GBRMC

Laboratory Design Process

Student Guide

2013

GLOBAL BIORISK MANAGEMENT CURRICULUM


Laboratory Design Process
GLOBAL BIORISK MANAGEMENT
CURRICULUM
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Introductions
• Instructors
• Students
– Your name?
– Where are you from?
Slide 2

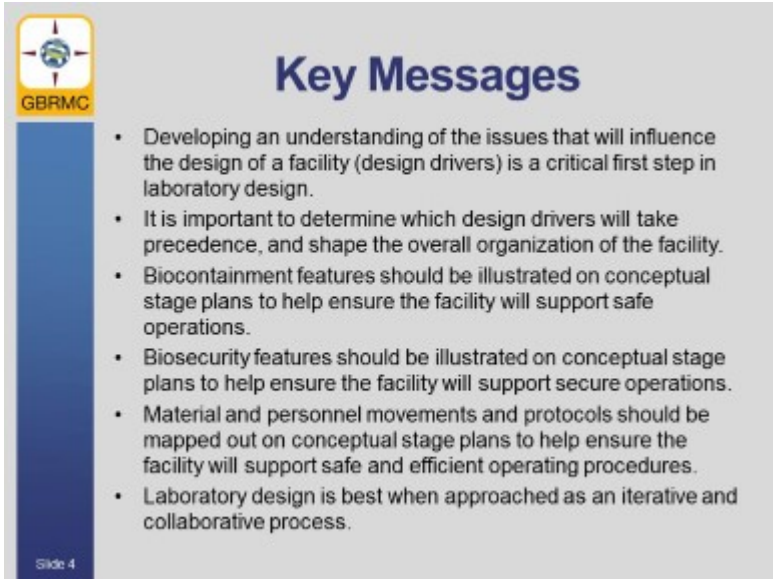
Action Plan

By the end of this lesson, I would like to:					
KNOW		FEEL		BE ABLE TO DO	

Your learning doesn't stop with this lesson. Use this space to think about what else you need to do or learn to put the information from this lesson into practice.

What more do I need to know or do?	How will I acquire the knowledge or skills?	How will I know that I've succeeded?	How will I use this new learning in my job?

Use space on back, if needed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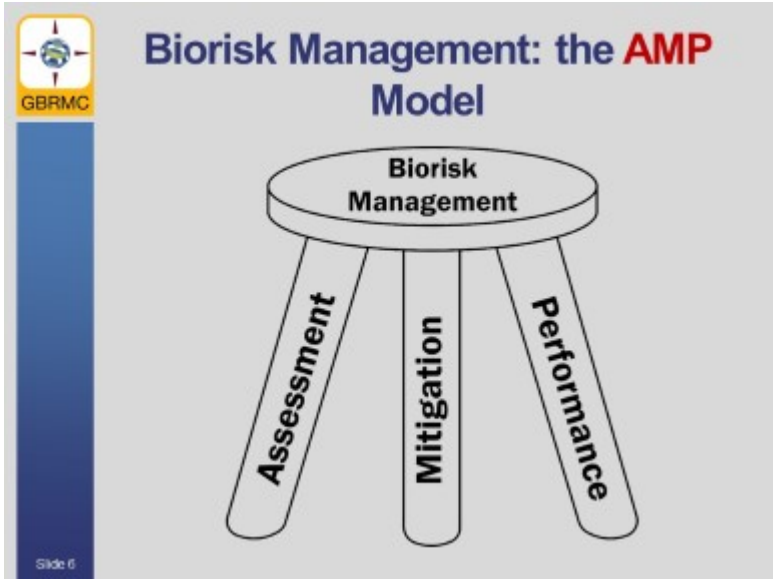
Key Messages
• Developing an understanding of the issues that will influence the design of a facility (design drivers) is a critical first step in laboratory design.
• It is important to determine which design drivers will take precedence, and shape the overall organization of the facility.
• Biocontainment features should be illustrated on conceptual stage plans to help ensure the facility will support safe operations.
• Biosecurity features should be illustrated on conceptual stage plans to help ensure the facility will support secure operations.
• Material and personnel movements and protocols should be mapped out on conceptual stage plans to help ensure the facility will support safe and efficient operating procedures.
• Laboratory design is best when approached as an iterative and collaborative process.
Slide 4

Notes: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Biorisk Management: the AMP Model
Biorisk Management
Assessment
Mitigation
Performance
Slide 6

Notes:

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Key Components of Biorisk Management

- Biorisk **Assessment**
  - Process of identifying the hazards and evaluating the risks associated with biological agents and toxins, taking into account the adequacy of any existing controls, and deciding whether or not the risks are acceptable

Slide 6

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Key Components of Biorisk Management

- Biorisk **Mitigation**
  - Actions and control measures that are put into place to reduce or eliminate the risks associated with biological agents and toxins

Slide 7


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Key Components of Biorisk Management
• Biorisk **Performance**
– Improving biorisk management by recording, measuring, and evaluating organizational actions and outcomes to reduce biorisk.


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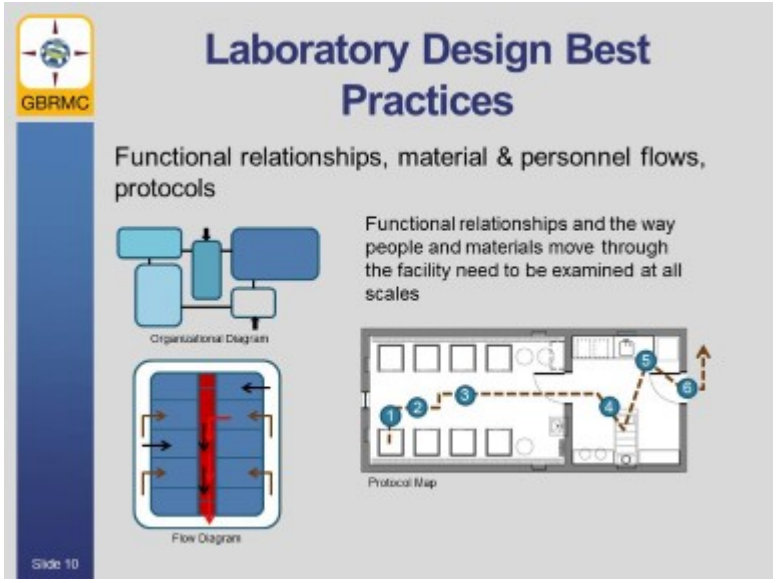
Laboratory Design Process
This course is designed to aid in Biorisk Management by promoting good bioscience lab design practices.
Slide 9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Laboratory Design Best Practices
Functional relationships, material & personnel flows, protocols
Functional relationships and the way people and materials move through the facility need to be examined at all scales
Organizational Diagram
Flow Diagram
Protocol Map
Slide 10

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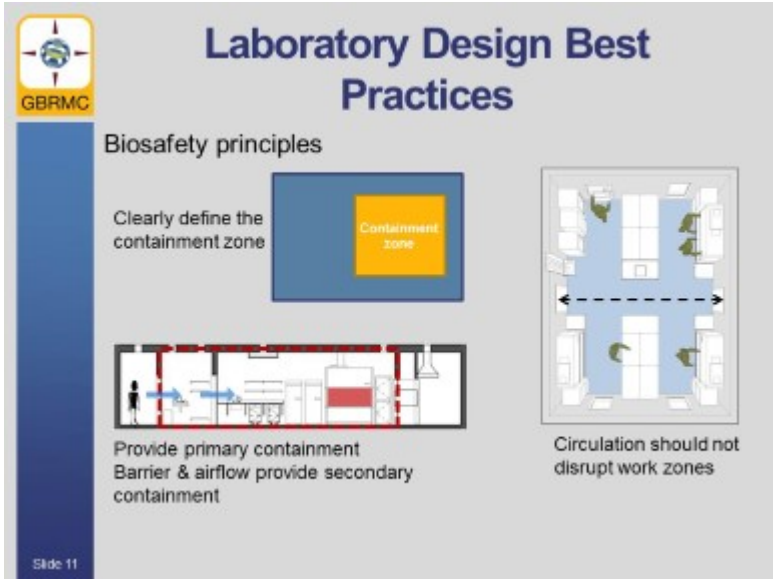
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Laboratory Design Best Practices
Biosafety principles
Clearly define the containment zone
Containment zone
Provide primary containment
Barrier & airflow provide secondary containment
Circulation should not disrupt work zones
Slide 11

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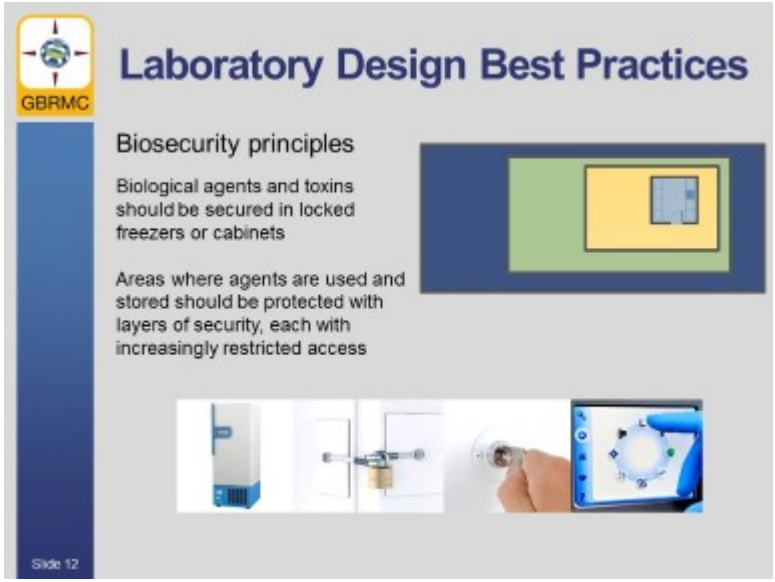
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Laboratory Design Best Practices
Biosecurity principles
Biological agents and toxins should be secured in locked freezers or cabinets
Areas where agents are used and stored should be protected with layers of security, each with increasingly restricted access
Slide 12

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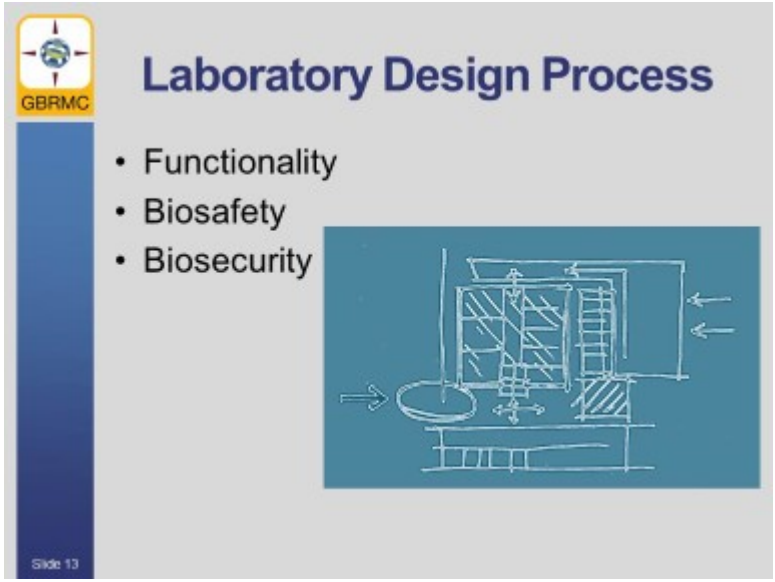
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Laboratory Design Process
• Functionality
• Biosafety
• Biosecurity
Slide 13

