GUIDELINE DOCUMENT FOR DESIGN OF BSL 2 LABS (DISTRICT HOSPITALS, CHC AND PHC) LEVEL

Contents

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Introduction

Medical diagnostic laboratories have the mandate to produce accurate and reliable reports, manage its productivity and protect its workers, environment and community. For these reasons, "Facility Management & Safety" find its place among the vital aspects that a clinical laboratory needs to incorporate into its principles of operation. Listed in the forefront of Facility Management & Safety is the need for optimum lab design which should be addressed both in new constructions and renovations. Such a proactive approach can optimize productivity and minimize health and safety hazards. Designing clinical laboratories, thus, is an area that needs focussed attention.

ISO 15189 Medical laboratories — Particular requirements for quality and competence in clause 5.2 explains the requirements for accommodation and environment. ISO 15190: Medical laboratories -- Requirements for safety gives in detail the specifics for safe laboratory design. IPHS defines the floor area that is required as per the level of health care up to district hospitals which in turn depends on population size, bed strength and aspects of health care services and referrals envisaged for specialized care. ICMR's Good Clinical Laboratory Practice Guidelines (GCLP) states that all diagnostic and healthcare laboratories in public or private sector should have BSL-2 facilities. Although comprehensive published guidelines are available in the country for BSL 3 and 4 laboratories, no definite guidelines exist regarding the design of BSL 2 although majority of the labs will fall under this category. Again, though the component activities of lab design are outlined in the ICMR GCLP, the details need expansion and scoping out. Clinical Establishment Act 2010 specifies space allocation for specific laboratory activities depending on the load of tests.

BSL 2 indicates laboratories for containment for agents of moderate potential hazards to personnel and the environment where laboratory personnel have specific training in handling pathogenic agents and are supervised by scientists competent in handling infectious agents and associated procedures. The access to the laboratory is restricted when work is being conducted; and all procedures in which infectious aerosols or splashes may be created are conducted in BSCs or other physical containment equipment. Immunization or antibiotic treatment may be available for organisms handled in these labs. Whereas primary barriers in any laboratory are the personal protective equipment used as part of work practice control, the laboratory infrastructure forms the equally important secondary barrier. Hence the importance of a good lab design cannot be overstated.

Scope of the Document

This guidelines document attempts to expand the concepts with reference to defining the area required, identification of processes that needs separation, personnel and material movement paths, addressing different aspects of laboratory safety, meeting air and water requirements and management of wastes; effluent and solid. Thus the purpose of this document is to refine and complement available standards and guidance at district and sub district level for BSL-2 lab facility based on available knowledge and experiences and to address contemporary issues. The scope of this document is limited to laboratories in secondary care hospitals.

A suboptimal facility infrastructures, designs that render maintenance difficult also add to the risk of hazards. This is a challenge, especially in old constructions. Thus it is imperative that architectural considerations and specifications be carefully considered, for constructions and renovations.

These guidelines are only indicative. The guideline remains an advisory document recommending best practices for establishing of new and strengthening of existing laboratories, from both biosafety and productivity management perspectives, and is not intended as a regulatory document.

Target Audience

This document is for the assistance of Policy makers, Health & Hospital Managers, lab in-charges, medical services corporations, healthcare practitioners and healthcare administrators while making decisions on new medical laboratory constructions or renovations of old facilities.

Principles of Laboratory Planning and Design

- **Design follows function**: Essentially this means that all areas in the hospital (incl. Labs) should be designed based on their function, and not "carved out" of circulation spaces [corridors, waiting and sub-waiting areas etc.]. All architectural and aesthetic design should be secondary in nature. The design of the lab should be as per its function, its processes and their sequence.

- **Hospital planning** starts with the "circulation" space or area: This refers to the "integration" of various services; keep travel distances short for all persons who use the hospitals. Efficiency, flexibility and versatility are the designing objectives for hospitals/lab designing. In public hospitals where the "footfalls" are likely to be large to start with and increase with passage of time, it would make sense to have separate staff and patient entry. In such labs proper demarcation of "clean" and "dirty" areas is essential based on sterility requirements.

- **Zoning and location**: Laboratories are needed for OPD, Emergency and IPD patients. Most large public hospitals prefer to have a separate self-contained laboratories unit exclusively for emergency patients; and the Main laboratories caters to both OPD and IPD patients. In case one laboratories is being planned; it should be easily approachable for all categories of patients. Ground or first floor is preferred, as about 60-65% of OPD patients need laboratories services along with 95-99% of indoor patients. In this era of automation a single supervised lab with an efficient hospital information system, circumvents the need for emergency laboratories.

- **Sample Collection Centres**: Hospital may have 'Sample Collection Centres' at critical points (ICU, SNCU, OPD, Emergency etc.), as required. Laboratories design should help in implementing "Single prick Policy" i.e. Irrespective of the number of tests or location of the testing labs, blood sample of a patient would be taken only once, at the first point of contact.

- **Single window for report collection:** On the same lines, there should only be one single window for report collection. At the same time there should be provisions of informing critical result to the consultant.

- **Sample Path:** The activities of the laboratories are largely divided into, pre-analytical, analytical and post analytical activities. Each of these activities has many sub-activities. All these components have to be incorporated into the design to ensure unidirectional flow of activities without any crisscross.

- **Future Expandability of Hospitals/labs**: Laboratories services are most prone for expansion as new technologies are added, hence adequate space should be kept for expansion at a later date.

