Light fixtures shall be covered by a transparent vapor tight shield to prevent vapor contact.

Supply or auxiliary air hoods shall not be used. Ductless fume hoods shall not be used.

Perchloric acid is not anticipated in the HXSPX2 lab expansion. Therefore, no provision for perchloric acid fume hoods is being accommodated in the lab design.

Radioistope use in significant quantities that would require the use of a radioistope fume hood is not anticipated for the HKSPX2 laboratory expansion. Therefore, no radioistope fume hoods are being provided for in the lab design. Low level radioistope use such as P32, and S35 can be used in basic research laboratories with proper protocol.

Walk-in fume hoods and glove box type fume hoods are not being provided in the lab design. These can be provided by lab tenants on an as needed basis, provided that there is spare fume hood exhaust capacity in the lab fume hood exhaust system.

Proper operation of fume hoods must be demonstrated by the contractor installing the fume hood priot to project closeout. The recommended containment performance test is the latest version of ANSI/ASHRAE 110.

Cancer Research Lab
Nevada Cancer Institute
Las Vegas, Nevada

Safety Shower/Eyewash Units:

A accessible safety shower/eyewash unit should be located in each lab unit. They should be located such that they are within 10 seconds walking distance from any fume hood in the lab. Safety Shower/Eyewash units shall conform to the latest version of ANSI Z358.1. Floor drains shall be provide below each safety shower.

Earthquake Safety:

All laboratory equipment taller than 1200 mm shall be braced to the floor or wall. The PROTEAN equipment detail provides a method for attaching equipment to the unistrut frame at wall. Open lab shelves shall be designed with integral seismic safety edge to prevent items on shelf from falling off of the shelf surface during earthquake.

Latches at lab casework doors:

All lab casework doors shall have postive door latch mechanism.

LAB GENERAL DESIGN CRITERIA (continued)

Transformation Core Lab
Columbus, Ohio

Cleanability:

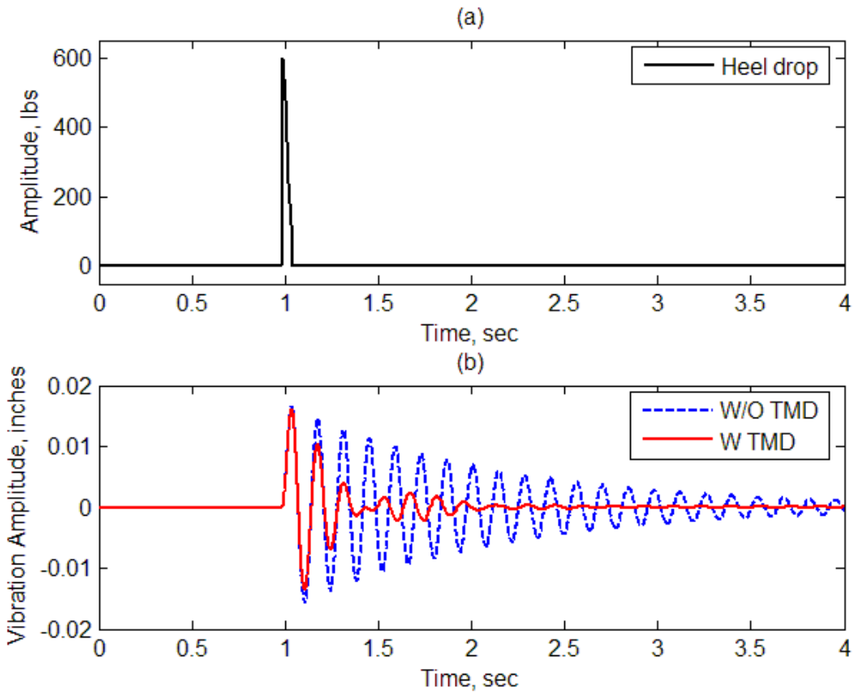
The laboratory shall be designed so that it can be easily cleaned. Bench tops must be one-piece design to prevent contamination. Plastic laminate tops are not suitable for laboratory environments. All pentrations into the lab for electrical conduit, plumbing piping, and mechanical ductwork must be sealed for both fire protection and biohazard containment. Lab benches at wall shall have backsplash. Walls shall be washable, with durable, non-porous paint. Spaces between benches, cabinets, and equipment must be accessible for cleaning and for servicing of equipment.