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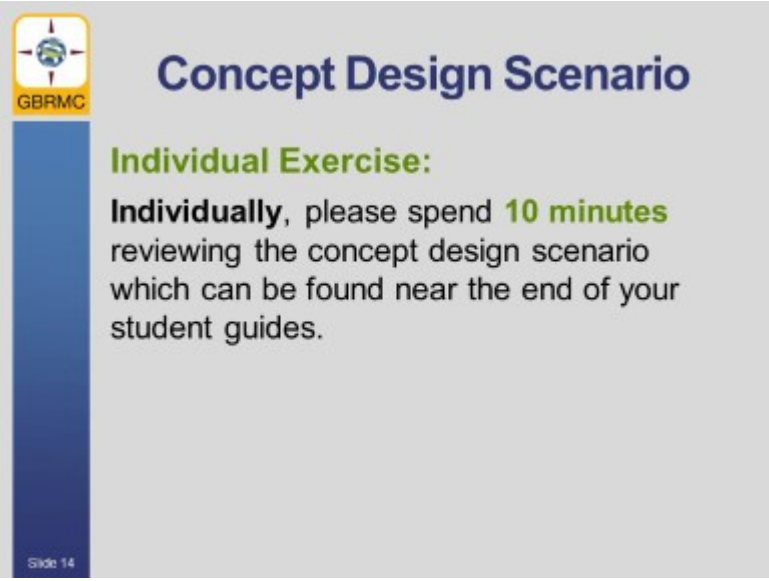
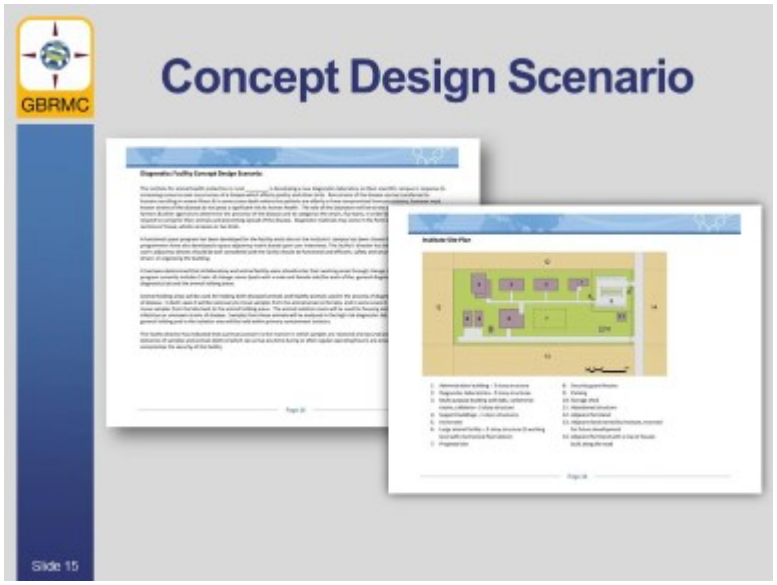

GBRMC
Concept Design Scenario
Individual Exercise:
Individually, please spend 10 minutes reviewing the concept design scenario which can be found near the end of your student guides.
Slide 14

Notes: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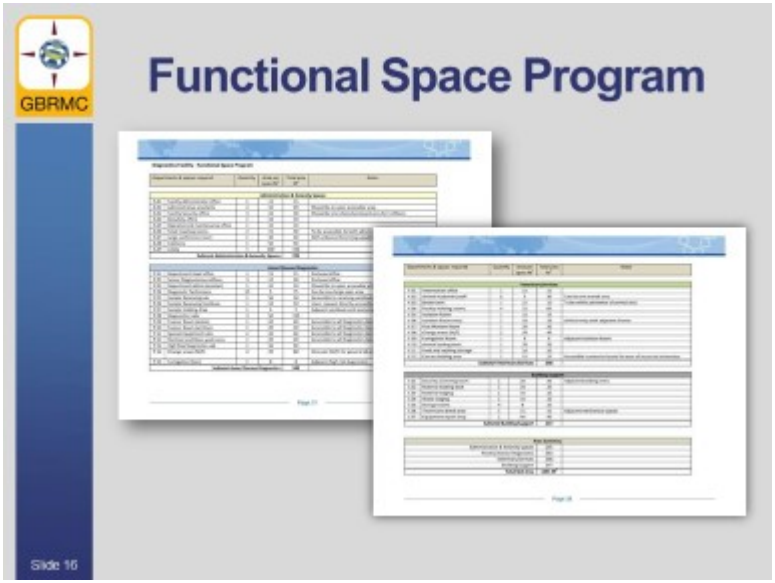
Concept Design Scenario
Slide 15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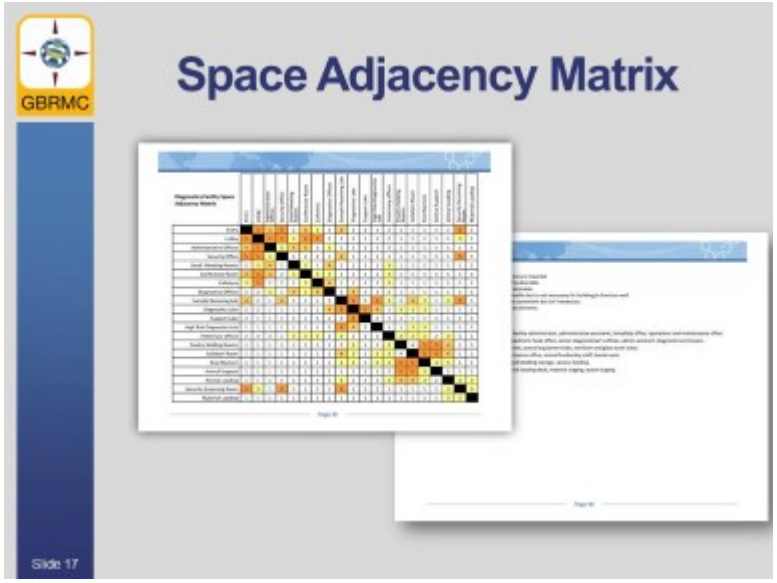
Functional Space Program
Slide 16



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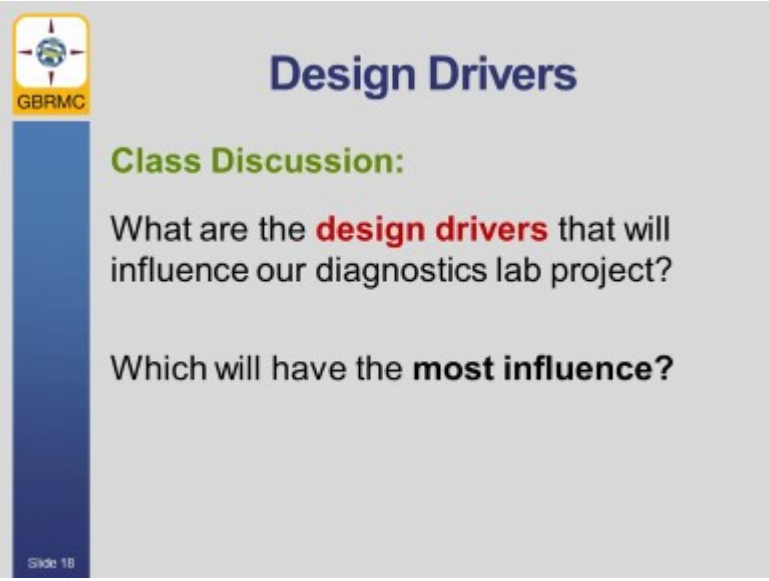
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Design Drivers
Class Discussion:
What are the design drivers that will influence our diagnostics lab project?
Which will have the most influence?
Slide 18

Notes:


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Organizational Strategy
• Sample Organizational Diagram
Science Offices (high r.)
Science Offices (low r.)
Admin Offices
Entry / Security
Amenity Spaces
Low Risk Labs
Lab Support
High Risk Labs
Vet. Offices
High Risk Animal Holding
Animal Program Support
Low Risk Animal Holding
Material, Waste Handling
Animal Loading
Slide 19

Notes:


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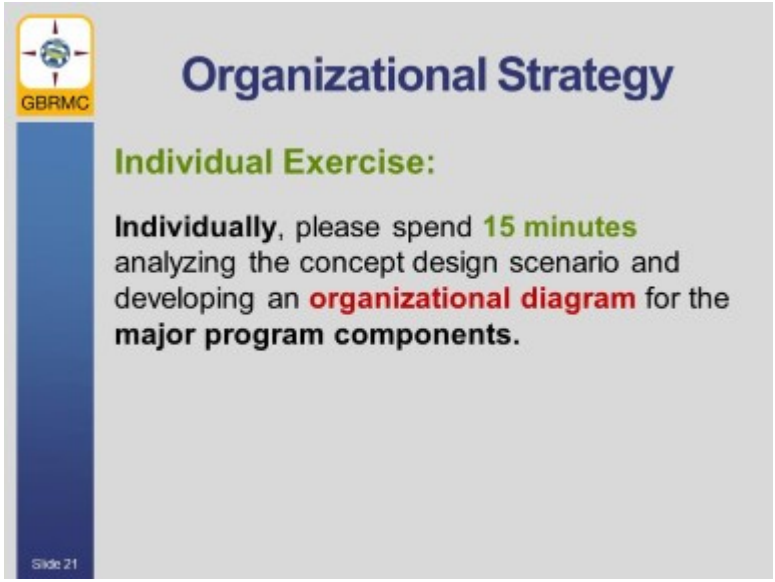
Organizational Strategy
Basic Program Components for Diagrams
Diagnostics Labs
Lab Support
Diagnostics Offices
High Risk Diagnostics Lab
Sample Receiving Lab
Lobby
Admin Offices
Cafeteria
Conference Room
Material Loading
Poultry Holding
Veterinary Offices
Animal Support
Isolation Room
Animal Loading
Security Screening
Slide 20

