Laboratory Facility Construction and Major Renovations Guidelines

MAY 2019

APHL ASSOCIATION OF PUBLIC HEALTH LABORATORIES®

Acknowledgments

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On the cover: The National Health Laboratory Services building, Uganda

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Introduction

Designing a laboratory to address the unique needs of a given area or region is a multi-faceted process with many different things to consider—safety, security, efficiency, cost-effectiveness, current research needs, future research needs, operating standards, etc. The list goes on and on. Approaching the lab design process in an organized and thorough manner can give laboratory teams confidence that they are getting the best outcome for their efforts.

This guide is meant to provide a general overview on some of the core activities included in the lab design process. The information provided should help laboratory teams walk through the design process and implement the activities that will help make the laboratory a success - not just in design, but also in operations.

This guide does not address the details and technical requirements behind good laboratory design, nor does it provide information specific to different lab types. Laboratory teams embarking on a new lab design or lab renovation should supplement the use of this guide with additional resources—such as local or lab-specific standards—and input and guidance from appropriate experts.

1.0 The Big Picture: Vision and Mission

GOAL: Every laboratory needs a clear idea of its purpose, goals and aspirations. Articulation of this idea is achieved by establishing vision and mission statements for a major renovation or new construction. Vision and mission are related to each other much like cause and effect. A vision statement is a broad, future-oriented view of how the laboratory will impact the greater community it serves. A mission is how the vision will be realized. In other words, the vision is the destination, while the mission is the path to reach it. A thorough assessment of the existing conditions, operations and problems is essential in planning for facility improvements needed to support the strategic vision and mission of the laboratory.

1.1 Vision

A laboratory's vision expresses its purpose and reason for being. It provides inspiration and a framework of values that define its culture, identity and brand. In a sense, a laboratory's vision is its DNA and its values are the genes that form that vision (DNA).

A laboratory's vision should express the image and identity the institution wants to portray to the public, to its peers in the profession and to its own personnel. It should describe desired synergies that address connectivity, collaboration and the team environment and address values related to cost appropriateness and sustainability. The vision statement looks to the future of the laboratory and its growth potential (through flexibility and the attraction and retention of staff) and should establish a standard for the quality of life that the laboratory supports, with respect to its professional environment, opportunities for staff to thrive and the provision of amenities. Security is also an important issue to address in considering aspects of the laboratory's vision.

A visioning session with key laboratory leadership can be a useful tool in developing a vision statement. A variety of tools, such as value trees and imagery exercises, can be used to facilitate choice, challenge and consensus in identifying the key values of the laboratory organization. Visioning session outcomes—in the form of implementation outlines—can then be used as the basis of the laboratory's mission statement.

1.2 Mission

A laboratory's mission statement clearly and concisely defines how the lab will achieve its vision. It is a declaration of core purpose and focus and serves as a filter to separate what is important, from what is not. The mission clearly states which populations will be served and how and communicates a sense of intended direction to the entire organization.

A mission statement should answer four basic questions:

- What do you do? Define the role that the laboratory plays in supporting health in the region or market it serves.
- How do you do it? Define what you need to test for? Define current and future endemic diseases, surveillance and response. Determine if you have the capacity and overall staffing skills needed to support the testing.
- Whom do you do it for? Define who your target client base is that you serve and what their needs and expectations are, now and into the future.
- What value are you bringing? Define the unique value that your laboratory brings, that differentiates you and sets you apart from other laboratories. State how the work you are doing contributes to strategic needs in the region or the area of health science you serve.

1.3 Laboratory Assessment

A thorough assessment of unmet testing needs in comparison to current international standards and best practices and comparable, leading benchmark facilities is key in developing a plan for facility improvements needed to support the laboratory's vision and mission. An Existing Conditions Assessment Report and a review of the laboratory's operational plan will provide crucial information toward meeting this goal. This begins by performing a SWOT (Strengths, Weaknesses, Opportunities, Threats) analysis to examine the strengths, weaknesses, opportunities and threats for the existing laboratory facilities and identifying associated gaps. Specifically, examine the issues, needs, deficiencies or problems that need to be addressed in the following areas:

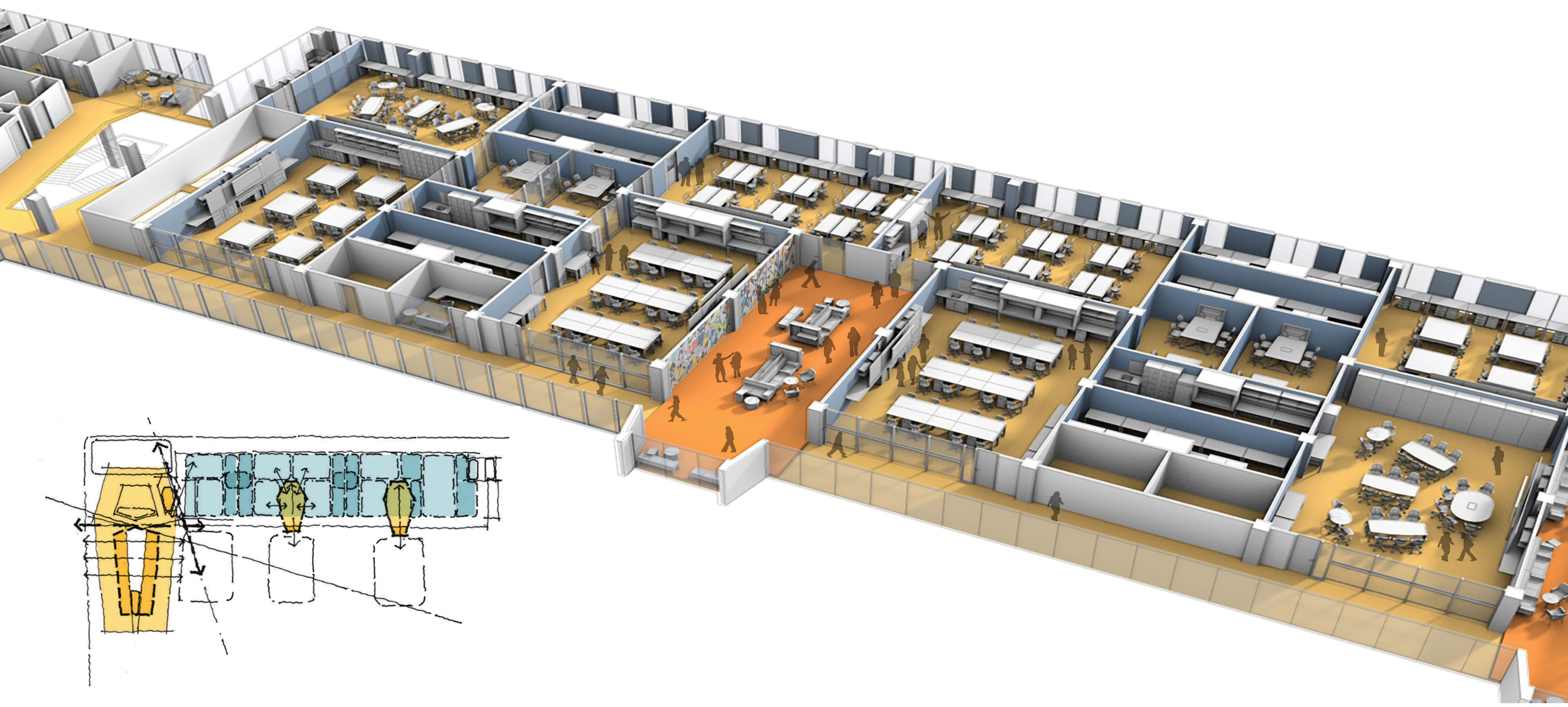
- **Workforce:** Review the quantity and capability of the existing lab personnel to carry out the mission and laboratory's operational plan.
- **Site:** Review adequacies of space needs, workflow, and site safety and security.
- **Facility:** Assess the building's capacity and capability, efficiency and location.
- **Space:** Evaluate the existing facilities to determine if the quality and quantity of space exists to safely perform the anticipated test list and volumes. This includes assessing the needs for specialized space, such as PCR and higher biosafety level space. Consider efficiency, work flows and life safety.
- **Mechanical, Electrical, Plumbing Systems:** Assess operational condition and sustainability.
- **Equipment:** Catalog existing equipment and evaluate it for capability to support the required laboratory services.