Specialty Gases:

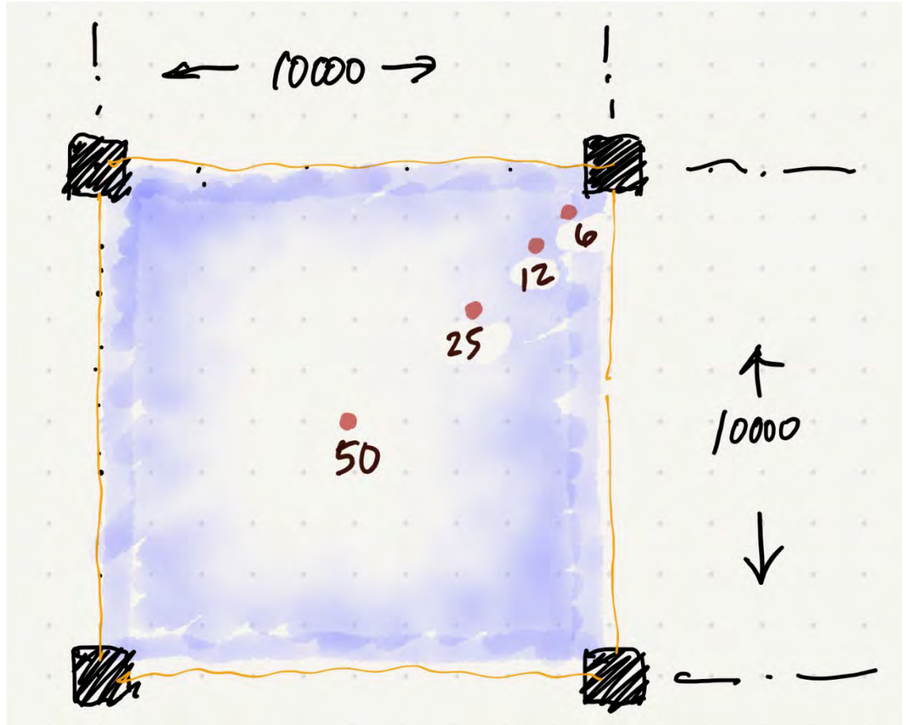
Specialty gas cylinders for inert gases (helium, argon) shall be provided by each lab tenant. The lab design shall provide cylinder restraints in various locations throughout each lab unit. Flammable cylinder gases such as hydrogen or oxygen shall be provided by each lab tenant. Gas cabinets required for flammable cylinder gases shall be provided by each lab tenant as needed. Provision will need to be made for water fire suppression connection and exhaust connection at tenant furnished gas cabinets.

Breakrooms:

The laboratory buildings must incorporate adequate facilities for food storage and consumption and personal hygience tasks. Food and/or drink shall not be consumed inside laboratories. It is assumed that the office areas adjacent to lab floors shall have adequate and appropriately sized break rooms for lab personnel. If break rooms are not provided in adjacnet office suites, then they must be provided within the lab floors, as separate rooms, outside of the lab suites.



Heel drop excitation and floor vibration response



LAB STRUCTURAL DESIGN CRITERIA

Vibration Attenuation

Vibration due to foot fall is the primary source of vibration problems in life science laboratories. As people walk at an accelerated pace through a corridor adjacent to laboratories, it can create vibration sufficient to cause interference with microscopes and instruments in the adjacent labs. Science buildings located adjacent to train tracks can also have issues for sensitive intruments. Lifts should have sufficient structural framing so as not to pass the vibration of moving lifts through the structure adjacent to lab floors.

The Institute of Environmental Sciences and Technoglogy has developed and defined Velocity Criteria (VC) curves, which indicated vibration attenation for different building contexts. These are:

VCA- 50 micrometers per second or less (2000 microinches per second or less).
VCB- 25 micrometers per second or less (1000 microinches per second or less).
VCC- 12 micrometers per second or less (500 microinches per second or less).
VVD- 6 micrometers per second or less (250 microinches per second or less).
VVE- 3 micrometers per second or less (125 microinches per second or less).

VCA is considered to be a reasonable and appropriate vibration attenuation for science building design. For instruments requiring a higher level of vibration attenuation (higher attenuation = lower number) local point-of-use vibration attenuators can be used at the instruments which require the higher level of attenuation.

VCA is also considered to be the level of vibration attenuation where the greatest benefit is obtained for the cost incurred. Higher levels of vibration do not provided a return on the investment sufficient to warrant the higher attenuation. Concrete slabs on grade at basement or ground floor levels provide higher than normal attenation than suspended lab floors above. Specific equipment requiring higher attenuation such as electron microscopes and laser tables are oftne located on basement or ground floor slab on grade floors.