- **Synergy with local climate and use of appropriate material for buildings:** India being a tropical country has long, hot and often humid summer, which ideally requires air-conditioning. This may not be possible in resource constrained settings, hence aligning the longer walls of the building with north/south, having high ceilings, smaller windows may be worthwhile. Choice of material should be done with care, keeping an eye on the intended function and proper maintenance. It is also advisable to consider locally available material for construction as well as maintenance.

- **Safety and Infection Control:** The aspects of architectural and engineering controls have to be understood in the planning phase itself to avoid the need for renovations. Safety systems should cover primarily biological hazards, fire and electrical emergencies.

- **Communication:** The design should incorporate the requisite aspects of intramural and extramural communications like telephone, internet, intranet, LAN and WAN.

A. Architectural Considerations for laboratory design

1. Area of laboratory

a. **Layout for PHC:** An average lab load of 10-20 patients and a limited scope of testing exist for PHC labs. A minimum area of 10 m^2 thus is defined for this.

b. **Layout for CHC:** An average lab load of 30- 50 patients per day is defined for CHCs and a minimum area of 90 m^2 is suggested for this

c. **Layout for District Hospitals**: The bed strength and hence IPD strength is variable from 100- 500 plus. OPD load also varies likewise. An average lab load of 100 upwards can be expected. A minimum area of 150 m^2 is suggested for a lab load with 100 collections. This may be scaled up as per requirement.

2. **Path of workflow & Layout of the laboratory:** Unidirectional workflow is important in view of productivity Management and infection control.
3 paths should be kept in mind. Sample Path, Reagent Path and Report Path. The movement of personnel will be along all three and good planning will optimize this movement.