1.4 Develop Problem Statement

Based upon the assessment of workforce, site, facility, space, MEP Systems, equipment—and other needs, issues and deficiencies—a problem statement should be developed to clearly define the needs and requirements to develop each problem's solution. Often, problem statements appear as conclusive recommendations at the end of the Existing Conditions Assessment Report and consist of follow-up plans, activities, specific organizational actions or facility studies that will be necessary to achieve the vision and mission (e.g., BOD to address facility responses needed).

Deliverables:

- Vision statement document
- Mission statement document
- Existing conditions assessment report
- Problem statement document.



2.0 Program Planning

GOAL: Develop and detail a comprehensive plan for laboratory facilities, informed by what is required to achieve the vision and mission. The program planning stage of lab design begins with the development of scope and conceptual solutions based on the defined needs, gaps and problem statements. The four primary aspects of program planning include: space program, master plan, workforce staffing plan and project budget. Early phases of the project are important because they can significantly affect the outcome of the facility and influence functionality, cost, quality and project viability.

2.1 Programming

The initial programming phase explores and develops the scope of work and functional requirements to meet user needs. Detail is provided on each laboratory activity that will be performed and estimates of space and equipment requirements are made. These requirements inform the final space use estimate, providing the basis for further discussion of international best practices and modular planning, which are key to future flexibility.

The purpose of programming is to provide adequate space to accommodate testing, people and equipment needed to perform the testing. It also identifies key functional adjacencies, enhances efficiencies to minimize duplication and increases economy of resources. Each department is interviewed to identify:

- Tests performed
- Microorganisms and chemicals used or likely to be encountered
- Material resources required
- Number of personnel working in the department
- Workflows
- Materials and waste flows
- Utilities needed
- Special requirements that impact the space
- Equipment used.

In the end, this data will be used to develop room data sheets that are reviewed as a check list to ensure all needs are accounted for in the space program and final design.

2.2 Master Planning

One of the most important and overlooked opportunities for improvement is preparing a master plan for the lab. A master plan will help guide the laboratory improvements necessary to optimize laboratory processes and achieve the vision and mission of the lab. This planning will involve collecting and analyzing information on current laboratory workflows, community testing needs, current and future staffing and current building schematics. A strategic look at how institutional growth occurs ensures that critical future adjacencies and relationships are accounted for and managed. This helps to ensure continuity of operations as growth occurs.

Establishing a thorough list of questions to ask is important in understanding future growth needs. Every activity that occurs on-site, both at the macro scale and the micro scale should be considered. The following are some examples:

- What visitor flow will be generated on site? (e.g., public, professional/scientific, courier, deliveries) What level of security will be needed?
- How do samples arrive on site? Is a perimeter reception facility required, or do they come directly to the lab building?
- How will waste be handled? (e.g., municipal, private service, on-site)
- What municipal utilities are available? How dependable are they? Will on-site provision of emergency back-up utilities be needed?
- Are there provisions for employee housing?
- Are there external groups coming to the facility for training? What is the period of time they are on site? How do they arrive?
- How does the staff get to the facility? (e.g., car, shuttle, public transportation)
- Will there be provision for food? (e.g., on-site, locally available)
- What site or facilities are adjacent and what impact do they have on the facility?
- What available open land areas exist for expansion? Is additional land required?
- What is the volume of materials delivered to the site regularly? Is there a need for central reception or security screening of materials and storage?

Many times, facility infrastructure is undersized due to a lack of future planning. If future infrastructure expansion needs are accounted for in a master plan, future growth is much easier to implement and is also much more economical.

The master plan can also be a key tool in financial planning especially for funding phases of expansion. This not only helps in forecasting annual capital expenditures in institutional budgets, but also when seeking funding from external sources. Many times the terms *master plan* and *strategic plan* are either confused or used interchangeably because of the close relationship between them. A strategic plan details the data behind the business of operations and growth strategies whereas the master plan is the road map to realizing the physical reality of that same data.

During the master planning process, different approaches as to how growth can happen will present themselves. These different strategies are comparatively analyzed for their pros and cons. An effective way to judge the merits of different options is to create a color-coded value matrix that graphically lists these values side-by-side. This becomes a tool that enables the steering committee, core team and design team to have an in-depth discussion and come to consensus on what direction the final master plan should take to satisfy the vision and mission of the laboratory.

2.3 Workforce Staffing Plan

A strategic workforce staffing plan should be developed to support the current mission of the lab and to plan for any future testing expansion. Each department should look at its current work load and anticipate its expansion over a designated period (e.g., 5-10 years).

This should also include consideration of the expansion of each department's focus with in its specific scientific area of expertise (Will it be handling new agents in addition to those currently tested? Or adding new tests or equipment? Or automation?). This will help to anticipate initial built-in expansion space and future expansion space needs. It is also necessary for right-sizing staff support areas in the facility. Consideration should also be given to space required for training activities that occurs in the laboratory areas. How are the internal personnel trained? Are there cooperative programs with other institutions that require additional space, from a staffing perspective? Forecasting these needs will help future-proof the laboratory, in the end.

2.4 Budget Estimate

Cost estimates and an understanding of available funding will inform the development of the scope of work. Preparing a high-level cost estimate will assure that the total costs to achieve the mission and vision are documented. All facility improvements (both new construction and renovation) should be accounted for in the cost estimate. Multiple cost estimates, based on different scenarios identified in the master planning phase, can be developed. Overall sustainability funding for facility, testing and staffing costs (current and future needs) should also be considered. A well-qualified budget estimate will help avoid short falls, during the design process, from unanticipated costs realized when more detailed cost estimates are developed. Many times, this is accounted for in the preliminary budget should have an allocation called "contingency" to allow for elements not specifically known in the design at this stage. A contingency at this stage would be between 10% - 30% of the total budget. Additionally, identify all items in the budget that will be subject to Value Added Taxes (VAT). It is important to take into account a realistic, well-validated estimated schedule in order to incorporate funds for escalation of all costs due to inflation and market changes that affect materials and other costs over time.

Deliverables:

- Complete function and space program
- Checklist for lab planning, staffing and equipment list
- Master plan document
- Detailed workforce staffing plan
- Cost estimate
- Outline of key budget considerations.

MASTER PLAN SCORECARD	EXISTING	OPTION 1	OPTION 2	OPTION 3	OPTION 4
LAB CAPACITY	■	■	■	■	■
LAB FLEXIBILITY	●	▲	■	■	■
LABORATORY SUPPORT	●	▲	■	■	■
CAMPUS SUPPORT	●	▲	■	■	■
CAMPUS OFFICE CAPACITY	●	▲	■	■	■
CAMPUS INFRASTRUCTURE	●	▲	■	■	■
CAMPUS AESTHETIC	▲	▲	▲	▲	▲
QUALITY OF OPEN SPACE	■	■	■	■	■

3.0 Project Team

GOAL: The project team is an interdependent collection of stakeholders (lab design work groups, core team, steering committee and external laboratory design team) who work together towards the common goal of implementing the vision and mission of the laboratory and share the responsibility for the specific outcomes of the project. The project team is a cross-functional team that represents a combination of disciplines, expertise, roles and abilities to achieve both a collaborative tension and a cooperative relationship. The project team should seek to create a relaxed and comfortable atmosphere where members are allowed to participate freely and are engaged and invested in the project work. Team members must rely on each other and work to communicate well in order to discuss their opinions, intentions and possible solutions, considering others' ideas carefully to gain consensus on all decisions throughout the design process.