In the design of lab structural bays, the selected criteria is used to determne the level of vibration attenuation at the center of a structrual bay. As one moves from the center of the bay out toward a column, the vibration attenuation approximately halves as the distance halves. As one is near a column in a lab, the vibration attenuation approached VVD. This gradient attenuation allow for vibration senstive procedures to be located on upper suspended floors, if located near columns.

HERA recommends building vibration attenuation of VCA- 50 micrometers per second or less.

For live floor loading, 5 kPa (5 kilopascals = 104 lbs per square foot) is recommended as the live load capacity design criterion for suspended lab floor for all life science labs except for engineering type labs that are likely to require higher than normal floor loading. For these labs we recommend 7 kPa (146 lbs per square foot).

Lab Mechanical Design Criteria

Rooms in which chemicals are used and/or stored are defined as "laboratories" and as such, are required to have 24/7/365 lab exhaust, with no recirculation of air to areas outside of the lab suite. Each lab suite shall have mechanically generated supply air and exhaust air.

Lab Temperature:

18-22 deg C +/- 2 deg C.

Lab Humidity:

Controlled at no more than 65% relative +/- 5%.

Lab Air change rate:

Minimum of 6 air changes per hour shall be provided while the lab is occupied. Air change rate may be higher due to equipment heat gain. During unoccupied hours, lab exhaust can be reduced to 3 air changes per hour.

Lab Exhaust:

Lab room exhaust shall be continous, 24 hours a day, 7 days a week, 365 days a year. Night set backs may be applied to when lab personned are not working in the lab. Variable Air Volume (VAV) exhaust and supply air systems should be incorporated into the lab design for energy conservation. Chilled beams and/or air sensor devices (Aircuity) may be considered as part of the energy conservation strategy. Each lab room shall have its own supply and exhaust valves, not including exhaust equipment such as fume hoods, snorkels, or thimble exhaust biological safety cabinets. Where exhaust equipment occurs, there should always be general lab room exhaust in addition to the exhaust equipment. Exhaust air from laboratories shall not pass through any area unducted. Lab fume hood exhaust fans at the roof shall be oriented in an up-blast vertical orientation. Hood exhaust stacks shall extend a minimum of 2.5 meters above the walking roof level. Fume hood exhaust shall be located as far from lab supply air intake as possible, with a minimum of 20 meters horizontal distance separation. Lab exhaust discharge shall be a minium of 1000 meters per minute. Rain caps that divert the exhaust toward the roof are prohibited. Lab fume hood exhaust is not required to be treated (filtered or scrubbed) unless required by local codes/regulations. Lab exhaust fans shall be located outside of the building envelope at the point of final discharge. The exhaust fan shall be the last element of the system so that the ductwork remains under negative pressure. Exhaust fans shall be readily accessible for maintenance.

Lab Supply Air:

The lab suppy air system shall meet the technical requirements of the latest version of AHSRAE, Standard 62.1: *Ventilation for Acceptable Indoor Air Quality.*

Lab Equipment Heat Gain:

Larger, open lab suites should be designed such that heat from from instruments and equipment is removed from the lab interior via the lab exhaust system. Heat gain factor of 500 btuh per square meter should be applied. Smaller instrument, equipment, and procedure rooms should be designed to a heat gain factor of 750 btuh per square meter.

Lab Room Air Pressure:

Laboratory suites shall be negative to adjacent corridors. Interior procedure rooms within a lab suite should be designed to operate at either positive or negative pressure, depending upon the scientific activity taking place in the room. When two adjacent labs have different hazard levels, the high hazard lab shall be negative to the lower hazard lab.

Lab Diversity Factor:

Diversity factors should be applied to the lab exhaust and supply air systems. A factor of 80% of the total connected load may be used to determine actural design load. For example, if the total connected load is 100,000 cfm, a design load of 80,000 cfm may be used to size the system.

LAB MECHANICAL DESIGN CRITERIA (continued)

Biomedical Research Laboratory
University of California, Santa Cruz

Lab Fume Hood Duct Materials:

Lab fume hood duct material shall be type 316 stainless steel, spiral seam. No laboratory ventilation ductwork shall be insulated on the interior surface of the duct. Sound baffles or external acoustical insulation should be used at the source of noise generation. Horizontal ducts shall be sloped 3 cm per 3 meter of duct run.

Lab Controls:

The building HVAC system controls shall be designed such that each tenant lab suite can be operated, monitored, and controlled independent of other lab tenant suites. Systems shall be designed so that municiple monitoring of use is by tenant lab suite.