Notes: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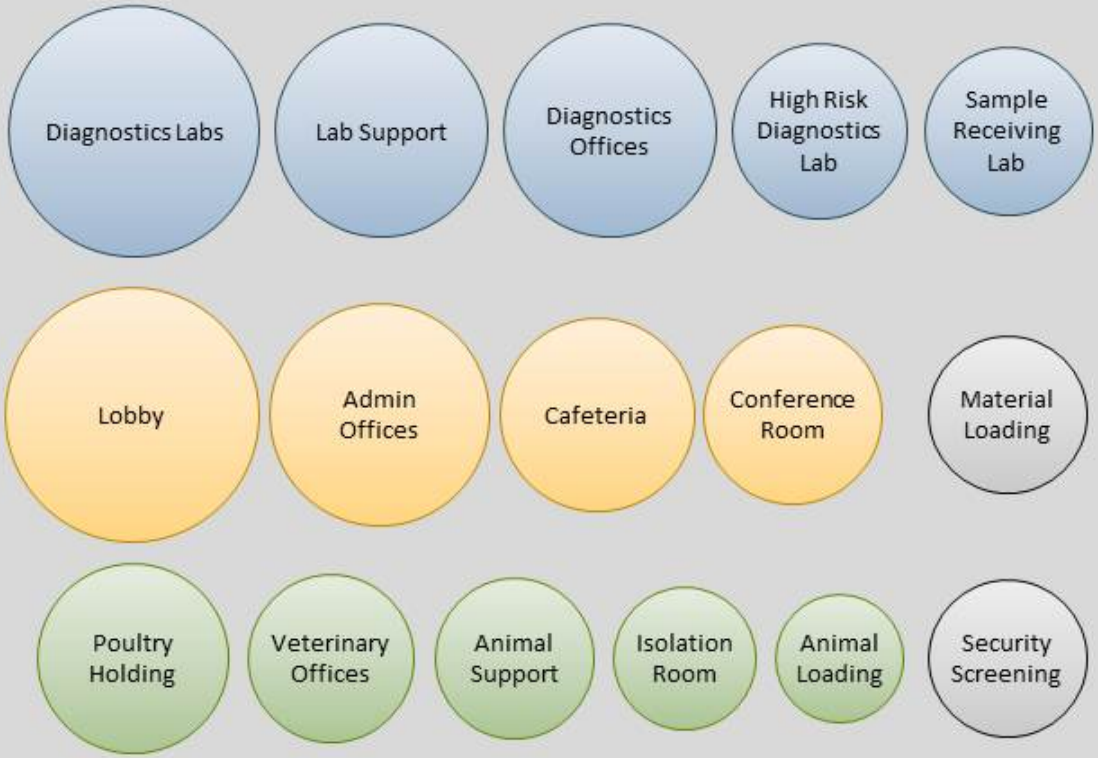
Organizational Strategy
Individual Exercise:
Individually, please spend 15 minutes analyzing the concept design scenario and developing an organizational diagram for the major program components.
Slide 21

Notes:

Organizational Strategy

Basic Program Components for Diagrams



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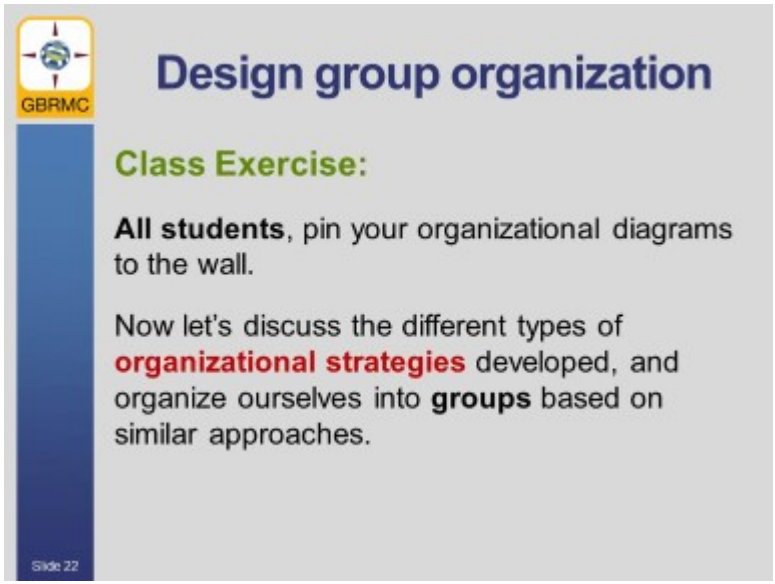
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Design group organization
Class Exercise:
All students, pin your organizational diagrams to the wall.
Now let's discuss the different types of organizational strategies developed, and organize ourselves into groups based on similar approaches.
Slide 22


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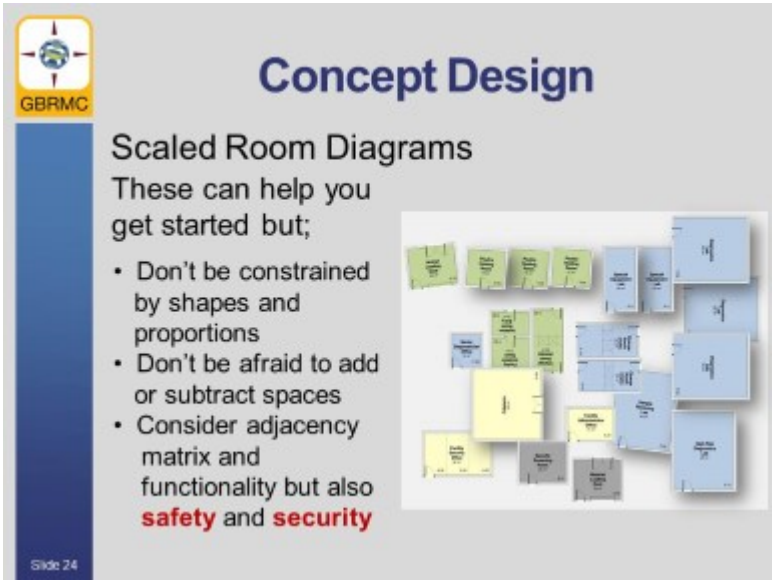
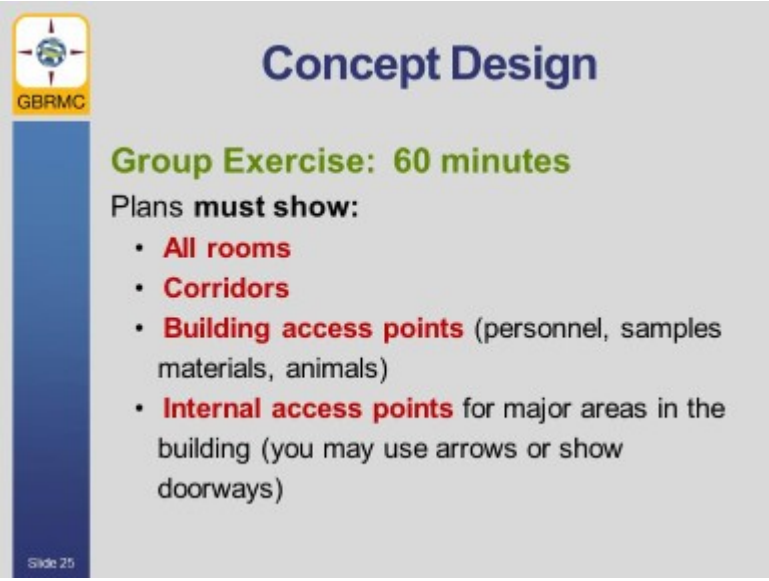
Concept Design
Group Exercise:
In your groups, please spend 60 minutes developing a conceptual plan for the diagnostics facility.
Discuss the important design drivers as you work.
Use scaled room diagrams as a guide for areas. Proportions can be altered.
Slide 23


GBRMC
Concept Design
Scaled Room Diagrams
These can help you get started but;
• Don't be constrained by shapes and proportions
• Don't be afraid to add or subtract spaces
• Consider adjacency matrix and functionality but also safety and security
Slide 24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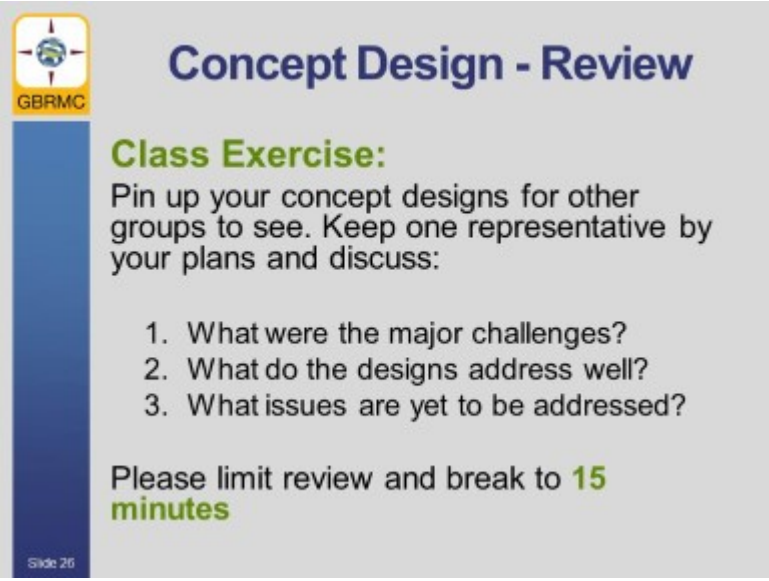
Concept Design
Group Exercise: 60 minutes
Plans must show:
All rooms
Corridors
Building access points (personnel, samples materials, animals)
Internal access points for major areas in the building (you may use arrows or show doorways)
Slide 25

Notes: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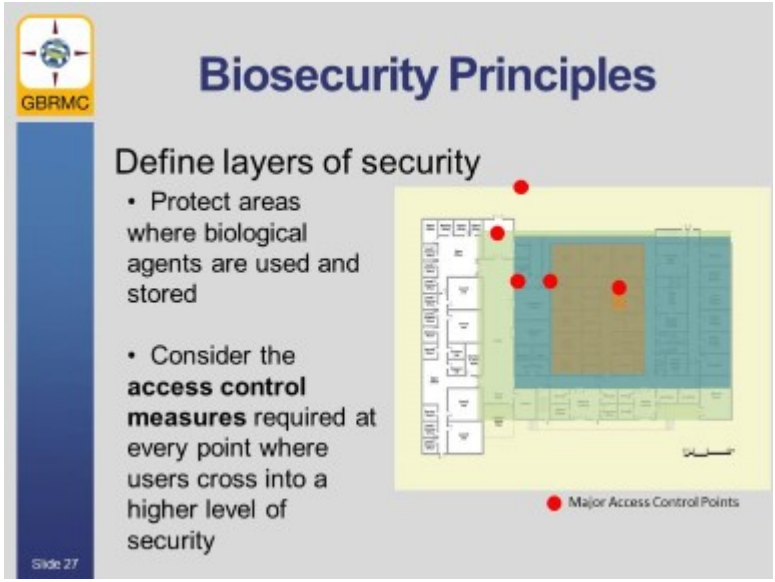
Concept Design - Review
Class Exercise:
Pin up your concept designs for other groups to see. Keep one representative by your plans and discuss:
1. What were the major challenges?
2. What do the designs address well?
3. What issues are yet to be addressed?
Please limit review and break to 15 minutes
Slide 26