3.1 Laboratory Design Working Groups

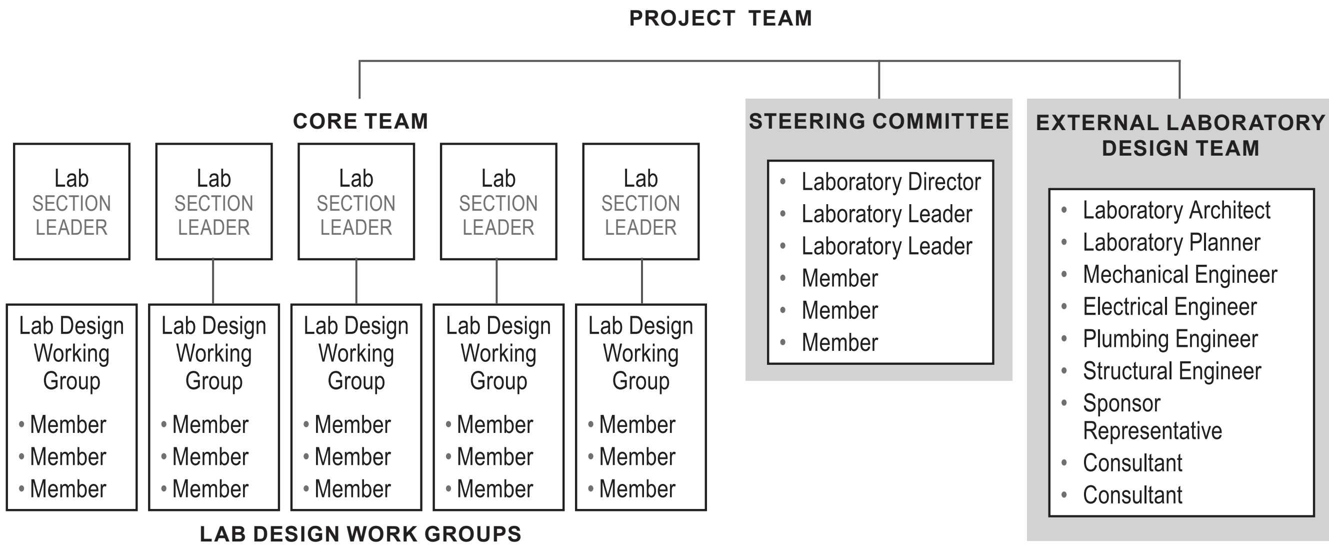
The most important element impacting the success of planning facility improvements is engaging laboratory personnel in the process. When employees are included, they feel a sense of ownership in decision-making and will be more satisfied with the outcome of the project. Establishing lab design working groups, from each discipline of the lab, ensures that everyone has a voice in the process. Working groups give their input as representatives on the core team or report to the core team, depending on the size and structure of the organization.

3.2 Core Team

The core team usually includes laboratory section leaders, laboratory scientists and facility maintenance and operations personnel familiar with testing requirements, staffing and equipment. Core team members should be integral members of everyday operations in their respective departments, with detailed knowledge of operational processes and procedures. The primary responsibility of the core team is to develop performance criteria and provide direction and feedback to the laboratory architect and engineer.

3.3 Steering Committee

The lab director, senior leadership, financial officers and other select stakeholders typically make up the steering committee. The steering committee serves as the final review and approval body for decisions reached by the core team, budget issues and the future direction of the project. The steering committee also provides counsel to the core team in overcoming any obstacles they may encounter.



3.4 External Laboratory Design Team

Members of the external design team may include sponsor organizations, laboratory architects and engineers, local architects and cost estimators. The external laboratory design team will work with the laboratory to facilitate predesign services and the design process, providing subject matter expertise on international best practices and performance criteria. For example:

- APHL can provide oversight of the facility expansion design process and coordinate between the sponsor and the laboratory to provide resources and funding to facilitate the design process.
- A laboratory architect or engineer, specialized in laboratory construction, will be selected to assist the laboratory in developing a functional, flexible and productive laboratory design to accommodate the required testing to be conducted at the facility.

Deliverables:

- Organization chart of the laboratory team
- Identify lab design steering committee and working groups.

4.0 Principles of Laboratory Design

GOAL: While laboratory directors are very good at running the lab and laboratory scientists are very good at performing the testing, in many cases, they have been working for years in facilities with less than optimal conditions. Consequently, laboratory staff involved in planning renovations or expansions need to understand the underlying principles of lab design in order to contribute to the creation of modern, safe and productive testing environments.

4.1 Risk-Based Design Decisions

Risk-based design decisions are informed by the completion of a risk assessment report, which serves to identify hazards that are present in the facility. Biorisks in laboratory facilities may originate from:

- Microbial agents or toxins present in the facility
- Procedures being carried out in the laboratory
- Testing procedures that may impact personnel exposure to agents or toxins
- Environmental release of agents or toxins
- Theft of agents or toxins
- Attack from those outside the laboratory.

Effective management of biorisks is dependent on prioritizing primary and secondary containment measures and strategies to assure secure operations and efficient allocation of resources. Clear identification of mitigation measures needed to minimize the risks presented with handling and storage of biohazardous materials is a safer, more secure approach than incorporating measures based solely on biosafety level or a prescribed solution approach.

The biosafety and biosecurity risk assessment report is a key tool for the design team (i.e., steering committee, core team and external design team) as they seek to reach consensus on appropriate mitigation measures to address identified risks. Design team members also benefit from research on containment requirements, review of benchmark facilities and consultation with biosafety experts to better understand the risks associated with the agents being used in the laboratory.

A more detailed description of a risk assessment report is available in Section 5.1

4.2 International Best Practices

International best practices are systems of guidance intended to promote uniformity, reliability, biosafety and biosecurity in laboratory practice and design. The following organizations have published guidance on international best practices and actively promote them through education programs:

- Association for Biosafety and Biosecurity International (ABSA)
- World Health Organization (WHO)
- US Centers for Disease Control (CDC)
- Association of Public Health Laboratories (APHL)
- Peer institutions & benchmarks.

4.3 Laboratory Design Fundamentals

Guidelines, codes and standards should be used as references for basic lab design principles and design guidance, even though some recommended practices may increase project costs. Judicious use and performance-based application of those standards will assist the local architect/engineer (A/E) in developing a lab design and construction documents that comply with local building codes and safely accommodates program needs.

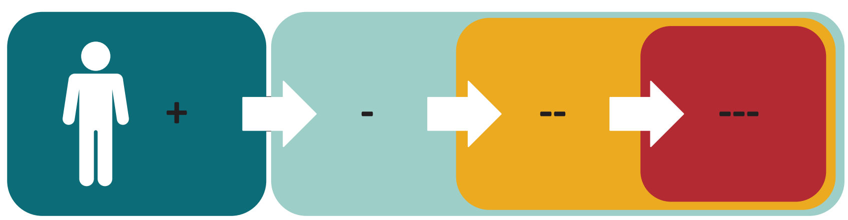
Additionally, understanding common terminology in reference to laboratories and the processes that take place in the lab building is paramount to being able to understand and apply lab planning and design principles.

Beyond codes and terminology, understanding the fundamentals of laboratory design and planning concepts will help minimize the risks associated with laboratory work by creating safe environments to work in. However, it's important to remember that a good laboratory design will not substitute for good laboratory operations and practice. Ideally, the two should work together to create a favorable environment.

The lab planning and design fundamentals include planning concepts, safety concepts and program components, adjacencies and workflow.

Laboratory planning concepts to consider during the design process include:

Airflow: Less Hazardous to More Hazardous



- Open versus closed lab concept (where required for safety and security)
- Flexibility to plan for expansion and contraction of programs
- Modular planning for economical use of space and construction
- Mechanical engineering solutions that provide appropriate airflow and serviceability
- Laboratory finishes that minimize maintenance and upkeep requirements (e.g., withstanding decontamination with harsh chemicals; minimizing seams, joints and crevices)
- Layout and placement of equipment (chemical fume hoods, biological safety cabinets); planning for shared equipment where appropriate
- Protocol mapping to assure viability of space layouts and work flows
- Local, in-country casework system evaluation, including investigation of local millwork manufacturers that can fabricate comparable products to meet performance specifications
- Structural engineering design that minimizes/mitigates vibration affecting sensitive equipment
- Electrical engineering (municipal power, emergency power, uninterrupted power supply) and plumbing engineering (sinks, safety systems, piping material, vacuum, pure water, water source and quality) solutions
- Decontamination strategies (e.g., process, frequency, autoclaves, incinerator)
- Local, regional, national, global sustainability best practices.

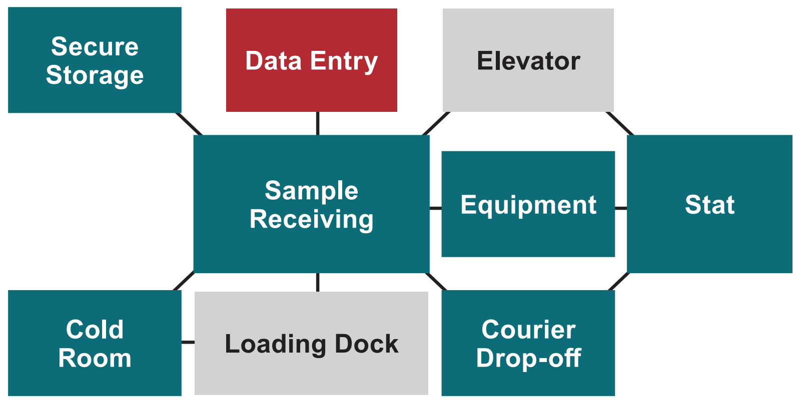
Safety concepts that are fundamental to lab design include:

- Safe working zones
- Knowledge and understanding of biocontainment concepts
- Safety equipment
- First aid stations, eyewash/drench hoses at lab sinks, emergency showers
- Proper use of personal protective equipment (PPE)
- Availability and use of biological safety cabinets (BSC) for working with specimens.
- Availability and use of proper class of BSC according to risk level of specimen
- BSC properly positioned in laboratory so as not to compromise its operation
- Airflow direction must be visually monitored
- Safe lab practices.