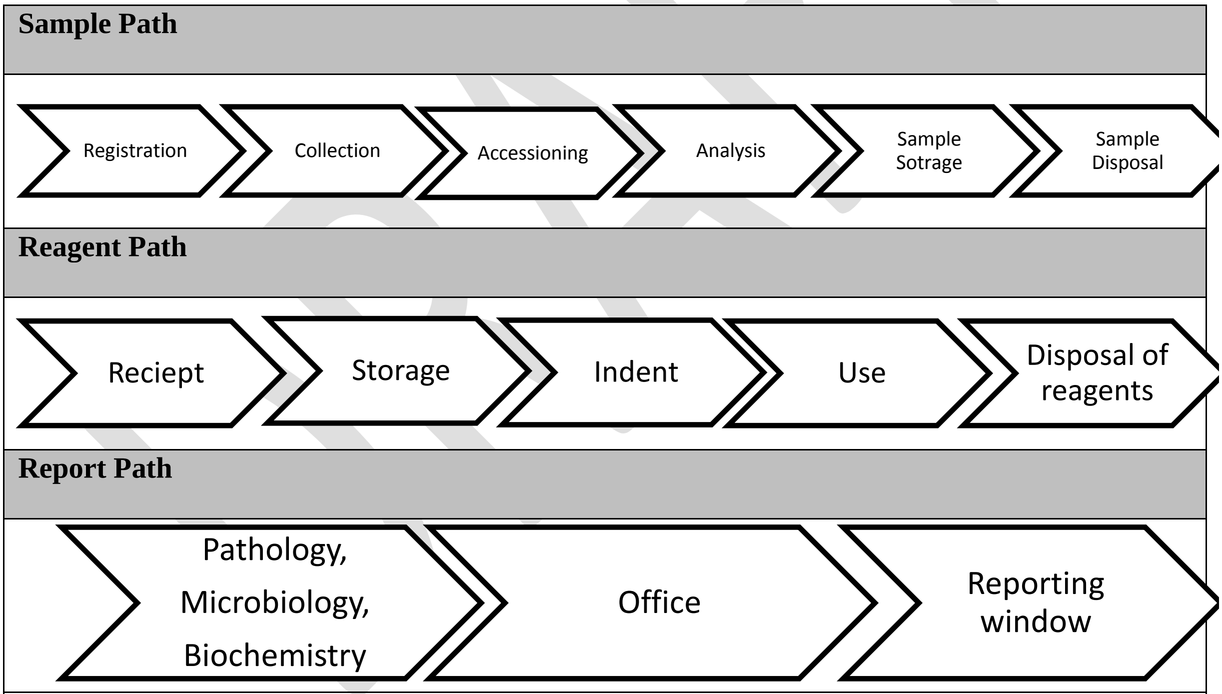

Figure 1: Sample Path

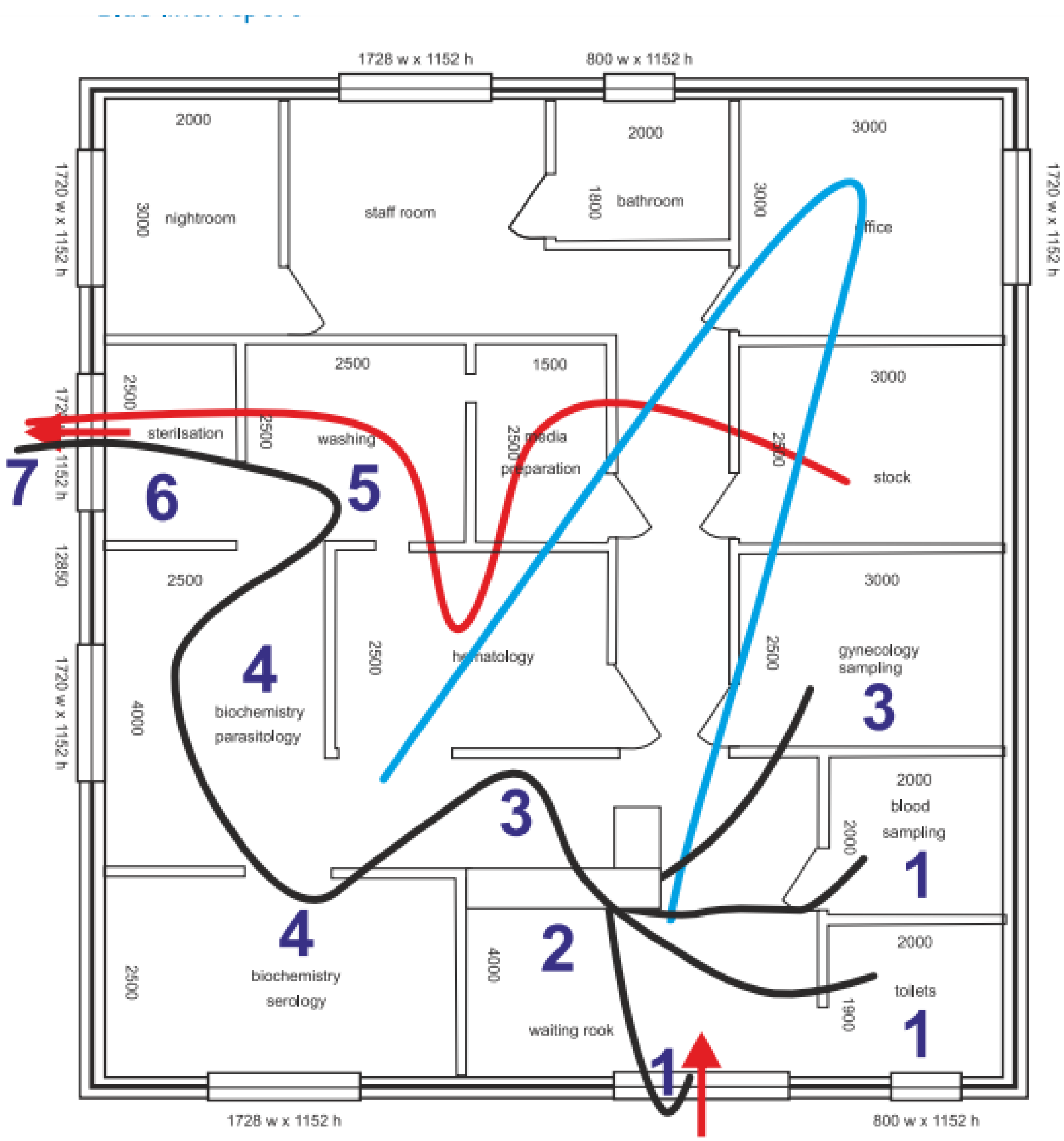

Figure 2: Path of workflow & Layout of the laboratory

Black lines – Lab sample path

1. Sampling
2. Sample Reception
3. Sample preparation
4. Sample Analysis
5. Washing Room
6. Autoclave Room
7. Out!!

Red Line: Reagent Path

Blue Line: Report

PHC Layout

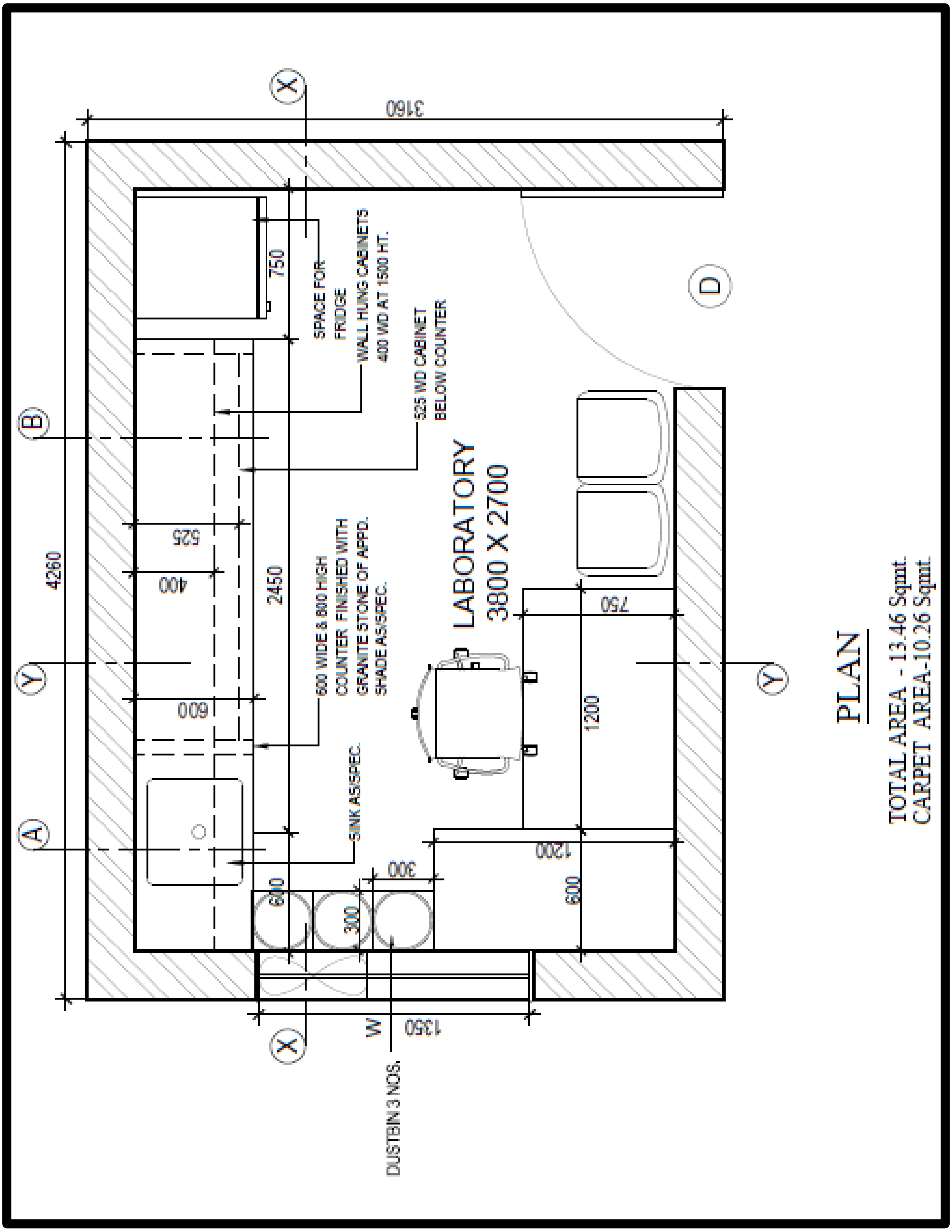

Figure 3: PHC Laboratory Layout

CHC Layout

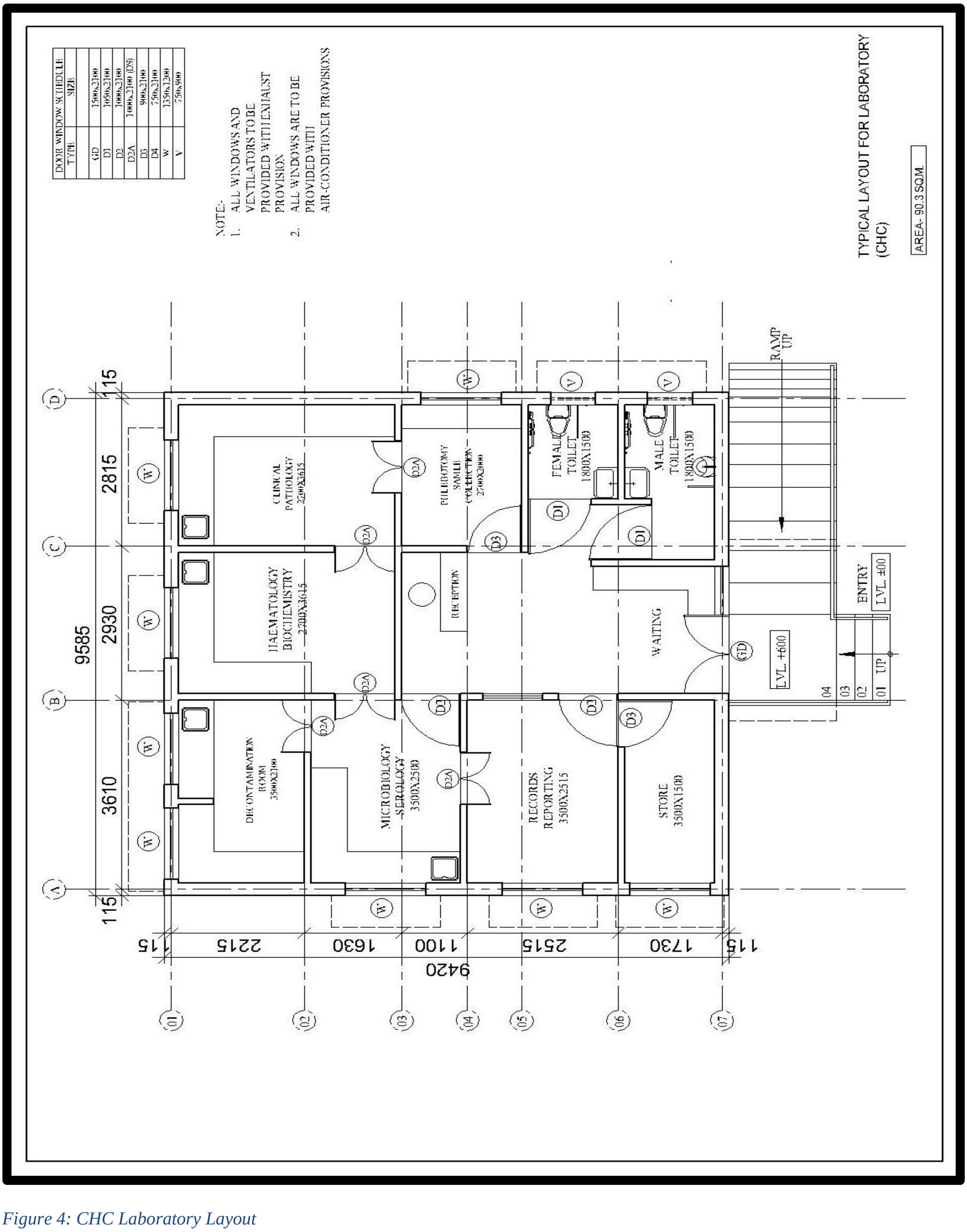

Figure 4: CHC Laboratory Layout

DH Layout

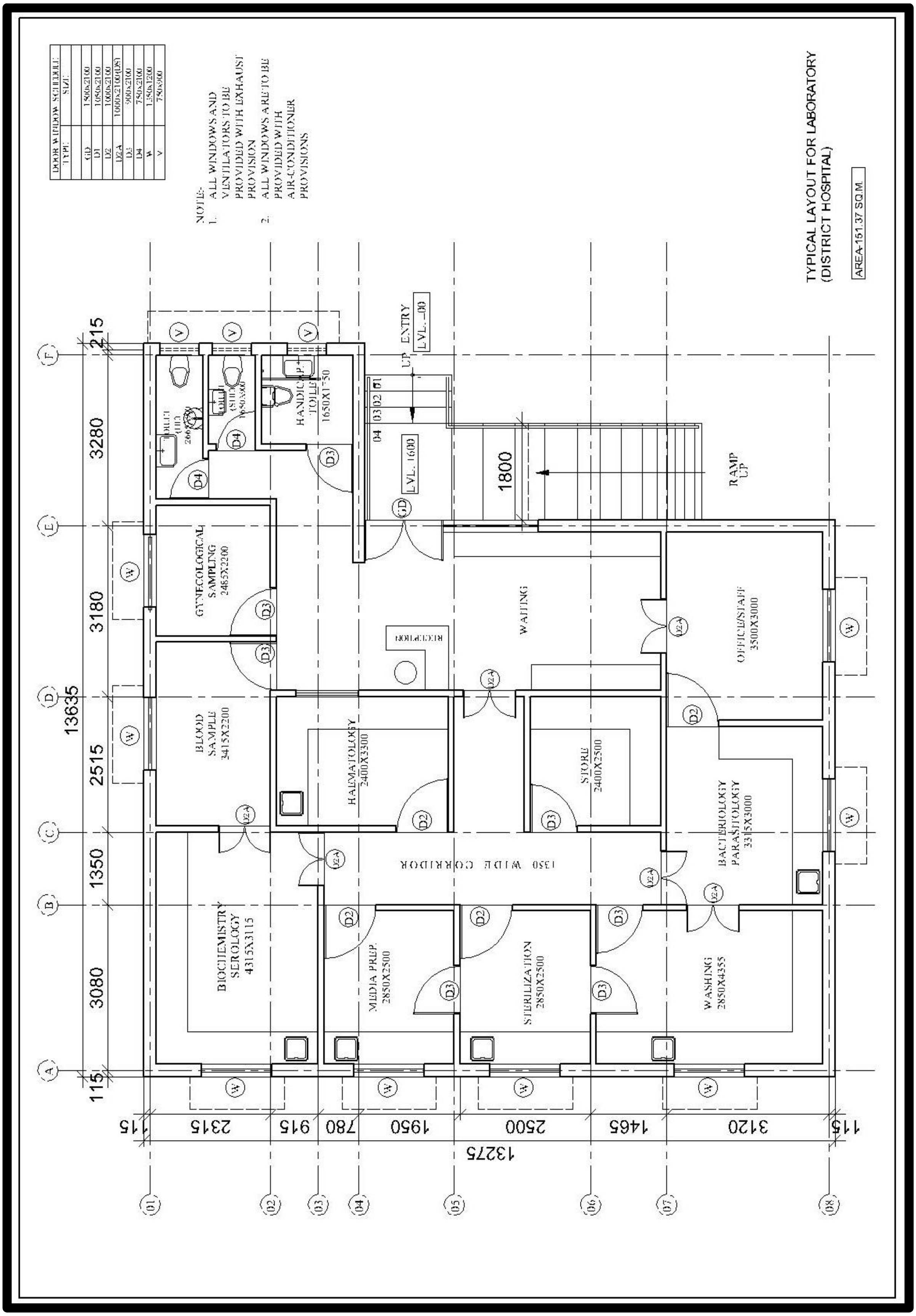

Figure 5: DH Laboratory Layout

3. **Corridors:** Internal Corridor width should be not less than 2550 mm. Corridors and passages to exits should be clear of obstructions.

4. **Ceilings**: The minimum clear ceiling height in laboratory should be 3000 mm.

5. **Entry to the laboratory**

   - A lobby (buffer space) at each laboratory exit should form the boundary between the laboratory and non- laboratory space. This will allow for the hygienic, safe and secure laboratory spaces.