Notes: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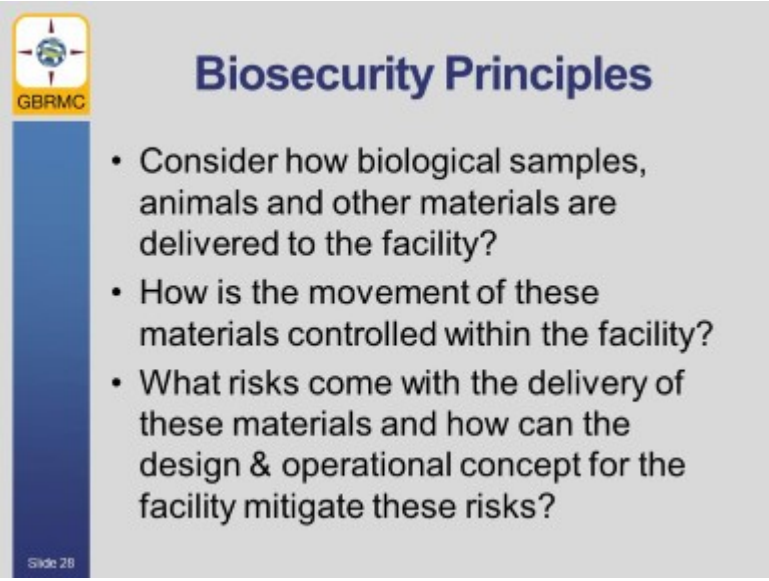
Biosecurity Principles
Define layers of security
• Protect areas where biological agents are used and stored
• Consider the **access control measures** required at every point where users cross into a higher level of security
Major Access Control Points
Slide 27

Notes: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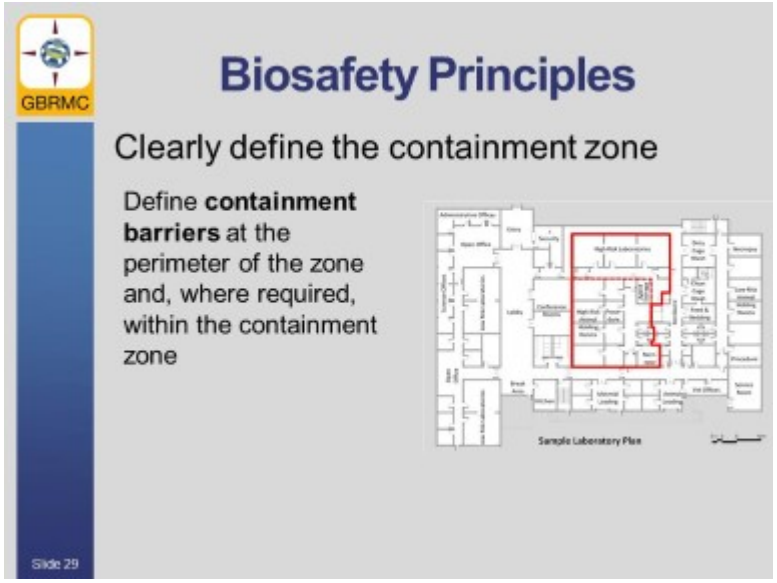
Biosecurity Principles
• Consider how biological samples, animals and other materials are delivered to the facility?
• How is the movement of these materials controlled within the facility?
• What risks come with the delivery of these materials and how can the design & operational concept for the facility mitigate these risks?
Slide 28

Notes: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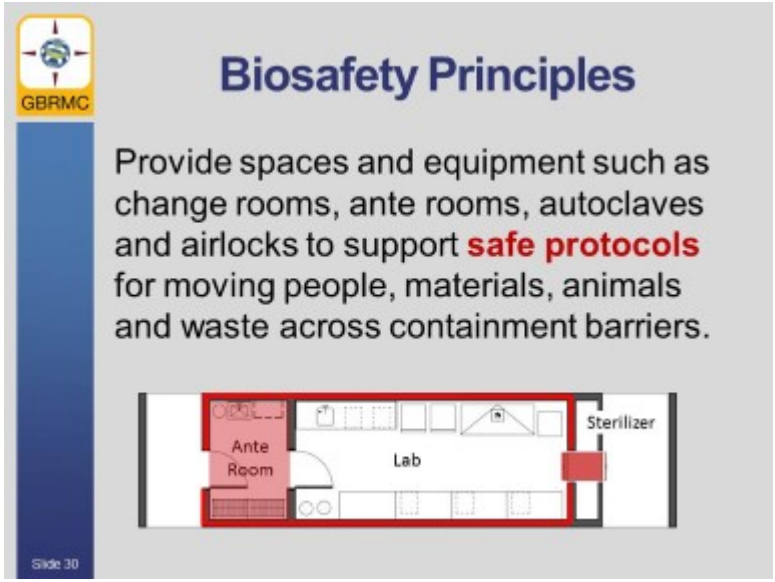
Biosafety Principles
Clearly define the containment zone
Define **containment barriers** at the perimeter of the zone and, where required, within the containment zone
Sample Laboratory Plan
Slide 29

Notes: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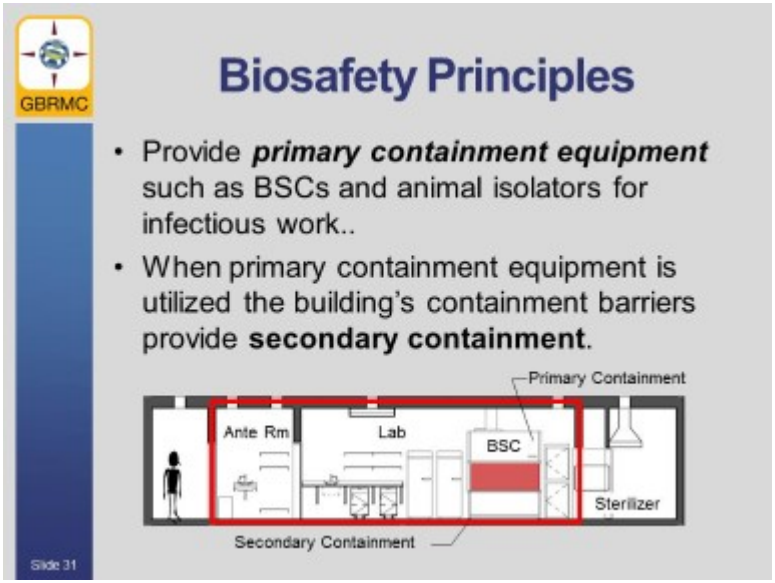
Biosafety Principles
Provide spaces and equipment such as change rooms, ante rooms, autoclaves and airlocks to support safe protocols for moving people, materials, animals and waste across containment barriers.
Ante Room
Lab
Sterilizer
Slide 30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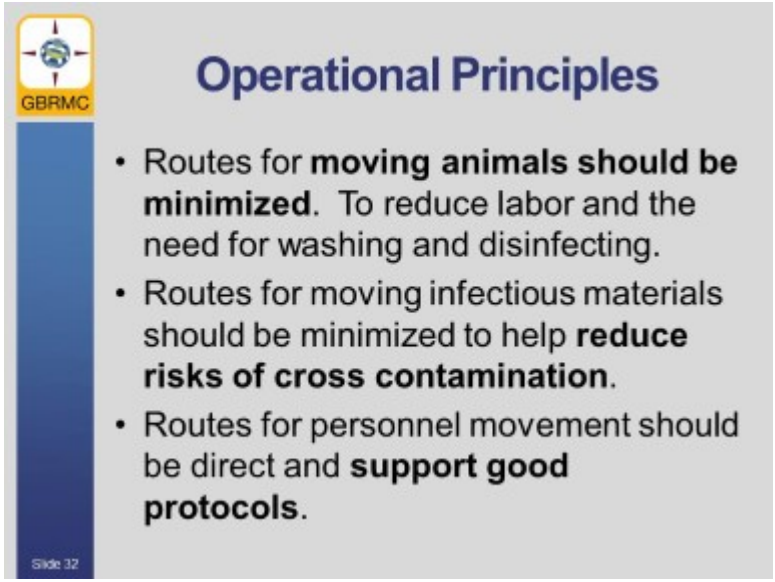
Biosafety Principles
• Provide *primary containment equipment* such as BSCs and animal isolators for infectious work..
• When primary containment equipment is utilized the building's containment barriers provide **secondary containment**.
Primary Containment
Ante Rm
Lab
BSC
Sterilizer
Secondary Containment
Slide 31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Operational Principles
• Routes for moving animals should be minimized. To reduce labor and the need for washing and disinfecting.
• Routes for moving infectious materials should be minimized to help reduce risks of cross contamination.
• Routes for personnel movement should be direct and support good protocols.
Slide 32

Notes:


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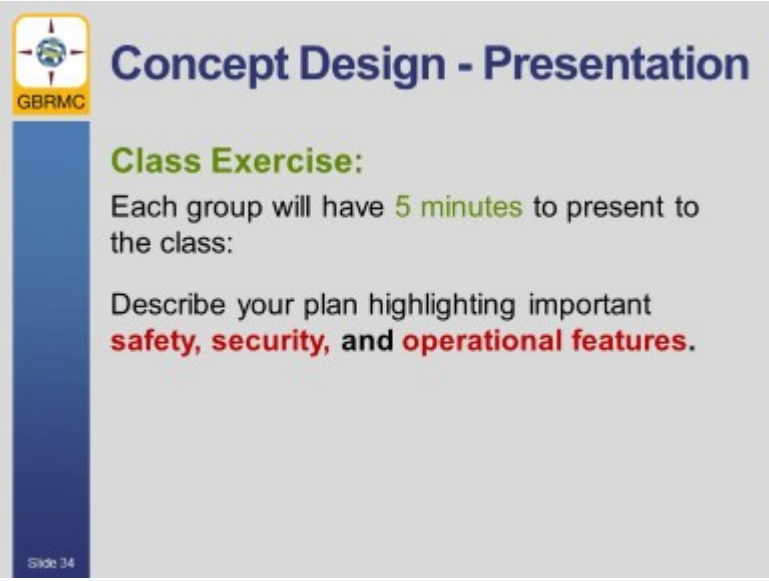
Concept Design - Refinement
Group Exercise:
In your groups, please spend 50 minutes revising your plan as necessary and illustrating:
• Personnel Flow – with major protocol points
• Sample Flow
• Containment Zones and Barriers
• Security Zones – with major access control points
Slide 33