Program components, adjacencies and work flow impact the layout of spaces in relation to one another. Examples include:

- Sample management and receiving facilities have functional adjacencies with administrative and laboratory areas.
- Administrative areas consist of manager and staff offices and should provide a work environment away from the laboratory. Time spent in the laboratory should be dedicated to sample triage and testing (STAT) lab functions only.
- The laboratory is accessed through a secure corridor and consists of larger open lab and support areas.
- The building receiving area is located directly adjacent to the STAT laboratory, providing immediate access for sample receipt, log-in and processing.
- Equipment delivery is in the adjacent corridor near the shop.

Sample Adjacency Diagram



This is one example of the symbiotic relationship many spaces have with one another: the functional program and flow diagram studies are useful in identifying adjacencies.

4.4 Biosafety and Biosecurity

Biosafety and biosecurity are related to:

- Sample management
- Inventory systems
- Access controls
- Security response
- Personnel management

The terms *biosafety* and *biosecurity* have frequently been used interchangeably in reference to the containment of hazardous biological agents. Biosafety relates not only to the containment of potentially harmful biological agents, but also to the safe management and handling of those

BIOSAFETY BEST PRACTICES

- Inventory systems are an important part of the biosafety and biosecurity in tracking the chain of custody of every sample that arrives at the facility.
- Access controls ensure that established zones are effective in controlling access of staff and the public.
- A security response plan, which should also be part of the risk assessment report, provides details regarding security personnel (e.g., security officer and staff, emergency response team), security monitoring systems, emergency response plans and standard operating procedures (SOPs).
- Personnel management includes proper staff identification and validation, as well as regular safety training.

materials. Biosecurity is focused on the containment of harmful biological agents, but also addresses procedures and measures to prevent transmission of harmful biological agents including biological agent theft and biological terrorist attacks.

Both active and passive measures are used to achieve biosafety and biosecurity. Active measures are task-related and can include executing protocols and SOPs, sample management, inventory systems and security response. Passive measures are related to features of the design, equipment, or systems that have been incorporated into the building, such as access controls, CATV monitoring systems, personnel management systems, HEPA filtration, exclusion zones, perimeter walls, guard houses and wheel washes.

This risk assessment report in section 5.1 is the best tool to help develop appropriate biosafety and biosecurity responses.

References

Building Codes:

- 2012 International Building Code
- 2012 International Mechanical Code
- 2012 International Plumbing Code
- 2012 International Electrical Code
- 2012 International Fuel Gas Code.

American National Standards Institute (ANSI):

- ICC/ANSI A117.1: Accessible and Usable Buildings and Facilities
- ANSI/AIHA Z9.5: Laboratory Ventilation
- ANSI Z358.1: Emergency Eyewash and Shower Equipment.

National Fire Protection Association (NFPA)

- NFPA 30: Flammable and Combustible Liquids Code
- NFPA 45: Standard on Fire Protection for Laboratories Using Chemicals
- NFPA 101: Life Safety Code.

National Institutes of Health: NIH Design Policy and Guidelines, 2003

National Research Council: Prudent Practices in the Laboratory: Handling and Disposal of Chemicals, National Academy Press, 1993

United States Department of Health and Human Services, Centers for Disease Control and Prevention and National Institutes of Health: Biosafety in Microbiological and Biomedical Laboratories (BMBL), 5th ed. 2007

United States Department of Labor, Occupational Safety and Health Administration: Occupational Exposure to Hazardous Chemicals in Laboratories, Code of Federal Regulations: 29 CFR, Ch. XVII., 1910.1450

5.0 Advancing Concept Development

GOAL: After establishing the vision, determining the program, forming the project team and understanding the principles of lab design, the actual development of the design of the laboratory campus, facility, renovation or expansion is ready to begin. This process involves a series of steps that will analyze key technical design drivers of the laboratory's operations and environment. These design drivers will be used in the design process to develop design options that will be reviewed in each phase to consolidate the best options into one cohesive solution in the end that satisfies all the design drivers and the vision and mission of the laboratory. This solution is documented in the Basis of Design (BOD). The BOD is critical in communicating not only the technical standards and guidance of the facility to the design and construction team, but also the spirit of the vision that should be expressed in its architecture.

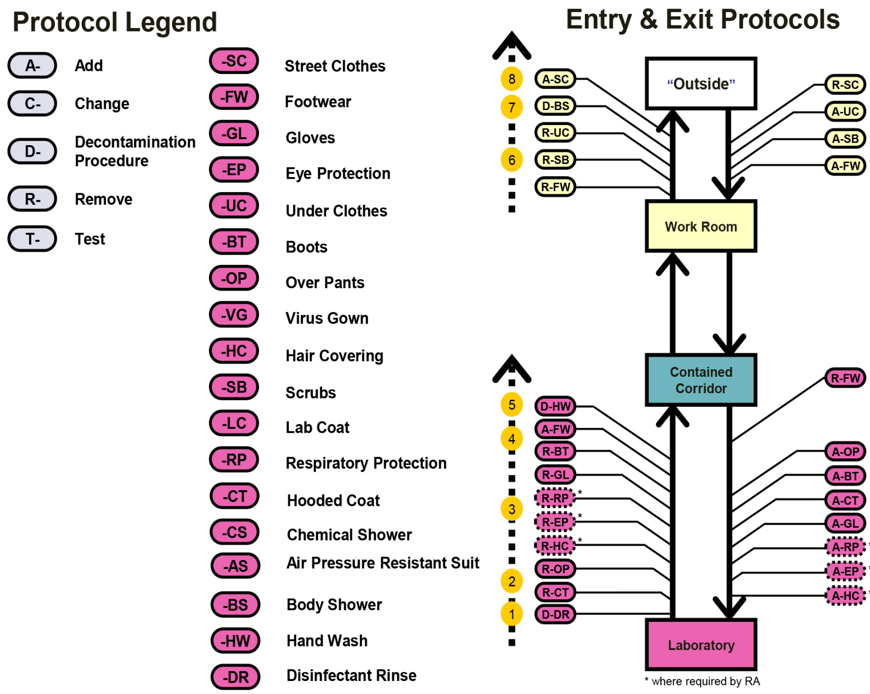
5.1 Risk Assessment

The aim of a risk assessment is to identify hazards or risks inherent in lab activities that may cause harm to laboratory processes and most importantly to laboratory staff and/or community. These risks are associated with tests performed, agents used and threats to the security of building systems, data and intellectual property. Once hazards or risks are identified, they are analyzed and evaluated in order to determine appropriate ways to eliminate or control them. Risk control measures are typically formalized in the form of protocols or standard operating procedures (SOPs). The end result of the assessment process is a risk assessment report.

The risk assessment report identifies the complexity and risks of agents to be handled during testing, (e.g., TB, Flu, *E. coli*, Ebola-PPE) and provides guidance on appropriate means of risk mitigation and agent disposal—whether on-site or off-site, or by use of autoclave or incineration. The report may also identify systems, such as IT infrastructure, that could be vulnerable to outside interference or access and what measures are needed to prevent access. Internal protection of data systems and intellectual property should be carefully evaluated.

Power and water utility systems should also be considered in the risk assessment. If power outages are common, an estimate of required back-up power generation or needed emergency water storage capacity can be made based on historical data. All utilities crucial to operations should be evaluated.

5.2 Protocol Mapping



A protocol map is a tool used to illustrate a multistep process graphically. It literally "maps" each step necessary for the process to be correctly completed and is an effective way to depict protocols that must be followed exactly, in order to execute critical functions in a laboratory building.

Protocol maps can be created for the flow of samples, materials, personnel and waste. They aid in understanding needs for sample receipt, order and entry, materials and supplies, personnel training, PPE use and storage, waste disposal and associated risks and proper decontamination.