Lab Supply and Exhaust Diffuser Location:

Supply and exhaust diffusers in labs must be located such that they do not interfere with the airflow of lab equipment such as fume hoods, biological safety cabinets, and laminar floow hoods. Room air currents at the chemical fume hood shall not exceed 20% of the average face velocity of the fume hood. Supply diffusers should be located at opposite ends of the lab from the fume hood location, so as to create a directional flow of air, as much as possible.

Air Duct Velocity:

The air velocity in lab ductwork shall be sufficient to prevent condensation on the walls of the ductork.
American Conference of Governmental Industrial Hygienists (ACGIH) recommends minimum of 300 meters per second.

General Room Exhaust:

Chemical fume hoods shall not be the sole means of lab air exhaust. General room exhaust shall be provided for all lab, regardless of fume hood density.

Local Exhaust:

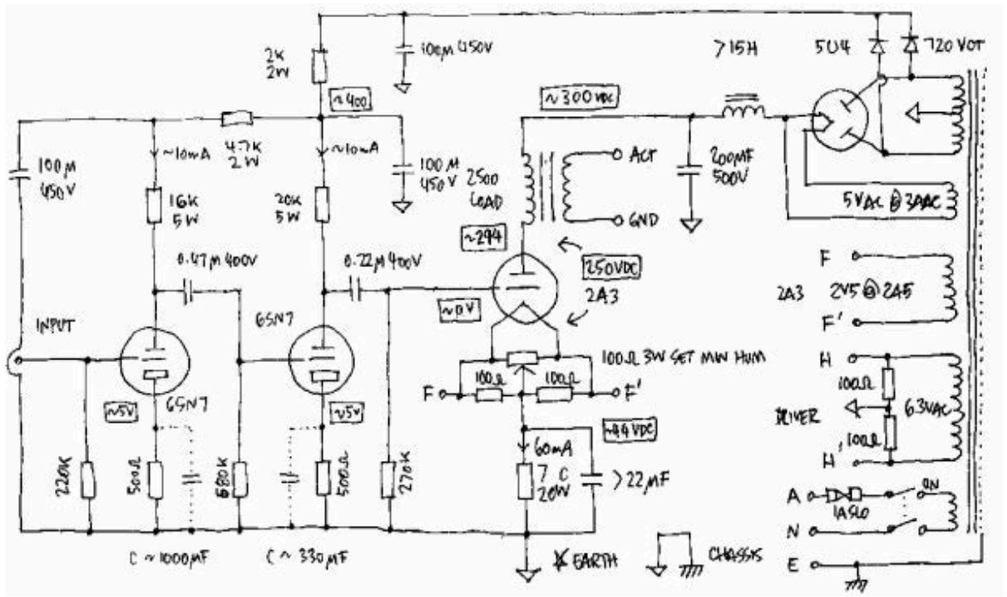
Local lab exhaust for snorkel units, vacuum pump cabinets, chromatographs, and other equipment requiring exhaust shall be manifolded to the general lab fume hood exhaust system.
Exhuast ducts shall be manifolded in a fire rated shaft or mechanical room.

Redundancy:

Lab system motors, pumps, and fans shall be designed to have N+1 redundancy.

Fire Dampers:

Fire dampers shall not be provided in lab fume hood exhaust ductwork. Fire detection and alarm systems shall not be interlocked to automatically shut down laboratory fume hood exhaust fans.



LAB ELECTRICAL DESIGN CRITERIA

Lab Power:

All laboratories shall be supplied with 220v single phase power outlets.

Electrical Panels:

Each lab suite shall have its own dedicated power panel(s). Monitoring of power consumption shall be by lab suite, such that each lab tenant has a separate, dedicated record of their own power consumption.

Spare Circuite Capacity:

Each lab Suite shall have 20% spare circuit capacity in each electrical panel serving the lab suite. This will allow lab tenants to install additional circuits when and where needed.

Dedicated Circuits:

Dedicated circuits shall be provided at equipment spaces for freezers, centrifuges, incubators, biological safety cabinets, and other large floor mounted equipment.

Emergency Power:

Chemical fume hood exhaust shall have emergency power (via emergency generator) such that the fume hoods remain operational during power outages. The fuel source for emergency (and stand-by) power shall be determined by local code requirements.

Stand-by Power:

Stand-by power shall be provided for laboratory equipment such as freezers, refrigerators, and incubators. In the event of a power outage, samples stored in these units will not perish.