Notes: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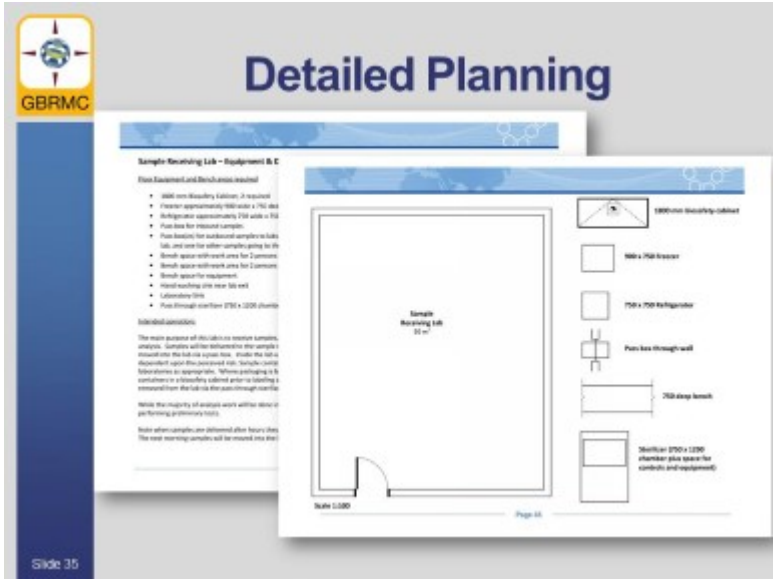
Concept Design - Presentation
Class Exercise:
Each group will have 5 minutes to present to the class:
Describe your plan highlighting important safety, security, and operational features.
Slide 34

Notes: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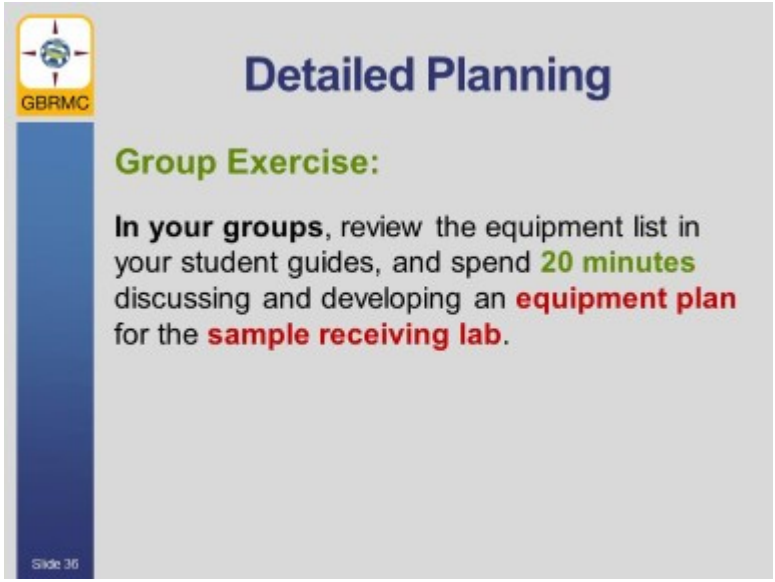
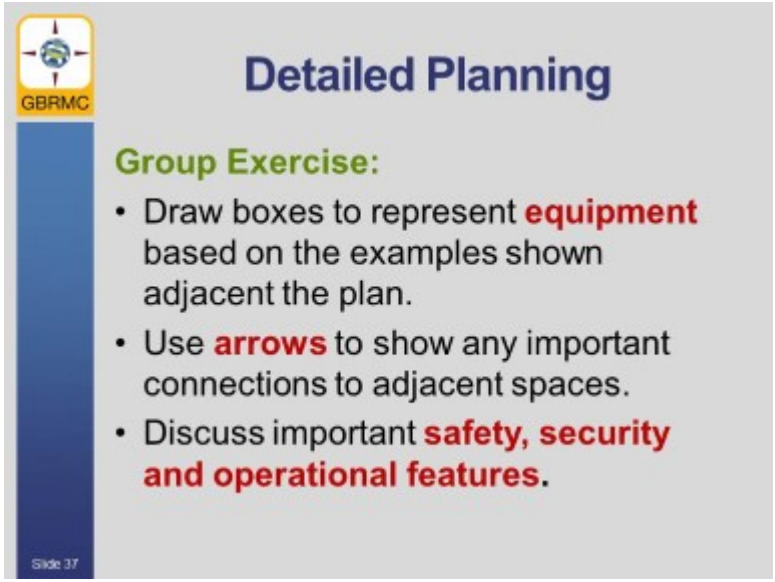
Detailed Planning
Slide 35


GBRMC
Detailed Planning
Group Exercise:
In your groups, review the equipment list in your student guides, and spend 20 minutes discussing and developing an equipment plan for the sample receiving lab.
Slide 36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Detailed Planning
Group Exercise:
• Draw boxes to represent equipment based on the examples shown adjacent the plan.
• Use arrows to show any important connections to adjacent spaces.
• Discuss important safety, security and operational features.
Slide 37


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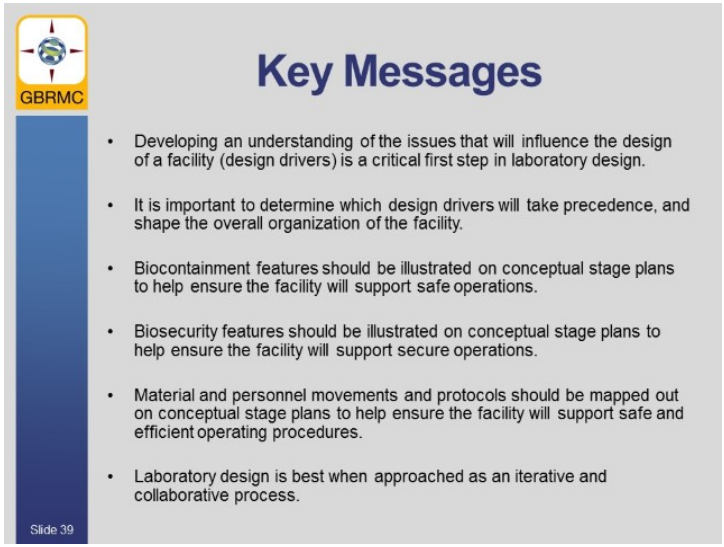
Review
To wrap-up, let's discuss what we learned about the Laboratory Design Process
What did we learn?
What does it mean?
Where do we go from here?
Slide 38

Notes:



- Developing an understanding of the issues that will influence the design of a facility (design drivers) is a critical first step in laboratory design.
- It is important to determine which design drivers will take precedence, and shape the overall organization of the facility.
- Biocontainment features should be illustrated on conceptual stage plans to help ensure the facility will support safe operations.
- Biosecurity features should be illustrated on conceptual stage plans to help ensure the facility will support secure operations.
- Material and personnel movements and protocols should be mapped out on conceptual stage plans to help ensure the facility will support safe and efficient operating procedures.
- Laboratory design is best when approached as an iterative and collaborative process.

Remember your action plan!

Action Plan

By the end of this lesson, I would like to:					
KNOW		FEEL		BE ABLE TO DO	

Your learning doesn't stop with this lesson. Use this space to think about what else you need to do or learn to put the information from this lesson into practice.

What more do I need to know or do?	How will I acquire the knowledge or skills?	How will I know that I've succeeded?	How will I use this new learning in my job?

Use space on back, if needed


Thank You!
Don't forget to complete your evaluation!
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Diagnostics Facility Concept Design Scenario.

The institute for animal health protection in rural _____ is developing a new diagnostics laboratory on their scientific campus in response to increasing concerns over occurrences of a disease which affects poultry and other birds. Rare strains of the disease can be transferred to humans resulting in severe illness & in some cases death where the patients are elderly or have compromised immune systems, however most known strains of the disease do not pose a significant risk to human health. The role of the laboratory will be to test samples delivered by local farmers & other agencies to determine the presence of the disease and to categorize the strain, if present, in order to direct the farmers with respect to caring for their animals and preventing spread of the disease. Diagnostic materials may come in the form of blood or fecal samples, sections of tissue, whole carcasses or live birds.

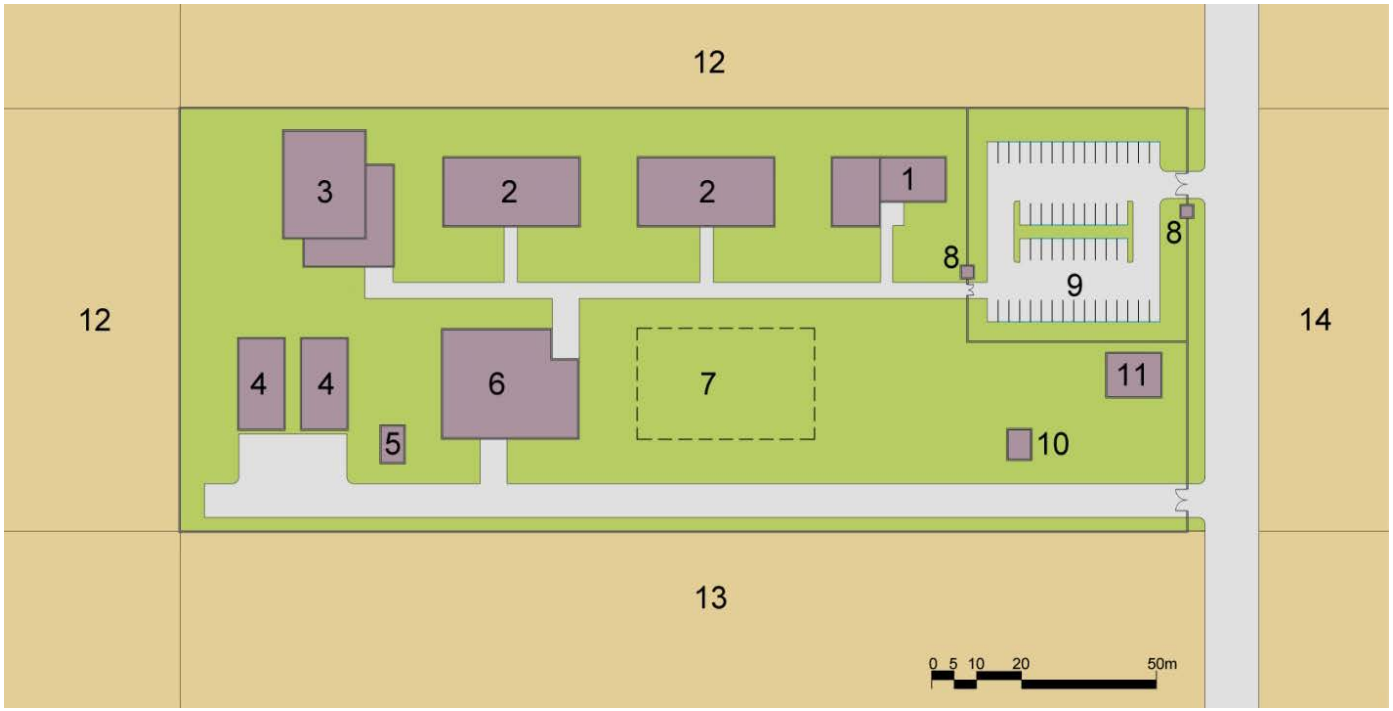
A functional space program has been developed for the facility and a site on the institute's campus has been chosen for the building. The facility programmers have also developed a space adjacency matrix based upon user interviews. The facility's director has indicated that while the user's adjacency desires should be well considered and the facility should be functional and efficient, safety and security should be the primary drivers in organizing the building.