   - Provision of hand- washing facilities and coat pegs for hanging laboratory protective clothing should be provided in the lobby. Provision of storage space for linen bags for storing dirty protective clothing.

6. **Safety and Infection control**

   - Proper segregation between laboratories and non-laboratories.
   - First-aid areas or rooms near laboratory suitably equipped and readily accessible should be available. An emergency tray to be available 24x7 with lifesaving drugs.
   - A method and adequate space for decontaminating all laboratory wastes should be available in the facility (e.g., autoclave, chemical disinfection, or other validated decontamination method).
   - The laboratory equipped with fire/emergency exits, and all fire exits lead to an open space outside.
   - Specified locations for fire extinguishers, fire blankets should be available

7. **Security**
   - The entire laboratory area should be planned as a secure area.
   - Access should be restricted to authorized personnel.
   - The whole laboratory securely locked when unoccupied.
   - One security guard to be deputed during peak hours.

8. **Lighting**

   - The laboratory should be illuminated to optimal level (300 lux) for safe working. Glare should be minimized.
   - Emergency lighting should be provided for corridors/exit pathways.
   - Power back-up

9. **Spatial provision for equipment**

   - Access to equipment for entry and maintenance: There should be no physical restrictions for access such as door and elevator size that could pose a problem for the delivery and maintenance of new machines and equipment. Optimum door width for all analytical/pre-analytical spaces be considered.
   - Power supply: Provision for round the clock stable power supply for sensitive equipment. A UPS power supply or emergency generator for laboratory facility be provisioned separately.