Power Density:

Electrical outlets shall be provided at lab bench and equipment spaces at an average density of one 220v outlet every half meter. Power outlets shall be provided at fixed lab benches where they occur. Power outlets at mobile lab benches shall be at adjacent vertical service columns and/or overhead horizontal service raceways. Consecutive power outlets at lab benches and equipment spaces shall have alternating circuits.

Conditioned Power:

All lab power supply shall be conditioned to avoid spikes/surges in electrical power supply.

3 Phase Power:

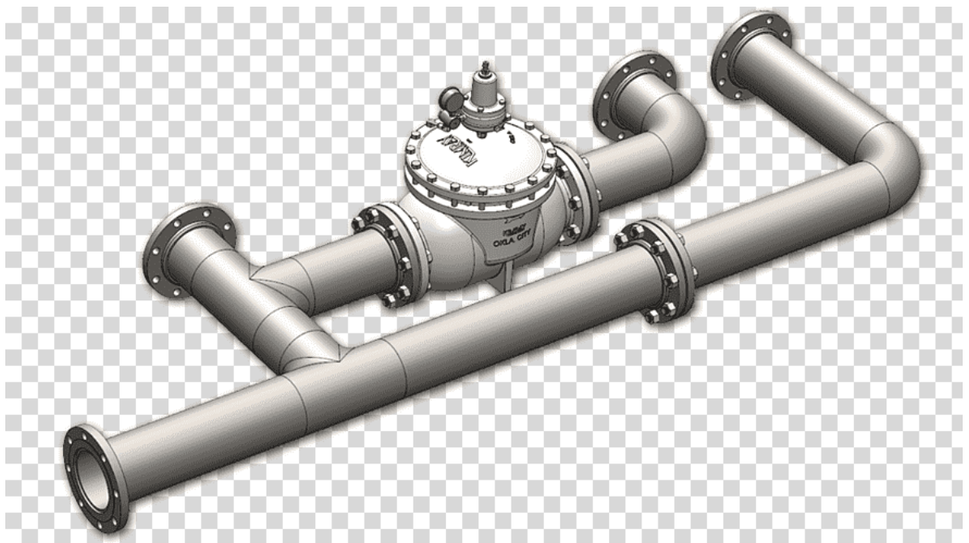
Provision for dedicated 3 phase power supply in the Bioengineering/Robotics lab shall be provided. Quick disconnects shall be provided at these locations.

Lab Lighting:

Lighting levels in laboratories shall be designed at 500 LUX at the lab bench work surface. Additional lighting in labs, where needed, can be provided by tenant furnished task lighting.

Ground Fault Interrupt (GFI):

GFI protection to electrical receptacles at lab benchtops within 2 meters of sinks shall be provided.



LAB PLUMBING DESIGN CRITERIA

Lab Plumbing Systems:

Central lab plumbing systems shall consist of hot & cold water, RO water, and natural gas.

Hot & Cold Water:

Domestic hot and cold water shall be provided at all lab sinks.
Hot water shall be provided at autoclaves, and washers.

RO Water:

Reverse Osmosis (RO) water shall be provided in each lab suite with a local RO unit which will provide RO water at point-of-use water polishers, glassware washers, and autoclaves.

Pure Water:

Type II and/or Type I purified water will be provided by each lab tenant via point-of-use polishers units. The feed water for the polishers will be from the RO (reverse osmosis) unit located in the tenant lab suite, or on each floor, or from a central building RO system.

Central Piped Systems:

Lab piped services piped from a central building location, or from a central room on each lab floor, shall consist of vacuum, compressed air, nitrogen gas, and carbon dioxide gas. Compressed air shall be distributed at 70 kPa (kilo pascal) and shall be stubbed-out at each lab unit or lab suite, with pressure reducing valves to distribute air at 20 kPa to the lab bench locations. Automatic switchover manifolds shall be used where cylinder tanks are used, such as for C02.

Point-of-use water polisher

Specialty gases:

Specialty gases such as inert gases (helium, argon) shall be provided locally in each lab suite by the lab tenant. Provision for cylinder restraints shall be in included in the physical lab design. For flammable specialty gases such as hydrogen and oxygen, vented gas cabinets shall be provided.

Lab Waste Water:

Lab waste water lines shall be separate from general building waste water. A central acid sampling point shall be provided in an easily accessible area at ground floor. Lab waste water can be mixed with municpal waste water stream after approprite neutralization has been tested and verified as suitable for municipal waste stream.

Shut-Off Valves:

All piped services to lab units (water, vacuum, compressed air, etc.) shall have ball valve type shut-off valves that are readily visible and accessible.