It has been determined that all laboratory and animal facility users should enter their working areas through change rooms with showers. The program currently includes 3 sets of change rooms (each with a male and female side) for each of the; general diagnostics area, high risk diagnostics lab and the animal holding areas.

Animal holding areas will be used for holding both diseased animals and healthy animals used in the process of diagnosing and identifying strains of disease. In both cases it will be necessary to move samples from the animal areas to the labs, and in some cases it will also be necessary to move samples from the labs back to the animal holding areas. The animal isolation room will be used for housing animals diseased with highly infectious or unknown strains of disease. Samples from these animals will be analyzed in the high risk diagnostics lab. Animals in both the general holding and in the isolation area will be held within primary containment isolators.

The facility director has indicated that a primary concern is the manner in which samples are received and secured and wants to ensure that deliveries of samples and animals (both of which can arrive any time during or after regular operating hours) are properly addressed and do not compromise the security of the facility.

Institute Site Plan



1. Administration building – 2 story structure
2. Diagnostics laboratories - 2 story structures
3. Multi purpose building with labs, conference rooms, cafeteria – 3 story structure
4. Support buildings – 1 story structures
5. Incinerator
6. Large animal facility – 2 story structure (1 working level with mechanical floor above)
7. Proposed site
8. Security guard houses
9. Parking
10. Storage shed
11. Abandoned structure
12. Adjacent farmland
13. Adjacent land owned by institute, reserved for future development
14. Adjacent farmland with a row of houses built along the road

Diagnostics Facility - Functional Space Program

	Departments & spaces required	Quantity	Area per space M^2	Total area M^2	Notes
Administration & Amenity Spaces					
A.01	Facility Administrator office	1	15	15	
A.02	Administrative assistants	2	10	20	Should be in open accessible area
A.03	Facility Security office	3	10	30	Should be one shared enclosed area for 3 officers
A.04	Biosafety office	1	10	10	
A.05	Operations & maintenance office	1	10	10	
A.06	Small meeting rooms	2	15	30	To be accessible to both administrative and scientific offices
A.07	Large conference room	1	30	30	With videoconferencing capability
A.08	Cafeteria	1	50	50	
A.09	Lobby	1	100	100	
	Subtotal Administration & Amenity Spaces			**295**	
Avian Disease Diagnostics					
P.01	Department Head office	1	15	15	Enclosed office
P.02	Senior Diagnosticians offices	3	10	30	Enclosed office
P.03	Department Admin Assistant	1	10	10	Should be in open accessible area
P.04	Diagnostic Technicians	15	5	75	Can be one large open area
P.05	Sample Receiving Lab	1	50	50	Accessible to receiving vestibule
P.06	Sample Receiving Vestibule	1	10	10	Users request directly accessible to exterior if possible
P.07	Sample Holding Area	1	5	5	Adjacent vestibule and receiving lab
P.08	Diagnostics Labs	3	50	150	
P.09	Freezer Room (active)	1	20	20	Accessible to all Diagnostics labs
P.10	Freezer Room (archive)	1	20	20	Accessible to all Diagnostics labs
P.11	Special Equipment Labs	2	20	40	Accessible to all Diagnostics labs
P.12	Sterilizer and Glass wash area	1	20	20	Accessible to all Diagnostics labs
P.13	High Risk Diagnostics Lab	1	50	50	
P.14	Change areas (M/F)	4	20	80	One pair (M/F) for general lab areas, the other for high risk area
P.15	Fumigation Room	1	8	8	Adjacent high risk diagnostics
	Subtotal Avian Disease Diagnostics			**583**	

Departments & spaces required		Quantity	Area per space M^2	Total area M^2	Notes
Veterinary Services					
V.01	Veterinarian office	1	15	15	
V.02	Animal husbandry staff	6	5	30	Can be one shared area
V.03	Break room	1	15	15	To be within perimeter of animal area
V.04	Poultry Holding rooms	4	15	60	
V.05	Isolation Room	1	15	15	
V.06	Isolation Room entry	1	10	10	Airlock entry with adjacent shower
V.07	Post Mortem Room	1	20	20	
V.08	Change areas (M/F)	2	20	40	
V.09	Fumigation Room	1	8	8	Adjacent Isolation Room
V.10	Animal loading dock	1	20	20	
V.11	Feed and bedding storage	2	10	20	
V.12	Carcass holding area	1	15	15	Accessible to exterior locate for ease of access to incinerator
Subtotal Veterinary Services				**268**	
Building Support					
S.01	Security screening room	1	20	20	Adjacent building entry
S.02	Material loading dock	1	20	20	
S.03	Material staging	1	10	10	
S.04	Waste staging	1	10	10	
S.05	Storage rooms	4	8	32	
S.06	Technicians break area	1	15	15	Adjacent mechanical spaces
S.07	Equipment repair shop	1	40	40	
Subtotal Building Support				**147**	

Area Summary		
Administration & Amenity Spaces	295	
Poultry Disease Diagnostics	583	
Veterinary Services	268	
Building Support	147	
Total Net Area	**1293 M^2**	

Diagnostics Facility Space Adjacency Matrix

	Entry	Lobby	Administrative Offices	Security Office	Small Meeting Rooms	Conference Room	Cafeteria	Diagnostics Offices	Sample Receiving Lab	Diagnostics Labs	Support Labs	High Risk Diagnostics Lab	Veterinary offices	Poultry Holding Rooms	Isolation Room	Post Mortem	Animal Support	Animal Loading	Security Screening Room	Material Loading
Entry		5	4	5	2	4	3	2	4	2	2	1	2	1	1	1	1	1	5	1
Lobby	5		5	5	3	5	5	2	2	2	1	1	2	1	1	1	1	1	3	1
Administrative Offices	4	5		3	4	4	2	3	1	1	1	1	2	1	1	1	1	1	1	1
Security Office	5	5	3		2	2	2	1	4	1	1	1	1	1	1	1	1	1	5	1
Small Meeting Rooms	2	3	4	2		3	1	4	1	1	1	1	3	1	1	1	1	1	1	1
Conference Room	4	5	4	2	3		3	3	1	1	1	1	3	1	1	1	1	1	1	1
Cafeteria	3	5	2	2	1	3		4	1	1	1	1	3	1	1	1	1	1	1	1
Diagnostics Offices	2	2	3	1	4	3	4		3	4	1	1	2	1	1	1	1	1	1	1
Sample Receiving Lab	4	2	1	4	1	1	1	3		5	2	5	3	2	4	3	1	3	5	1
Diagnostics Labs	2	2	1	1	1	1	1	4	5		5	4	1	3	3	3	1	1	1	1
Support Labs	2	1	1	1	1	1	1	1	2	5		2	1	1	1	1	1	1	1	1
High Risk Diagnostics Lab	1	1	1	1	1	1	1	1	5	4	2		1	1	3	3	1	1	1	1
Veterinary offices	2	2	2	1	3	3	3	2	3	1	1	1		3	3	3	2	3	1	1
Poultry Holding Rooms	1	1	1	1	1	1	1	1	2	3	1	1	3		4	5	5	4	1	1
Isolation Room	1	1	1	1	1	1	1	1	4	3	1	3	3	4		5	5	4	1	1
Post Mortem	1	1	1	1	1	1	1	1	3	3	1	3	3	5	5		3	3	1	1
Animal Support	1	1	1	1	1	1	1	1	1	1	1	1	2	5	5	3		2	1	1
Animal Loading	1	1	1	1	1	1	1	1	3	1	1	1	3	4	4	3	2		3	3
Security Screening Room	5	3	1	5	1	1	1	1	5	1	1	1	1	1	1	1	1	3		3
Material Loading	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	3	3	

5 = Very strong relationship, close adjacency is required.
4 = Strong relationship, adjacency is highly desirable.
3 = Moderate relationship, adjacency is desirable.
2 = Minor relationship, adjacency has benefits but is not necessary for building to function well.
1 = Weak relationship, adjacency may be convenient but isn't necessary.
0 = No adjacency required between these elements.

Notes

A. Administrative offices includes: facility administrator, administrative assistants, biosafety office, operations and maintenance office.
B. Diagnostics offices includes: Department head office, senior diagnostician's offices, admin assistant, diagnostic technicians.
C. Support labs include: freezer rooms, special equipment labs, sterilizer and glass wash areas.
D. Veterinary offices include: Veterinarian office, animal husbandry staff, break room.
E. Animal support includes: Feed and bedding storage, carcass holding.
F. Material loading includes: Material loading dock, material staging, waste staging.

Sample Receiving Lab – Equipment & Detailed Planning Criteria

Floor Equipment and Bench areas required

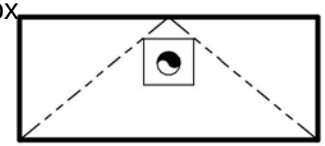
- 1800 mm Biosafety Cabinet, 2 required
- Freezer approximately 900 wide x 750 deep, 2 required
- Refrigerator approximately 750 wide x 750 deep, 2 required
- Pass box for inbound samples
- Pass box(es) for outbound samples to labs (note if there is a connection to the high risk diagnostics lab provide one pass box into that lab, and one for other samples going to the general diagnostics labs)
- Bench space with work area for 2 persons adjacent inbound sample pass box
- Bench space with work area for 2 persons adjacent outbound pass box(es)
- Bench space for equipment
- Hand washing sink near lab exit
- Laboratory Sink
- Pass through sterilizer (750 x 1200 chamber)

Intended operations

The main purpose of this lab is to receive samples, unpack and identify the samples, label them and distribute to the appropriate laboratory for analysis. Samples will be delivered to the sample receiving vestibule (or other adjoining space in the facility depending on design layout) then moved into the lab via a pass box. Inside the lab users will unpack the samples, either on the bench or in an adjacent biosafety cabinet dependent upon the perceived risk. Sample containers will be disinfected if necessary then will then be labeled for distribution to diagnostics laboratories as appropriate. Where packaging is broken or inappropriate for materials, substances may be transferred to the institution's own containers in a biosafety cabinet prior to labeling and distribution. All excess packaging and waste materials, broken containers etc. will be removed from the lab via the pass through sterilizer.