- Managing disposal of liquids from equipment: Disposal of liquid reagents, by-products, and wastes from laboratory equipment and procedures is a major concern for laboratories. Liquid wastes will be handled. It is important to be aware of, and comply with, local and national requirements for liquid waste disposal, in order to prevent contamination of community sewage systems with pathogens or toxic chemicals.
- Equipment should be placed appropriately, i.e. away from water hazards, and out of traffic areas

10. Ventilation and installation of Bio Safety Cabinets

- There are no specific requirements for ventilation systems required for equipment or BSC
- Mechanical ventilation systems However, for new facilities, be provisioned for improved flow of air without recirculation to spaces outside of the facility

B. Architectural Specifications

- Design features/elements and materials selected for the construction of laboratories should be durable, smooth and cleanable and easily maintainable
  Design of laboratory facility should have safe work environment, comfortable, and ease of maintenance.
- Materials for laboratory finishes should be as resistant as possible to the corrosive chemical activity of disinfectants and chemicals used in the laboratory.
- Selection of materials should be at least 2hr fire rating as per fire safety norms in buildings.

1. Flooring and Base Materials

- Floor materials should be non-absorbent, skid-proof, resistant to wear, and also resistant to the adverse effects of acids, solvents, and detergents in normal use.
- Flooring be monolithic or have a minimal number of joints such as vinyl composition tile (VCT)
- Floor surfaces should be easily cleanable and impervious to water.
- Joints in the flooring material should be kept to a minimum and sealed by hot welding. At wall junctions, the flooring should be coved to walls and sealed.

2. Walls

- Wall surfaces should be free from cracks, unsealed penetrations, and imperfect junctions with ceiling and floors.
- Materials should be washable with strong detergents and disinfectants and be capable of withstanding the impact of normal traffic.

3. Ceilings

- Ceilings such as washable lay-in acoustical tiles (with smooth surface) or any suitable suspended ceiling tiles should be provided for most laboratory spaces.
- Open ceilings are acceptable provided minimal ducting and piping is present and all exposed surfaces are smooth and cleanable.

4. Windows and window Treatment

- Energy- efficient glass in windows are recommended.
- Laboratory windows that open to the exterior are not recommended. However, if a laboratory does have windows that open to the exterior, they must be fitted with screens.
- Windows should be non-openable in sterile areas and should be sealed and caulked.

5. Doors

- Minimum door width shall be 1200mm in all analytical areas, with double shutters. In laboratories where the use of larger equipment is anticipated, wider/ higher doors should be considered.
- Vision panels in doors are recommended for all. Pre-analytical/analytical areas

- High-touch fittings with copper finish are recommended.
- Self-closing doors are recommended to aid in infection control
- Laboratory doors should be recessed and swing outward in the direction of egress.
- The doors and windows of the laboratory to be security proof
- Access restriction to laboratories for example swipe cards or locks to control entry.

6. Ergonomics features in Furniture /workstation /counters:

Ergonomics gives a reasonable common base for design. Laboratory furniture should demonstrate good ergonomic design and must be compliant with local norms/standards.

Following all items may consider to follow ergonomics in design.

a. Workbenches

- A workstation intended for working, writing or typing while in seated position should be 720 mm high.
- The optimum recommended configuration for a workstation includes one work surface of 750 mm.
- Work surface of 600 mm with the computer position in the corner. If a computer is positioned in the corner, then the corner should be angled with a minimum dimension of 400 mm.
- Workstation should have provision for safe cable management like provision of an open tray under the work surface.
- A counter to counter clearance of 2150 mm is recommended
- Workbenches should be made of materials which are non-absorbent, skid proof, resistant to wear, and also resistant to the adverse effects of acids, solvents, and detergents in normal use.
- These should be monolithic or have a minimal number of joints between them which can sometimes harbor contaminating microorganisms.
- Organize workbenches according to the type of analysis that is performed, with adequate space for bench-tops equipment and enough space to place SOP while in use and display job aids.
- Provision for supply of water and disposal of drainage be made on and below the workbenches.
- Open spaces between and under benches, cabinets and equipment should be accessible for cleaning.

b. Furniture

- Lab furniture should be sturdy and ergonomically effective, for long usage.
- Chairs used in laboratory work must be covered with a non-porous material that can be easily cleaned and decontaminated with appropriate disinfectant.

c. Storage Shelves

- The recommended depth for shelves below a work bench is the approximate full width of the bench.
- The recommended average depth for wall mounted shelves is 350 mm.
- A shelf may be installed as low as 150 mm above the floor or as high as 1810 mm above the floor.

- The recommended starting point of wall mounted shelves above a work surface designed at 720 mm above the floor is 1370 mm above the floor.

7. Washing stations

a. **Sinks:**

- General laboratory sinks should be "all- in one' units to avoid the need for sealing around the sink. They should be or Stainless Steel and should drain directly to the Waste via a simple S-bend trap.
- A dedicated sink is required when liquid radioactive or clinical waste is disposed of by dilution.
- A sluice will also be required where urine samples are handled.
- Splash-proof sinks should be provided, especially at the washing areas of reusable items.
- To be designed in a way so to allow disposal for an Effluent Treatment Plants when such mechanisms are made available

b. **Clinical hand- wash basins /Showers:**

- Adequate number and location of clinical hand-wash basins be provisioned.
- Taps should be lever- knee-or elbow or automatic sensor- operated.
- Wall mounted paper towel and soap dispensers should be provided at each clinical hand-wash basin.
- Eyewash stations should be provided adjacent to clinical hand-wash basins.
- Provision of emergency shower hoses (within closed cubicle) in pre analytical areas.
- An emergency shower (optional) should be provided in a lobby or corridor adjacent to any work area in which there is a risk of severe chemical contamination. All wet areas to have proper floor drainage needs to be provided in these areas

C. Accommodation Requirements for Specific Areas of Laboratories:

1. Sample Collection

Each collection station should have adequate space to accommodate a phlebotomy chair for the patient, a chair for the phlebotomist, shelves to hold supplies (lockable), access to computer (1.5 sq. meter/ phlebotomy station).