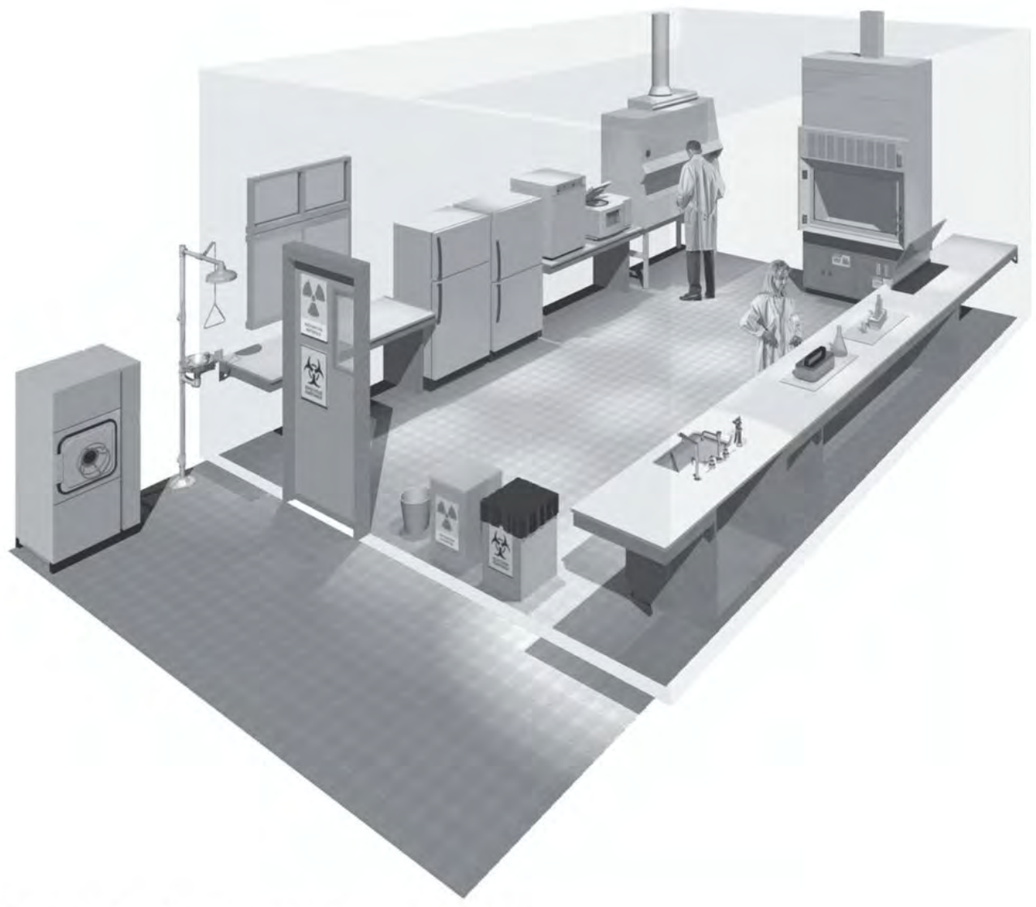


Figure 3. ***A typical Biosafety Level 2 laboratory***

BSL2 Lab Design Criteria

Laboratory Biosafety Manual:

Biosafety levels shall conform to the guidelines published in the World Health Organization *Laboratory Biosafety Manual*, Third Edition, 2004. Biosafety Level 2 requirements are noted on pages 12 through 14 of the manual, and are summarized here as follows:

Cleanable Surfaces:

Walls, ceilings, and floors should be smooth, easy to clean, impermeable to liquids and resistant to the chemicals and disinfectants normally used in the laboratory. Floors should be slip resistant. Benchtops should be impervious to water and resistant to disinfectants, acids, alkalis, organic solvents, and moderate heat.

Lighting:

Illumination should be adequate for all activities. Undesirable reflections and glare should be avoided.

Lab Casework:

Laboratory furniture should be sturdy. Open spaces between and under benches, cabinets, and equipment should be accessible for cleaning.

Storage:

Storage space must be adequate to hold supplies for immediate use and thus prevent clutter on bench tops and in aisles. Additional long-term storage space, conveniently located outside the laboratory working areas, should also be provided. Space and facilities should be provided for the safe handling and storage of solvents, radioactive materials, and compressed and liquified gases. Facilities for storing garments and personal items should be provided outside of the laboratory working areas.

Food and Drink:

Facilities for eating and drinking and for rest should be provided outside the laboratory working areas.

Handwash sinks:

Handwashing basins, with running water, should be provided in each laboratory room, preferable near the exit door.