Because protocol maps are based on biosafety risk levels and outline individual agents and tests, they can be used to review room-by-room protocols including specific requirements for handling agents, open versus closed labs for testing, the use of separate PPE based on workflow and the use of BSCs. Additionally, they are highly valuable for the laboratory design team in identifying unique functional requirements.

5.3 Functional Requirements

Functional requirements describe the spaces and systems that are needed for the building to meet its mission and perform properly as a laboratory. Spaces for administrative and testing activities, as well as support areas and MEP systems are all examples of functional requirements of the laboratory facility. While technical, biosafety, biosecurity, accessibility, operational zones and life safety requirements are all crucial, other factors that fit with the vision and mission of the lab—such as ergonomics, social environments that promote collaboration and cultural synergies—should also be considered.

Requirements for administrative areas include:

- Location in non-bio/chem hazardous areas
- Accessibility and adjacencies to labs
- Conferencing, teaming and areas that promote collaboration.
- Technical support for communications and A/V systems interface within the space

Laboratory areas require:

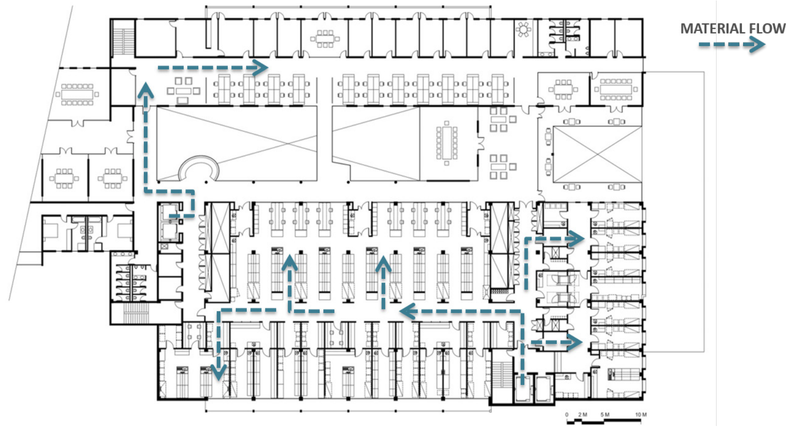
- Primary consideration be given to adequate space for workflow, sample volume and functional layout
- Consideration of open labs where possible and closed labs where required by agents used is a desired planning principle.
- Attention to negative versus positive air pressure areas based on risk assessment report.

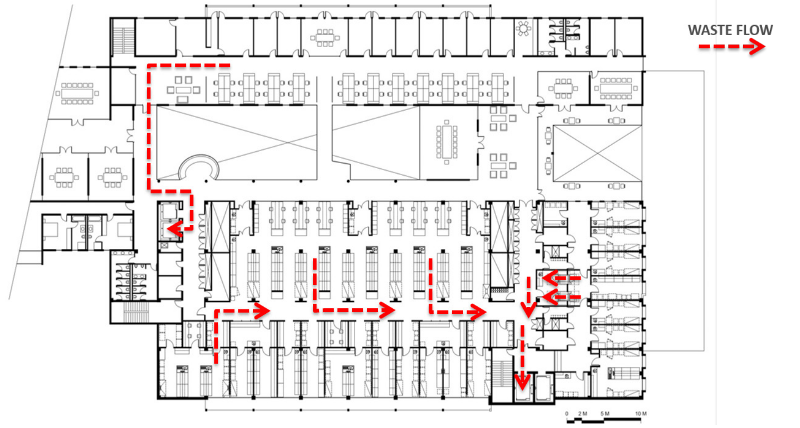
Lab support areas need:

- Special attention to equipment operating areas and service zones
- Efficient layouts that support efficient workflow

Requirements pertaining to MEP systems are important as they relate to the structure and future space needs. Consideration is needed to provide a sustainable approach to systems design.

5.4 Inventory Chemicals, Equipment, Waste





Develop an inventory of chemicals, equipment and waste involved in laboratory processes in order to provide appropriate operating space, power, specialized storage requirements, disposal systems and other unique needs required for these materials. The same principle applies to areas that support lab functions in the building.

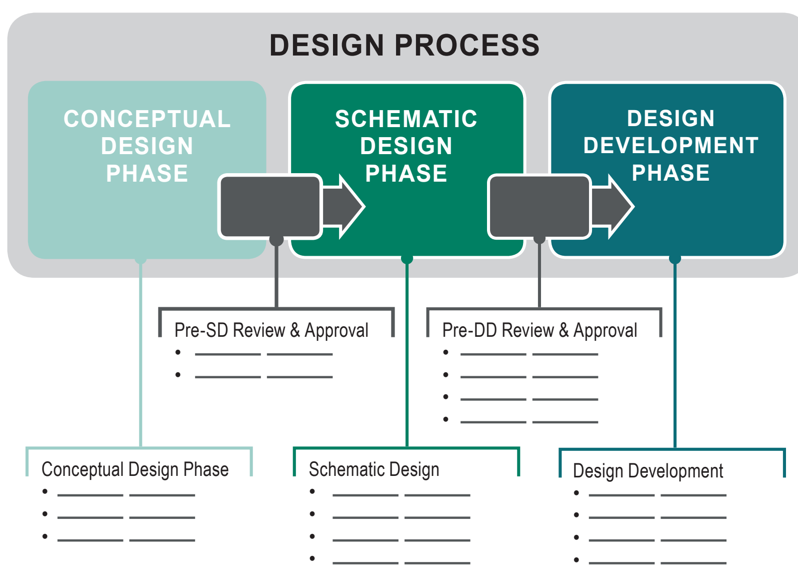
Chemicals used in the lab may dictate specialized storage areas with specialized ventilation or fire-proof enclosures and may have specific implications for local building code enforcement. Equipment lists ensure an understanding of peak power demands in laboratories and equipment rooms and also aid in right-sizing space for potential redundancy. Understanding waste streams is important to ensure safe disposal and segregation of different types of waste that are disposed of in different means (recyclables, hazardous, non-hazardous, chemical, biohazardous, radioactive, etc.). This is also crucial in maintaining the separation of clean and dirty flows where critical.

These inventories enable the laboratory design team to develop flow diagrams that are useful during discussions with the steering committee and core team to develop strategies that are sustainable.

5.5 The Design Process

The design process is iterative, by nature, continuously facilitating consensus and forward momentum.

Predesign activities (i.e., visioning, mission statement, assessments, programming, master planning, staff planning, budgeting, risk-based design decisions and assessments, protocol mapping, functional requirements, SOPS, inventory) produce data that form the basis of laboratory functions such as tests, equipment, chemicals, flows and adjacencies. These activities become the raw materials used by the design team to identify what lab user groups want and need—and form the building blocks used to create conceptual design options (i.e., layouts, diagrams, plans, elevations).



Conceptual design options present a variety of solutions that address what the design team heard during predesign and what they think it means. Through discussions with the steering committee and core team, alternatives are considered and consensus on a preferred building design solution is reached.

The evolution of the design occurs in three phases, from conceptual design through schematic design and finally into the final design development phase. This developmental, iterative process perfects the design concept adding more detail in each phase (for all systems in the building), while testing the progress against established goals and project vision. The final recommendation, at the end of the design development phase, has been based on previous discussions, puts safety first, incorporates sustainable features, promotes its own identity and achieves critical buy-in. In the end, everyone is on the same page and feels that the design expresses the vision and mission of the laboratory.

5.6 Biosafety and Biosecurity

Unless hazards are conclusively identified, it is not possible to accurately assess the biosafety and biosecurity risks associated with laboratory activities. Therefore, it is of vital importance that an accurate estimation of the potential risks be carried out in the form of a valid risk assessment report. It is on the basis of report that the Lab Design Team will be able to identify appropriate measures and strategies needed for proper sample management.

5.7 Cost Estimate

A cost estimate is a list of all probable costs of the construction for the laboratory building project. Cost estimates are calculated periodically through the design process to keep the project design in alignment with the project budget. If decisions are made during the design process, or the steering committee and core team require changes that result in cost overruns, early knowledge of these instances make it easier to make corrections in the design, through value management decisions, as approved by the steering committee.

The final design development documents are used create the cost estimate issued in the BOD document. The cost estimate (Total Project Cost) includes but is not limited to Hard Costs (all construction materials and labor costs, land cost, utility costs, site development costs, infrastructure costs) and soft costs (constructor overhead and profit, construction contingency, insurance, A/E fees, furniture and equipment costs).