2. Central Specimen Reception and Handling

- Ideally, there should be a single specimen reception area on each pathology site, which should process as all test requests and distribute samples to the appropriate laboratory section.
- It should immediately adjacent to the collection area.
- The specimen reception area should comprise a reception room.
- This area requires a number of workstations.
- Adjacent to the specimen sorting area, a separate specimen processing area should be provided for centrifuging, and dispatching samples to the appropriate laboratory section
- The workbench surfaces should be stable and skid proof to allow centrifuge operations

3. Laboratory Work Area

As described under architectural specifications. A few additional points for microbiology laboratory are enumerated below:

- Bio Safety Cabinets must be installed in such a way that fluctuations of the room air supply and exhaust do not interfere with proper operations of cabinets.
- BSCs should be located away from doors, windows that can be opened, heavily travelled laboratory areas, and other possible airflow disruptions.
- HEPA filtered exhaust air from a Class II BSC can be safely recirculated back into the laboratory environment if the cabinet is tested and certified at least annually and operated according to manufacturer's recommendations.
- BSCs can also be connected to the laboratory exhaust system by either a thimble (canopy) connection or directly exhausted to the outside through a hard connection. Provisions to assure proper safety cabinet performance and air system operation must be verified.
- An appropriate method for decontaminating all laboratory wastes should be available in the facility (e.g., autoclave, chemical disinfection, incineration, or other validated decontamination method) as per local, regional and national regulations.
- Sterilization and decontamination rooms must be located close to the microbiology laboratories so that the materials in question do not require passing through other areas.

4. Service rooms and Support Spaces

As far as possible, these should be located in a central area to minimize distances and facilitate circulation paths of materials, samples, and goods. These may be shared by all disciplines. These include:

a. Storage

The following storages are needed in a lab and may be provided appropriately.

- Storage space must be adequate to hold supplies for immediate use and thus prevent clutter on bench tops and in aisles.
- Storage of spare parts
- Facilities for storing aprons and personal items should be provided outside the laboratory working areas.

- Process and quality records.
- Blood and blood products.
- Housekeeping material.
- Flammable materials used in pathology should be stored in a vented, secure, external flammable goods store that is easily accessible from the laboratories. It may be grouped with other flammable goods stores to share vehicle access.

b. Washing

- Service rooms to accommodate autoclaves
- Sinks for cleaning glassware.
- Preparation and sterilization of culture media.

c. Administration office

- Normally, all reports of pathological examinations conducted on one site will be dispatched through a central administrative office.
- The office should have a dedicated area for housing printers and one computer workstation per desk.
- Storage space for records.

d. Doctors Rooms

- Single-person offices, which are sufficiently private for confidential discussions between staff and with space for the microscopic examination of slides.

e. Staff Rooms with facility of:-

- Staff changing
- Protective clothing storage
- Lunch room
- Pantry
- Washrooms

f. Bio-medical Waste Temporary Holding facilities

- Away from food storage or food preparation areas.
- Large enough to contain all the hazardous BMW with spare capacity.
- Totally enclosed and secured from unauthorized access.
- Inaccessible to animals, insects and birds.
- Easy to clean and disinfect.
- Have an impermeable hard-standing base, good water supply, drainage and ventilation.
- The BMW should not be stored for more than 48 hours.
- Should be packaged securely enough to ensure containment of the waste and to prevent penetration by rodents and vermin.
- The universal biological hazard symbol should be posted on the storage, area door, and waste containers.

Biomedical Waste Management

1. Segregation of BMW at point of segregation, storage transport and disinfect as per Biomedical Waste Management Rules 2016.
2. Liquid waste management s per BMW management rules 2016. Before installing Effluent Treatment Plant (ETP), separate drainage system should be established through new

D. Additional guidelines for Laboratories

1. Energy Conservation & Sustainability

- Heating, ventilation, cooling and lighting should be automatically controlled when not in use.
- Above facilities should be designed to meet the requirements of the Building Regulations norms.

2. Lighting

- Natural lighting should be used (optimally) where ever possible. Passive Solar Design should ensure that laboratory areas are located where they can benefit from natural daylight.

- Areas that do not benefit from natural lighting (for example stores and toilets) should be located towards the core of the facility.
- Solar protection should be provided to minimise solar gain and control glare. This may include the use of sun shades, sunlight reduction glazing and window blinds.
- Areas where glare may be a problem (for example rooms where computers are routinely used) should be located away from direct daylight.
- Glazing solutions should result in the optimum control of glare and solar gain consistent with adequate daylight, (neutral colour solar performance glass can be used).

3. Ventilation

Natural ventilation

- Natural ventilation should be used where possible.
- The design should incorporate measures like (good orientation) for minimising solar heat gain.

Mechanical ventilation

- Ventilation systems for clean laboratories should maintain positive pressures at all times. They should normally use 100% fresh air.
- The shape of the building and/or spatial relationships may result in some enclosed internal areas, which may require ventilation.
- Laboratories toilet require mechanical ventilation irrespective of whether their location is internal or peripheral.
- Storage spaces have transient occupation and therefore require little or no mechanical ventilation.
- Mechanical ventilation to internal rooms other than laboratories should provide minimum Air-changes. It shall be necessary to maintain comfortable conditions, therefore, a low-velocity mechanical ventilation system should be used.
- Diffusers and grilles should be located to encourage uniform air movement. Airflow should be from naturally ventilated spaces or spaces with a mechanical air supply, into spaces that have only mechanical extract ventilation, via transfer grilles in doors or walls.
- The supply air distribution system in the laboratory should not distort the unidirectional and stable airflow pattern required for fume cupboards and microbiological safety cabinets.
- Supply air ceiling diffusers or grilles should not discharge directly towards fume cupboards or safety cabinets, unless the terminal velocity is such that the airflow pattern is unaffected.
- Grilles and diffusers should be positioned some distance from the front face of fume cupboards and safety cabinets.