Doors:

Doors should have vision panels, appropriate fire ratings, and preferably be self-closing.

Autoclave:

An autoclave or other means of decontamination should be available in appropriate proximity to the laboratory. Autoclaves can be large benchtop units provided by the lab tenants, instead of Contractor furnished units.

First Aid:

First-aid areas or rooms suitably equipped and readily accessible should be available.

BSL2 LAB DESIGN CRITERIA (continued)

BSL2 Research Laboratory

Lab HVAC:

Mechanical ventilation systems should provide inward flow of air without recirculation.

Water:

A dependable supply of good quality water is essential. There should be no cross-connections between sources of laboratory and drinking water supplies. An anti-backflow device should be fitted to protect the public water system.

Electrical:

Ther should be a reliable and adequate electrical supply and emergency lighting to permit safe exit. A stand-by generator is desirable for the support of essential equipment such as incubators, biological safety cabinets, freezers, etc., and for the ventilation of animal cages (no animal cages are being planned for the HKSPX2 project).

Gas:

There should be a reliable and adequate supply of gas. Good maintanance of the installation is mandatory.

Security:

Laboratories are occasionally targets of vandals. Physical and fire security must be considered. Strong doors, screened windows (if any) and restricted issue of keys are compulsory. Other measures should be considerd and applied. See chapter 9 of the manual.

Safety Shower:

Safety Shower/Eyewash shall be provided in each BSL2 Lab Suite.

BSL3 Lab Design Criteria

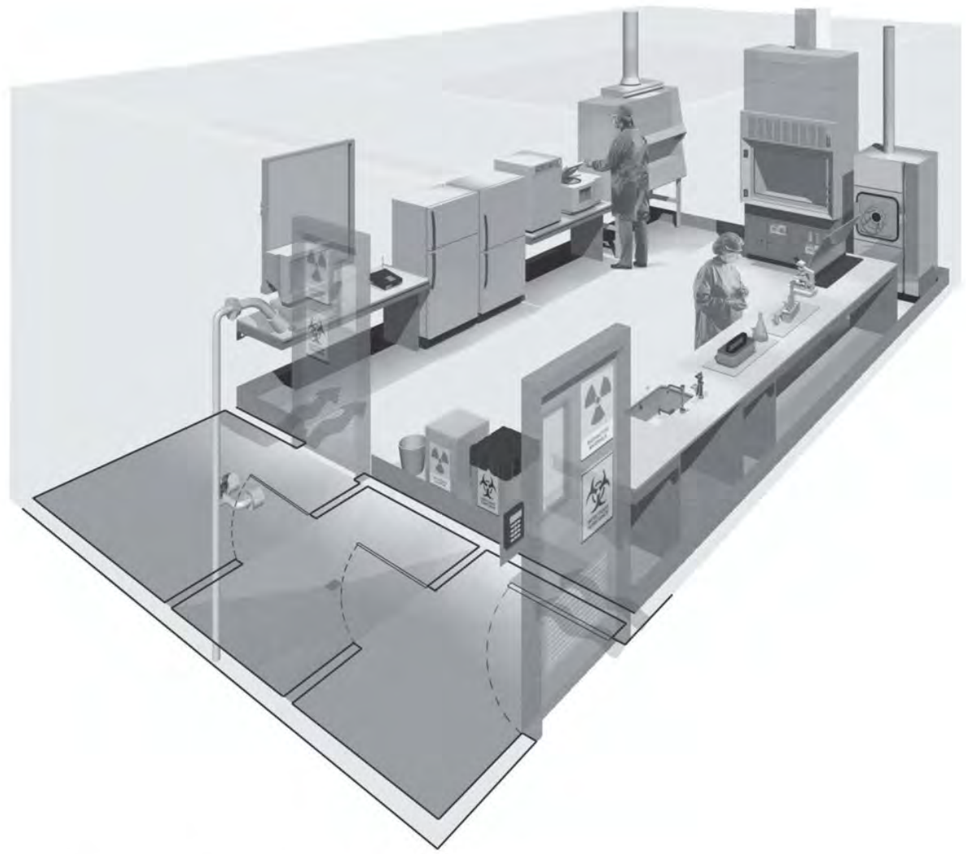


Figure 4. ***A typical Biosafety Level 3 laboratory***

Laboratory Biosafety Manual:

Biosafety levels shall conform to the guidelines published in the World Health Organization *Laboratory Biosafety Manual*, Third Edition, 2004. Biosafety Level 3 requirements are noted on pages 21 and 22 of the manual, and are summarized here as follows:

Biosafety Level 2:

All features of the Biosafety Level 2 design apply to Biosafety Level 3, unless noted here below in the additional requirements for BSL3.