5.8 Assembly of the Basis Of Design (BOD)

The BOD document is the summary of all the performance criteria needed to communicate the design intent for the laboratory building and to meet the vision and mission as stated in the project charter. The Basis of Design will be used as a guide by the local architect and engineers to produce documents for construction of the facility.

It gives an understanding of how and why the project design meets the mission through sections that outline historical data and operational information needed to explain the logic of the design.

The document sections are:

- Executive Summary—History, vision, mission
- Programming—Space list, budget/cost estimate
- Lab Planning—Lab requirements, equipment, room data sheets
- Site—Site-related drawings
- Architectural—Drawings related to the building architecture
- Structural—Drawings and data describing the structural system
- Mechanical—Drawings, details and information illustrating the distribution, controls and HVAC systems
- Electrical—Drawings and data pertaining to power, lighting and data
- Security—Drawings illustrating requirements and locations of security system equipment and access controls
- Plumbing—Drawings illustrating and specifying water distribution, sanitary streams, water treatment, fire suppression and effluent treatment
- Civil—Drawings and information relating to site topography, roads, storm drainage
- Commissioning—Criteria required to confirm that all building subsystems are designed and operate according to the owner's project requirements

Deliverables

- Risk Assessment Report
- Protocol Flow Diagrams
- Functional Program
- Cost Estimate
- Basis of Design
- Lab Design Options

6.0 Buy-In

GOAL: For a project to be successful, it must have buy-in on many levels. Laboratory leadership is represented on the steering committee (laboratory director and key leaders) and should assist in developing the preliminary assessment information and reviewing the conceptual information. The larger core team should participate in the programming and design phases to ensure there is input and buy-in at all levels.

Project Charter
(Conceptual example)

Laboratory Vision:

Laboratory Mission:

We, the undersigned, certify that we have fully participated in a comprehensive process (reference to 10-Step Approach to Laboratory Design) to assess the needs, requirements, costs, and justifications for the proposed laboratory infrastructure improvement project.

Name	Laboratory Director	Signature
Name	Steering Committee	Signature
Name	Steering Committee	Signature
Name	Steering Committee	Signature
Name	Core Team	Signature
Name	Core Team	Signature
Name	Core Team	Signature
Name	Core Team	Signature

6.1 Project Charter

The most important element impacting the success of planning facility improvements is engaging laboratory personnel in the process. When staff are included, they feel a sense of ownership in decision-making and will be more satisfied with the outcome of the project. Establishing lab design working groups, from each discipline of the lab ensures that everyone has a voice in the process. Working groups give their input as representatives on the core team or report to the core team, depending on the size and structure of the organization. Developing and signing a project charter is an activity that can help get all key stakeholders aligned.

6.2 Business Case

Developing a strong business case for the facility improvements will assist in the decision and approval process. The business case should provide cost information for not only building construction, but also for associated costs of equipment, furnishings, staffing and operations. These costs should, then, be compared with the immediate and future benefits of the improved laboratory infrastructure. This return on investment analysis should be expressed both in terms of monetary benefits (e.g., cost savings, revenue) and social benefits (e.g., improved health, faster outbreak detection) that justify the expenditure. The business case can be used in discussions with health ministry officials to identify potential funding opportunities. The information can also be used to discuss facility improvements with potential sponsors. The business case should be attached to the project charter.

It is very important that the laboratory achieve buy-in from key health ministry decision-makers prior to the start of detailed design (see Section 5 – Advancing Concept Development) in order to advance the design for the facility improvements. Ideally, the buy-in would be in place from ministry leadership and laboratory staff; thereby, providing good momentum in moving the project forward.

Deliverables:

- Project charter with attached business case

References

- Example Project Charter document
- Example Business Case document

7.0 In-Country Design and Contractor Selection

GOAL: The continued success of the project can be achieved if the team selected to complete the construction documents and perform the physical construction of the building is familiar with the programmatic requirements and performance criteria expectations of laboratories and possesses relevant experience with complex facility types.

Every country has their own specific procurement process for selecting architects and contractors for a new facility. However, it is important for laboratory leadership to be familiar with international best practices for the design and construction of a complex laboratory facility to ensure that the resulting building incorporates the performance criteria previously discussed.

7.1 Design and Construction Methodologies

A variety of methodologies may be used to obtain the services necessary to design and construct laboratory facilities. While all of the methods will result in a completed lab, each approach has advantages, disadvantages and associated risks that must be managed by the laboratory owner—specifically in the areas of contracts, construction costs, quality and schedules.

- Design-Bid-Build is the best design and construction method for the owner to control the quality of the final lab building, as all drawings are completed and reviewed in their entirety, prior to requesting a price from the constructor.
- Construction Manager at Risk (CMaR) is a good methodology when there is a complicated site or the owner needs additional personnel to manage the construction.
- Design-Build is a methodology that determines a lump sum cost for the project, early in the process, making cost management the constructor's responsibility.

7.2 Procurement Strategies

There are several procurement strategies that can be used to mitigate some of the risks inherent in different design and construction methodologies. Prequalifying architecture and construction firms prior to final selection for a project is one of the best strategies available to reduce owner risk. Identifying firms that have a track record of working on complex projects and familiarity with sophisticated engineering systems is key to a successful project and will help narrow the list of potential bidders.

Another strategy to assure that architects and constructors are qualified to work on a laboratory building is to call references from previous projects and verify how they performed.

Touring previous projects will also provide insight into the quality of the finished building.

7.3 Selection Process

Generally speaking, the decision to select a particular design or construction firm is based on qualifications, price or a combination of the two.

In the best value strategy, the best overall team is selected, taking into consideration both qualifications and price. Even if a firm's price is higher than a competitor's, they may be the most qualified and have the best people with the right experience and consequently represent the best value. Utilizing the best value selection strategy allows each criterion to be weighed separately, as well as collectively.

While qualifications, price and best value should all be considered, the most important factor in the selection process is to ensure that representatives from the laboratory are voting members of the selection committee. A laboratory facility is very complex and contains many specific technical and flow-related processes that need to be understood during design. Having laboratory personnel as part of the selection committee adds crucial subject matter expertise to the process.

METHODOLOGY	CONTRACT	CONSTRUCTION COST	QUALITY	SCHEDULE
Design Bid Build	MEDIUM RISK Owner holds a separate contract with the architect and the constructor.	HIGH RISK The cost of the project is estimated during design, and the actual costs are not known until bidding.	LOW RISK Since the architect works for the owner, the drawings reflect the needs of the project.	MEDIUM RISK The schedule is estimated during design and is subject to some change during bidding.
Construction Manager at Risk (CMaR)	HIGH RISK Owner holds a contract with the architect, constructor, and the CMaR. The CMaR acts as the owner's agent.	MEDIUM RISK The CMaR issues drawings to be bid by contractors, in multiple phases to speed construction, which can add cost.	MEDIUM RISK The project is procured in phases to speed construction, which can negatively impact quality.	LOW RISK One of the advantages of CMaR is the speed of the schedule because construction is started prior to final design.
Design Build (DB)	MEDIUM RISK The owner holds one contract with the constructor. The architect works for the constructor.	LOW RISK Cost is known very early as contractors respond to an RFP (tender).	HIGH RISK Since the selection is generally based on price, the overall quality of the project can be lessened.	LOW RISK There are usually incentives for the constructor to finish the project early.

QUALIFICATIONS

Firms are selected based solely on their qualifications

PRICE

Firms are selected based solely on their price

BEST VALUE

Firms are selected based on a combination of quality and price.

7.4 Specialty Consultants

Laboratories are very complicated facilities and have performance criteria that are driven by international best practices, codes and guidelines. It is very common for laboratory facility projects to have several specialty consultants—in addition to architects and engineers—who provide advanced subject matter expertise for performance criteria such as vibration, acoustics, biosafety, biosecurity and chemical handling.

One of the most overlooked but important services to include, as part of a laboratory construction project team, is the commissioning agent (Cx). The Cx will be most effective for the project when engaged early in the design process, through move-in. The Cx will be familiar with the Standard Operation Procedures (SOP) established by the laboratory for testing and assure that the building's performance criteria are installed to perform in concert with the SOP.

For most buildings, the constructor is responsible for buying and installing products and materials consistent with the performance criteria in the Basis of Design and for assuring that air handlers, generators and other constructor- installed equipment operate correctly under normal conditions. The Cx, however, is charged with developing criteria and scenarios to simulate real life situations that could cause an outage, or planned or unplanned system failures. As a result, we can assure that the equipment not only runs, but that systems will all work together in different failure and maintenance scenarios.