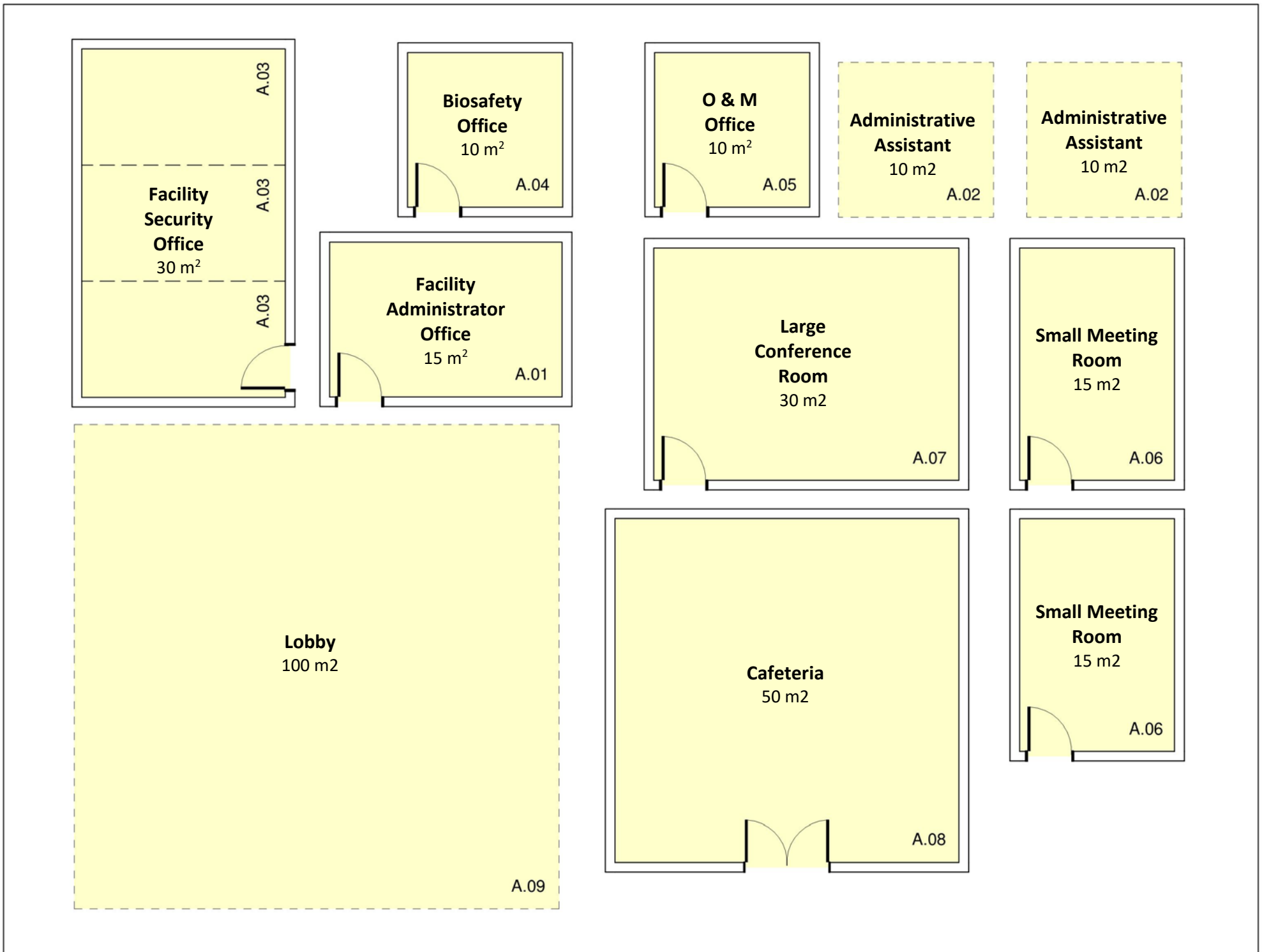
While the majority of analysis work will be done in the diagnostics labs there will be a small amount of bench top equipment in this lab for performing preliminary tests.

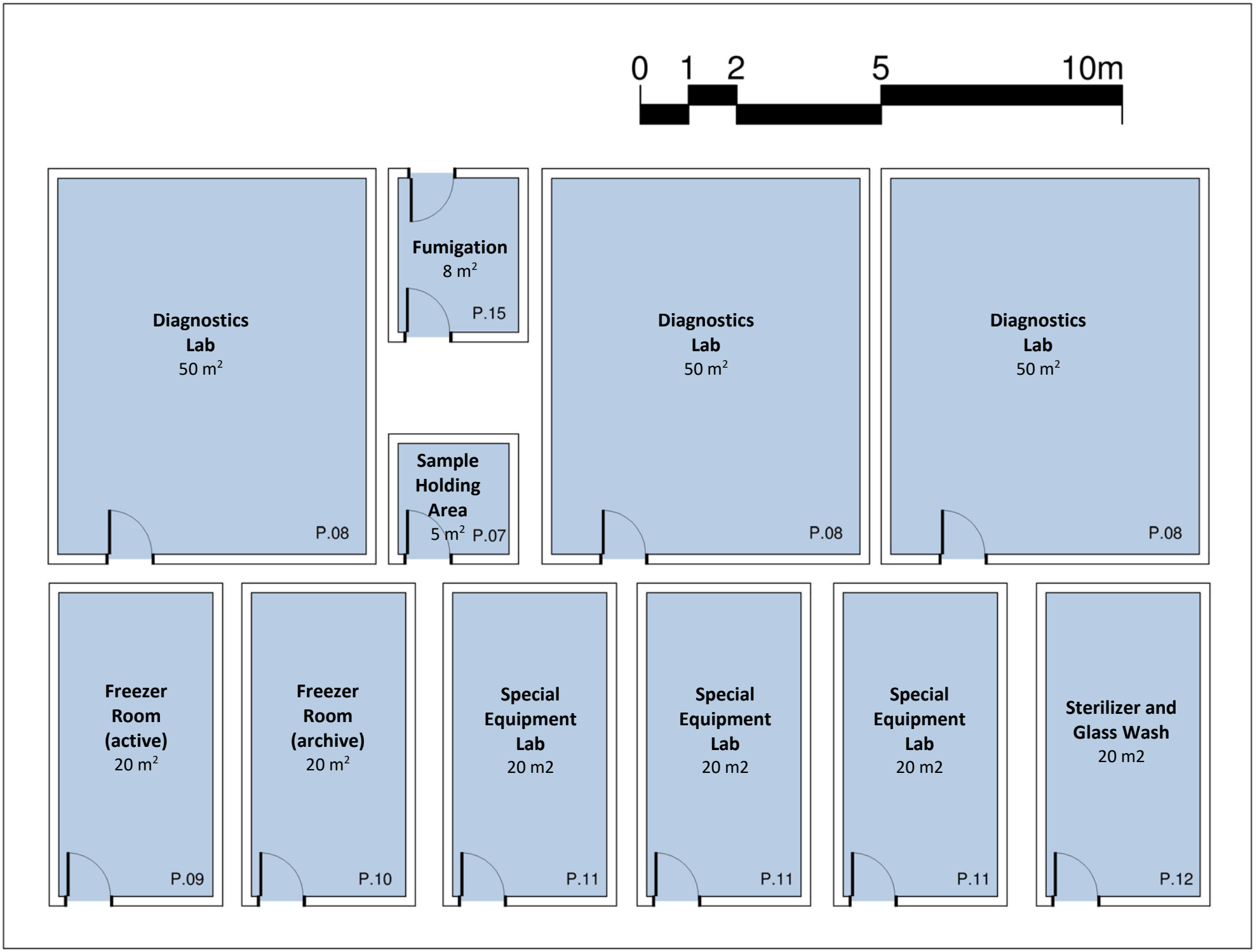
Note when samples are delivered after hours they will be held within a refrigerator, freezer or cabinet as appropriate in the sample holding area. The next morning samples will be moved into the lab via the pass box.