Access:

The laboratory must be separated from the areas that are open to unrestricted traffic flow within the building. Additional separation may be achieved by placing the laboratory at the blind end of a corridor, or constructing a partition and door or access through an anteroom. The anteroom should have facilities for separating clean and dirty clothing. Anteroom doors may be self-closing and interlocking to that only one door is open at a time. A break-through panel may be provided for emergency exit use.

Sealed openings:

Openings around electrical conduit and piping entering the BSL3 lab suite must be sealed and must facilitiate decontamination, using smoke pencil testing. This shall include epoxy plugs and silicone sealant around outlets, light fixtures, escutcheon plates, etc.
The laboratory must be designed so that it can be decontaminated with gas decontamination. Air-ductin systems must be designed so that the laboratory can have gaseous decontamination. Windows must be closed, sealed, and break-resistant.

Handwashing:

A handwash station with hands-free controls should be provided near the exit door.

Ventilation:

There must be a controlled ventilation system that maintains a directional airflow into the laboratory room. A visual monitoring device with or without alarms(s) should be installed so that staff can at all times ensure that proper directional airflow into the laboratory is maintained (ping pong ball pressure indicator or similar).
The ventilation system must be constructed so that air from the containment laboratory, Biosafety Level 3, is not recirculated to other areas within the building. This is best achieved through a dedicated exhaust sytem for the BSL3 unit. Air may be HEPA filtered, reconditioned, and recirculated only within a single laboratory unit. When exhaust air from the BSL3 laboratory is discharged to the outside of the building, it must be dispersed away from occupied buildings and air intakes. Control alarms should notify personnel of HVAC system failure.

Biological Safety Cabinets:

Biological safety cabinets (BSC) should be located away from walking areas and out of cross-currents from doors and ventilation systems. The exhaust air from BSC's must be discharged in such a way as to avoid interference with the air balance of the cabinet or the building exhaust system.

Lab Casework:

All lab casework in BSL3 lab units shall be epoxy powder coat metal. Work surfaces shall be epoxy resin.

BSL3 LAB DESIGN CRITERIA (continued)

BSL3 Research Laboratory

Autoclave:

An autoclave for decontamination of contaminated waste material should be available in the containment laboratory.

Water Backflow:

Backflow prevention devices must be fitted to the water supply. Vacuum lines should be protected with liquid disinfectant traps and HEPA filters, or their equivalent.

Vacuum:

Central vacuum system for BSL3 labs must be a separate and stand alone system from the building general vacuum system.

Design Documentation:

The BSL3 laboratory design and operational procedures should be documented.

Note: Limitations of BSL3 Lab Design:

There are "enhanced" design features beyond a standard BSL3 design requirement, which are not included in the design noted herein. These enhanced features include:

- **Ante room for clean storage of equipment and supplies with dress-in/shower-out capability (personnel shower facilities).**
- **Gas tight dampers to facilitate laboratory isolation.**
- **Final HEPA filtration on the BSL3 laboratory exhaust at the roof.**
- **Laboratory effluent decontamination.**
- **Advance access control devices, such as biometrics.**

ENGINEERING LAB DESIGN CRITERIA

Engineering High Bay Laboratory
Whiting School of Engineering
Johns Hopkins University
Baltimore, Maryland

HVAC Air:

The Engineering lab prototypes in Buildings 20E-A and 22E-A are designed to allow for recirculation of lab air, not 100% exhaust. The existing building infrastructure does not allow for lab exhaust to the roof of these buildings. The HVAC air systems in Buildings 20E-A and 22E-A will be similar to office design, with recirculation of air, and no 100% exhaust.

Non-Chemical Use; No Chemical Fume Hoods:

Because of the lack of exhaust shaft space, the Engineering labs in Buldings 20E-A and 22E-A do not accommodate the use and storage of chemicals, and therefore the use of chemical fume hoods.

Point-of-Use Exhaust Devices:

Lab tenants in the Engineering Labs in Buildings 20E-A and 22E-A may use local point-of-use exhaust devices, such as snorkel units, where required for the dissipation of very small amounts of chemical fumes, and/or dust or soldering applications, such as in Electrical Engineering.

Engineering Labs in Buildings 12W-A and 16E-A:

Engineering labs in Buildings 12W-A and 16E-A may have chemical use/storage, and chemical fume hoods.