Deliverables:

- Commissioning Check List
- Commissioning SOW

References

Construction Process Workshop

8.0 Documents for Construction

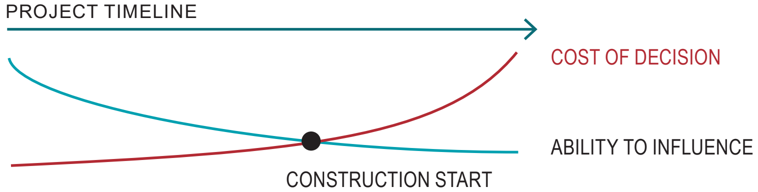
GOAL: The in-country design and construction team will be responsible for preparing the documents for jurisdictional review and finalizing material and product selection. But the work for the laboratory team is really just starting! It is very important that people from the lab stay involved by reviewing the documents prepared by the in-country design team. It is important for the laboratory team to stay involved for two reasons:

1. Having just gone through the very intensive programming and planning phase of work, the laboratory staff is very knowledgeable about the facility goals including space, equipment and staffing needs for the new facility.
2. The in-country architect and constructor will have had limited experience designing or constructing public health laboratories. Even though they are design and construction professionals, it is important for laboratory staff to review their work to ensure it meets the intent of the BOD.

8.1 Final Documents for Construction

The Basis Of Design (BOD) document, that was previously prepared as part of the programming and design phase of the project, will provide a good starting point for the in-country design team to outline the flows, space and performance criteria needed for the new facility. The final documents for construction, prepared by the in-country team, will be based on the BOD but will add local code compliance requirements and incorporate local construction materials and products to meet the intent of the BOD. It is important to remember that these are the documents the constructor will follow to build the building.

That is why it is important for members of the laboratory design team to review the final design documents for conformance to the BOD. This is essentially the last chance to correct any discrepancies prior to construction. Any changes that need to be made after construction begins what are referred to as "Change Orders." And since it will cost significantly more to make changes during construction, it is essential to take the time to review documentation before construction begins. The graphic shows that as we get further into the project timeline progresses, the cost of delayed decisions increases.



8.2 Final Specifications

The final product specifications document is another deliverable that will be developed by the in-country design team and the constructor. The final products specified are derived from the performance criteria in Basis of Design document, however, it can be challenging to find many of the products required for a laboratory locally, as the market for these materials is fairly small and many manufacturers do not sell or ship products in every location.

WHAT IS THE DEFINITION OF THE WORD EQUIPMENT?

SCIENCE INDUSTRY	CONSTRUCTION INDUSTRY
The laboratory tends to think of equipment in terms of analytical equipment used in testing that can sit on the bench or the floor. Some examples might include: Thermocyclers, refrigerators, freezers, chromatographs, computers	Equipment, in the construction industry, are those items that are used by the laboratory and are fixed to the building. Examples of items that the constructor will generally provide as part of the construction contract would be: Casework, autoclaves (built in), glassware washers and dryers (built in), elevators, generators, biological safety cabinets (BSCs), chemical fume hoods (CFHs).

If acceptable products or materials cannot be sourced locally, the in-country design team will broaden the search regionally, or even globally. The in-country architect will review the BOD and strive to respect the performance criteria and find locally sourced products; however, sometimes due to availability, cost, or schedule, a “substitution” that deviates from the BOD may be required.

Given that the construction process is very complex and substitutions frequently occur, in the case of a sophisticated test laboratory it is crucial that any “Request for Substitution” from the in-country architect be reviewed by the laboratory design team for conformance to the BOD.

8.3 Final Construction Budget

The final construction budget for the project is established at tender. Even if the tender documents define a value, the final cost will be determined through the prices received from the constructors at tender or bidding. Once again, it is important for the laboratory design committee to review the pricing documents to verify that all the requirements have been included in the final pricing.

From this point forward to project completion, changes requested by the laboratory owner are considered a change to the constructor contract. Furthermore, any change, even if deemed necessary, will likely impact the overall schedule and budget of the project.

Deliverables

- Final Documents for Construction
- Final Product Specifications
- Final Construction Budget

References

Construction Process Workshop

Bid Review Form

9.0 Construction and Oversight

GOAL: While it might seem premature, the start of construction is the best time to begin preparing for occupancy of the new laboratory facility. Laboratory staff can be trained on new procedures; facility managers can begin learning maintenance and operational protocols; and everyone in the lab can start thinking about move-in day.

9.1 Construction Oversight

While construction is the job of the constructor, it is important for members of the laboratory design committee to stay involved by making regular visits to the site to observe the progress of the work.

There are several important reasons why regularly scheduled visits to a facility under construction should be planned. Site visits:

- Increase familiarity with the new space. The layout for the new space will likely be quite different from the existing layout. Staff can become familiar with the general layout of the new laboratory space by walking the halls.
- Affords a look at systems being installed above ceilings and behind walls. This is valuable information that could be useful later, during move-in. It may also be an opportunity to observe elements that are inconsistent with the BOD and can be reported to the in-country design team.

Visits are great for morale. Having been a part of creating the space list, the BOD and the flows and adjacencies, walking the lab allows the staff to take pride in what they helped create.

9.2 Commissioning

Members of the laboratory design committee should participate in aspects of commissioning and review the commissioning reports to ensure that installed systems perform as planned. Commissioning is a quality-focused process to verify and document that a facility and its systems are planned, designed, installed, tested, operated and maintained to meet the Owner's project requirements. The major benefits of commissioning are:

- Providing a focused process for turnover and acceptance
- Validation of successful operation
- Building energy systems that perform as needed
- Proof of system performance

- Improvement from functional to optimal performance
- Baseline for ongoing operational support

Commissioning is the process from initial planning through initial operation that addresses how the project team will install, energize, test, validate performance and hand over with the appropriate documentation and training.

There are five steps to commissioning a building that should be followed to achieve the best results:

- Pre-construction
- Construction
- Acceptance
- Hand-over
- Occupancy

The following systems should be part of a comprehensive commissioning process:

- Heating Ventilating and Air Conditioning
- Chilled Water and Heating Water
- Plumbing Fire Protection
- Electrical Emergency Power
- Fire Alarm
- Monitoring and Control
- Chemical Fume Hoods, Biosafety Cabinets
- Laboratory Casework
- Security Access and Surveillance
- Building Automation Systems

PRE-CONSTRUCTION | CONSTRUCTION | ACCEPTANCE | HAND-OVER | OCCUPANCY

PRE-CONSTRUCTION

- Review Owner Requirements
- Conduct Design Reviews
- Develop Commissioning Plan and Specifications
- Identify Commissioning Responsibiolities
- Establish Communication Tools

CONSTRUCTION

- Finalize Commissioning Plan and Schedule
- Verify Installation
- Develop Testing Procedures
- Monitor Pre-Testing and Startup
- Monitor Issues/ Resolutions Log

ACCEPTANCE

- Review Test and Balance (TAB) Reports
- Participate in System Functional Testing
- Participate in Issues List Corrections
- Review Operations and Maintenance Manuals
- Implement Plan for Training

HAND-OVER

- Finalize Training
- Deliver Final Commissioning Report
- Deliver Systems Manual

OCCUPANCY

- Operational Procedures Manuals
- Periodic Operation and Maintenance Review
- Maintenance Contractor Training

9.3 Move-In

Relocating a modern public health laboratory is a challenging event that most laboratory professionals will experience only once in their careers. Begin preparing about a year in advance to allow time to work through the state or local government purchasing and bid process and to handle the myriad of details—some unexpected—that arise during a laboratory move. As one laboratory director has said, if you want a smooth transition, “plan, plan, plan, plan.” There are three phases to planning for a laboratory move that if followed, will help ease the stress related to moving into a new laboratory.