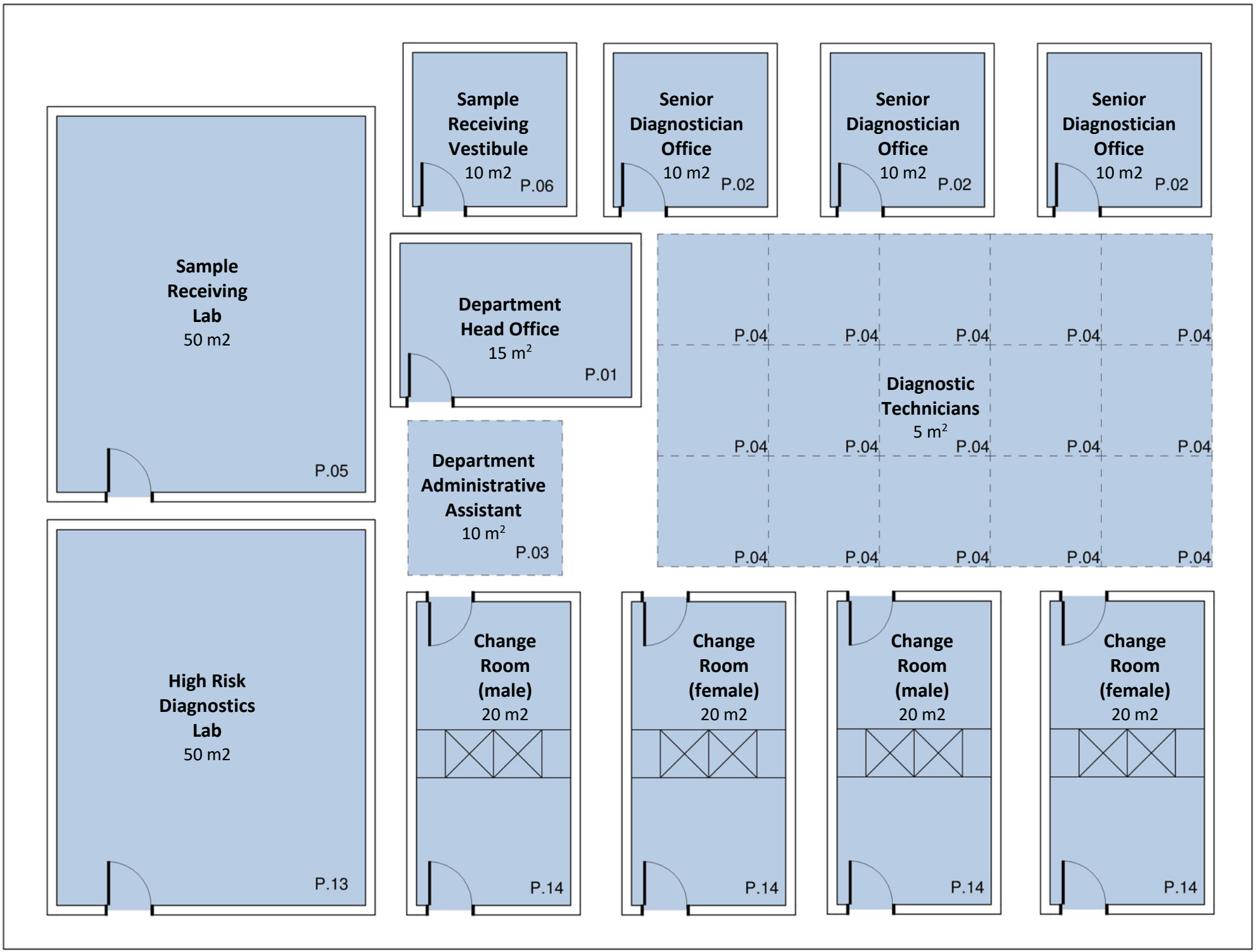


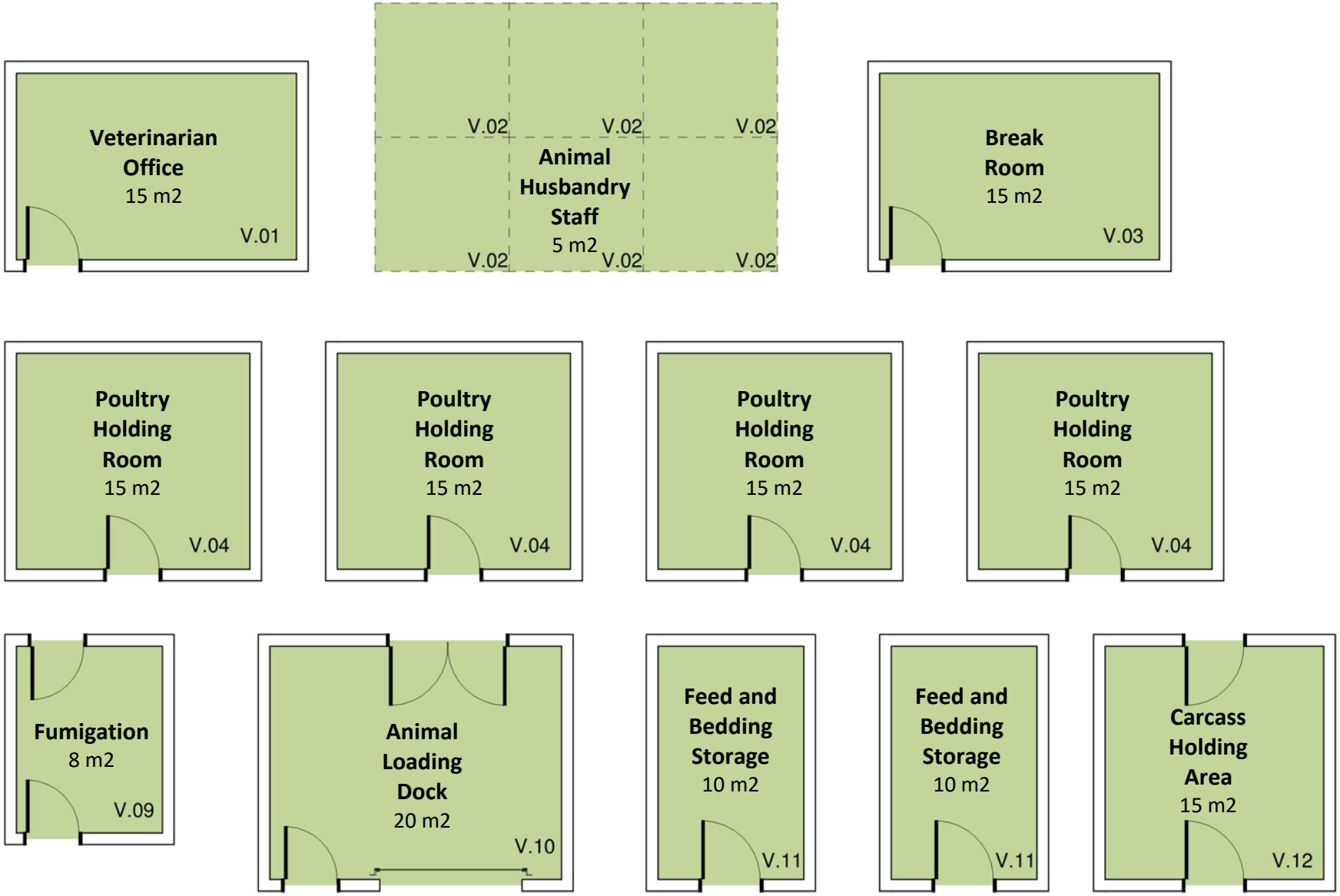
1800 mm biosafety cabinet

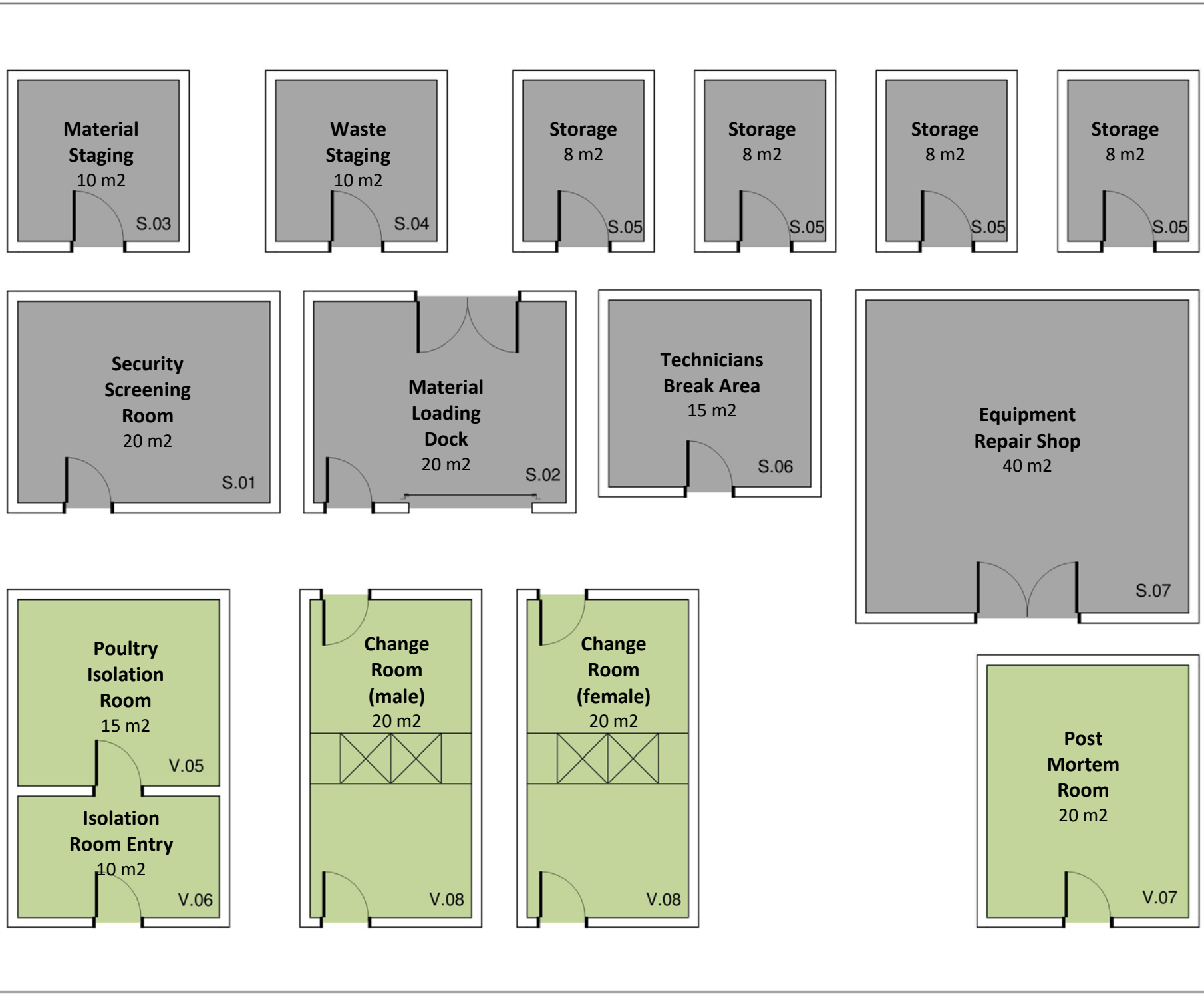
900 x 750 Freezer


A.03
Facility Security Office
30 m2
A.03
A.03
Biosafety Office
10 m2
A.04
O & M Office
10 m2
A.05
Administrative Assistant
10 m2
A.02
Administrative Assistant
10 m2
A.02
Facility Administrator Office
15 m2
A.01
Large Conference Room
30 m2
A.07
Small Meeting Room
15 m2
A.06
Lobby
100 m2
A.09
Cafeteria
50 m2
A.08
Small Meeting Room
15 m2
A.06


0 1 2 5 10m
Diagnostics Lab 50 m2
P.08
Fumigation 8 m2
P.15
Sample Holding Area 5 m2
P.07
Diagnostics Lab 50 m2
P.08
Diagnostics Lab 50 m2
P.08
Freezer Room (active) 20 m2
P.09
Freezer Room (archive) 20 m2
P.10
Special Equipment Lab 20 m2
P.11
Special Equipment Lab 20 m2
P.11
Special Equipment Lab 20 m2
P.11
Sterilizer and Glass Wash 20 m2
P.12


Sample Receiving Lab
50 m2
P.05
Sample Receiving Vestibule
10 m2
P.06
Senior Diagnostician Office
10 m2
P.02
Senior Diagnostician Office
10 m2
P.02
Senior Diagnostician Office
10 m2
P.02
Department Head Office
15 m2
P.01
Diagnostic Technicians
5 m2
P.04
Department Administrative Assistant
10 m2
P.03
High Risk Diagnostics Lab
50 m2
P.13
Change Room (male)
20 m2
P.14
Change Room (female)
20 m2
P.14
Change Room (male)
20 m2
P.14
Change Room (female)
20 m2
P.14


Veterinarian Office
15 m2
V.01
V.02
V.02
V.02
Animal Husbandry Staff
5 m2
V.02
V.02
V.02
Break Room
15 m2
V.03
Poultry Holding Room
15 m2
V.04
Poultry Holding Room
15 m2
V.04
Poultry Holding Room
15 m2
V.04
Poultry Holding Room
15 m2
V.04
Fumigation
8 m2
V.09
Animal Loading Dock
20 m2
V.10
Feed and Bedding Storage
10 m2
V.11
Feed and Bedding Storage
10 m2
V.11
Carcass Holding Area
15 m2
V.12


Material Staging
10 m2
S.03
Waste Staging
10 m2
S.04
Storage
8 m2
S.05
Storage
8 m2
S.05
Storage
8 m2
S.05
Storage
8 m2
S.05
Security Screening Room
20 m2
S.01
Material Loading Dock
20 m2
S.02
Technicians Break Area
15 m2
S.06
Equipment Repair Shop
40 m2
S.07
Poultry Isolation Room
15 m2
V.05
Isolation Room Entry
10 m2
V.06
Change Room (male)
20 m2
V.08
Change Room (female)
20 m2
V.08
Post Mortem Room
20 m2
V.07