Extracts Systems (Lab Safety Airflow Systems)

- Extract fans should be located close to the point of discharge to maintain negative pressure.

- Staining areas should have bench extract systems that ensure air flows away from operators' faces. Low-level extract should be provided adjacent to equipment for use when solvents are changed or when specimens in formaldehyde are opened.

- External discharge arrangements for extract systems should be protected against back pressure from adverse wind effects. They should be located to avoid reintroduction of exhausted air into the building through air intakes and windows.

Control Systems

- All supply and extract systems should have local control systems in addition to central main control.

- Supply and extract fans should be interlocked. This will ensure that the supply fan will not operate unless airflow is established with the extract system.

- Laboratory spaces should be comfort cooled without local humidity control. Large laboratory spaces should be zoned, with each zone equipped with a thermostat for individual control.

4. Noise

- Excessive noise can adversely affect the operational efficiency of a pathology facility and cause discomfort.
- Provision of acoustical treatment wherever need for auditory privacy is required.

5. Fire Safety and Precautions

- All necessary fire detection, protection and prevention should be provisioned in the laboratory. The principles of fire safety apply equally to new projects, alterations and upgrading of existing buildings.
- Consideration should be given to the fire safety strategy during the design stage. Operational aspects such as staff responsibilities, equipment provision, building and engineering layouts, should be made.
- Fire-Exit route should be displayed with location of the nearest exit.
- Installation of A, B, C type of fire extinguisher.
- Training of lab staff as new to operate.

6. Hot and Cold Water Systems

- Hot and cold water supplies to laboratories should be served by separate storage vessels and pipework distribution systems.

- All pipework, valves and flanges for water supply systems should be insulated and vapour-sealed.

7. Drainage and waste Systems

- The internal drainage system should use the minimum of pipework and remain water/airtight at all joints and connections.

- Laboratories should be provided with an acid-resistant waste and vent system connected, after dilution, to the foul sewer outside the building perimeter.

- Sink traps and piping to floor drops should be made of acid-resistant materials.

- Separate Drainage systems from clinical laboratories may be provisioned to ETP and not to be linked with other hospital system.

- Effluent management: Separate drainage collection system leading to effluent treatment system is required as per BMW rules.

- To prevent ingress of bacteria an air gap between equipment (autoclaves glassware washing machines and refrigerators) and drainage system.
- The internal drainage system should be connected to the main drainage system as far downstream as possible to ensure maximum dilution.
- The drainage system should allow easy access for inspection and maintenance.

8. **Building management system: No separate BMS is mandated, if the building has a BMS then these points should follow**
    - **a.** Engineering plant and equipment should be monitored and regulated by the BMS,
    - **b.** The BMS should also monitor, measure and record energy consumption for the facility.
    - **c.** Real time centralized monitoring of temperature sensitive operations: refrigerators, deep freezers

References

In the preparation of this Guideline document assistance has been drawn from the following publications and references taken:

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Glossary

Word	Definition
Biosafety Cabinet	A biosafety cabinet (BSC) — also called a biological safety cabinet or microbiological safety cabinet — is an enclosed, ventilated laboratory workspace for safely working with materials contaminated with (or potentially contaminated with) pathogens requiring a defined biosafety level.
Building Management System	A building management system (BMS), otherwise known as a building automation system (BAS), is a computer-based control system installed in buildings that controls and monitors the building's mechanical and electrical equipment such as ventilation, lighting, power systems, fire systems, and security systems.
Containment	The action of keeping something harmful under control or within limits.
Decontamination	The neutralization or removal of dangerous substances, radioactivity, or germs from an area, object, or person.
Disinfection	The process of cleaning something, especially with a chemical, in order to destroy bacteria.
Effluent	Liquid waste or sewage discharged into a river or the sea.
Infection Control	Infection control is the discipline concerned with preventing nosocomial or healthcare-associated infection, a practical (rather than academic) sub-discipline of epidemiology. It is an essential, though often under recognized and under supported, part of the infrastructure of health care.
Pathogens	A bacterium, virus, or other microorganism that can cause disease.
Sterilization	Sterilization (or sterilization), referring to any process that eliminates (removes) or kills (deactivates) all forms of life and other biological agents (as well as viruses which some do not consider to be alive but are biological pathogens nonetheless), including transmissible agents (such as fungi, bacteria, viruses
Variable Air Volume	Variable Air Volume (VAV) is a type of heating, ventilating, and/or air-conditioning (HVAC) system. Unlike constant air volume (CAV) systems, which supply a constant airflow at a variable temperature, VAV systems vary the airflow at a constant temperature.
Mechanical Ventilation	Mechanical ventilation refers to any system that uses mechanical means, such as a fan, to introduce outside air to a space. This includes positive pressure ventilation, exhaust ventilation, and balanced systems that use both supply and exhaust ventilation.

List of Abbreviations

BMS	Building Management System
BMW	Biomedical Waste Management
BSL	Biosafety Level
GCLP	Good Clinical Lab Practices
HVAC	Humidity Ventilation Air-Conditioning
ICMR	Indian Counselling of Medical Research
IPD	In patient department
IPHS	Indian Public Health Standards
OPD	Outpatient department
RCD	Residual Current Devices
VAV	variable air volume
VCT	vinyl composition tile