ADVANCE PREP

Advance prep should start a year out from the move, according to those who have been there. What do you spend that year doing? The top priorities:

- Ensuring funding
- Enlisting movers
- Preparing staff and clients
- Verifying contracts
- Notifying regulatory agencies
- Reducing inventories
- Minimizing the number of things you need to move

ON THE MOVE

With a laboratory move, smooth and consistent progress and right-on-time accuracy isn’t just convenient and cost effective. It’s critical for safety and maintenance of urgently needed services. A few of the key considerations outlined in APHL’s Practical Guide to Moving to a New Site for Public Health Laboratories:

- Move in stages
- Set up redundant testing sites
- Coordinate maintenance at the old and new site during transition
- Time the purchase of new equipment
- Decontaminate the old lab

SETTLING IN

The move isn’t over once you get into the new facility. In fact, it can take up to a year to “shake down” the new space. Some suggestions:

- Test air handling systems before moving
- Coordinate with IT
- Check warranties
- Get staff comfortable with the new space
- Prepare to give lots of tours of the new lab

Deliverables

- Commissioning checklist
- Move checklist

References

APHL – A Practical Guide to Moving to a New Site for Public Health Laboratories

10.0 Operations & Maintenance

GOAL: Among the most overlooked aspects of planning a new facility is the need to consider ongoing operations and budgeting for maintenance. Often, when a facility is new, issues related to operations and maintenance are not given adequate attention. Operation and maintenance issues are especially important as laboratories for public health testing are considered high performance buildings, primarily due to the number of systems required to support testing and equipment. Therefore, developing a plan for ongoing operations and a budget for maintenance should be considered from Day One.

10.1 Operations & Maintenance

OPERATIONS

Operations must take into account the mission of the laboratory to provide testing and to improve the health outcomes for the people it serves. Laboratories for public health are not static; they are dynamic facilities serving many purposes and should seek to provide a safe place to work and a clean environment for testing. To keep the building running on a day-to-day basis requires many elements, in addition to power and water, including:

- People—The public health laboratory should certainly consider the various working environments needed for the staff, as well as visitors to the laboratory. People working in or visiting the laboratory will require office furniture, laboratory furniture, lockers and conferencing equipment.
- Equipment—Analytical testing equipment is a core need of the public health testing laboratory, but there is also a need for specialty equipment to support laboratory operations, such as Biological Safety Cabinets (BSCs), Chemical Fume Hoods (CFH), autoclaves, glassware washers, glassware dryers and incinerators. The building itself may contain equipment, as well, including elevators that will need to operate daily.
- Building Systems—There are building systems that need to operate 24/7 to support the testing and training performed within the lab. These items could require attention on a daily basis as weather conditions have an impact on the systems. Day-to-day operations should consider performance and budgeting for:

1. Architectural items
    a. Laboratory casework
    b. Doors and windows
    c. Flooring

2. Heating ventilation and air conditioning equipment
    a. Air handling and exhaust equipment
    b. Chillers and pumps

3. Electrical
    a. Normal power
    b. Emergency power
    c. Lighting

4. Plumbing
    a. Water
    b. Fixture (sinks and toilets)
    c. Drainage

5. Fire protection
    a. Alarms
    b. Sprinkler systems
    c. Extinguishers

6. Cleaning
    a. Building cleaning
    b. Decontamination

7. Security
    a. Security personnel
    b. Security systems

8. Site
    a. Roads
    b. Grounds
    c. Storm water
    d. Lighting

MAINTENANCE

There are three levels of maintenance to consider in budgeting for a new laboratory facility.

- Predictive (routine)—Items that require daily or weekly maintenance based on usage or need (e.g., refilling the hand towels in the toilets).
- Preventative (on-going)—Maintenance tasks that can be scheduled based on usage (e.g., changing the oil in the emergency generator, in accordance with the manufacturer's recommended maintenance requirements).
- Reactive (emergency)—Issues that are unforeseen or out of sequence and require immediate attention to prevent future damage or to maintain continuity of operations (e.g., a water pipe burst must be repaired immediately to prevent further damage).

PREDICTIVE	PREVENTATIVE	REACTIVE
• Routine • Daily or weekly	• On-going • As scheduled by performance	• Emergency • As needed

10.2 Budget

An important and often overlooked element in a laboratory business plan is to budget properly for on-going operations and maintenance of the facility. In 1990, the Building Research Board's (BRB) Committee on Advanced Maintenance Concepts for Buildings prepared a report entitled, "Committing to the Cost of Ownership—Maintenance and Repair of Public Buildings." The report was widely distributed and the following recommendation has been often quoted:

"An appropriate annual budget allocation for routine M&R (i.e., maintenance and repair), in a substantial inventory of facilities, will typically be in the range of two to four percent of the aggregate current replacement value (CRV) of those facilities (excluding land and major associated infrastructure). In the absence of specific information upon which to base the M&R budget, this funding level should be used as an absolute minimum value. Where neglect of maintenance has caused a backlog of needed repairs to accumulate, spending must exceed this minimum level until the backlog has been eliminated."

Federal agencies currently use two different methods of determining CRV (which some agencies call the current plant value):

1. The current unit construction costs (e.g., dollars per square feet) for various types of facilities in an agency's inventory are multiplied by the total number of units (e.g., square feet) of each type of facility in the inventory. In making the calculation, it is essential that the units of area used are the same as the units in the assumed unit costs. Major errors can be introduced, for example, if unit costs based on gross area are multiplied by net or occupiable areas.
2. The original total cost of each facility in an agency's inventory is multiplied by an escalation factor (based, for example, on the Engineering News Record's building cost index) to determine the cost of the facility.

Either method will give current replacement values that are sufficiently accurate for M&R budgeting purposes. However, the committee believes that in most cases, the first approach is easier to use.

A good way to assure that a building can be easily maintained is to use locally-sourced materials and supplies. This will increase the likelihood of availability without additional shipping expense and ensure familiarity with the products as they are typically used by others in the area. For a laboratory facility; however, this can be challenging as some items such as fume hoods may need to be shipped from other countries.

10.3 Facility Management

As previously stated, a laboratory is a very complex facility to operate on a day-to-day basis and to maintain over the life of the building. Successful facility management considerations include:

1. Dedicated personnel—Monitoring the facility on a daily basis requires staff who are familiar with the numerous systems, equipment and people using the lab. A dedicated facilities management team can respond to lab demands and ensure that testing will continue every day.
2. Training—Facility management staff need to be trained in all aspects of the building to facilitate appropriate performance. Just like the lab staff, facilities personnel need to learn new trends, techniques and tricks to maintain and operate the building systems efficiently and productively.
3. Maintenance contracts—Effective use of maintenance contracts can improve long-term control of maintenance costs and prolong the life of many systems in the laboratory. The prudent use of maintenance contracts can also reduce personnel costs by contracting-out routine or very specialized services.

Deliverables

- Facilities Management tools
- O&M Budget

REFERENCE SECTION

www.nap.edu/read/9226/chapter/1

Appendix A: Laboratory Design Checklist

Vision, Project Team & Buy-in

Vision

- ☐ National, Regional and Local Planning
- ☐ Mission/Vision

Program Planning

- ☐ Master Planning
- ☐ Workforce Staffing Plan
- ☐ Funding

Project Team

- ☐ Project Sponsor
- ☐ Steering Committee
- ☐ Core Team
- ☐ A/E Team

Buy-in

- ☐ Purpose
- ☐ Project Charter
- ☐ Business Case

Concept Development

Principles of Lab Design

- ☐ Design Concepts
- ☐ Support of Safety Protocols

Concept Development

- ☐ Establish Goals, Wants & Needs
- ☐ Risk Assessment
- ☐ Functional Requirements
- ☐ Basis of Design
- ☐ Analyze Solutions
- ☐ Cost Estimates

Implementation

Engineer Selection

- ☐ Establish Selection Committee
- ☐ Establish Bidding Process

Design

- ☐ Documentation of Functional Requirements
- ☐ Safety Protocol Support
- ☐ Workflow
- ☐ Budget

Construction & Oversight

- ☐ Construction Plans/Documents
- ☐ Bidding and Selection of Construction Company
- ☐ Procurement
- ☐ Construction Oversight
- ☐ Handover/Commissioning

Operation & Maintenance

- ☐ Operations & Maintenance Manual
- ☐ Access
- ☐ Budget
- ☐ Availability of Materials and Supplies

Sustainability and Safety
(utilized throughout the process)

Sustainability

- ☐ Power Supply
- ☐ Water Supply
- ☐ Natural Ventilation
- ☐ Air Conditioning
- ☐ Decontamination
- ☐ Waste Streams
- ☐ Budget

Laboratory Safety

- ☐ Decontamination
- ☐ Safety Manual
- ☐ Risk Assessment
- ☐ Biosafety Cabinet Placement & Certification

Association of Public Health Laboratories

The Association of Public Health Laboratories (APHL) works to strengthen laboratory systems serving the public's health in the US and globally. APHL's member laboratories protect the public's health by monitoring and detecting infectious and foodborne diseases, environmental contaminants, terrorist agents, genetic disorders in newborns and other diverse health threats.

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