KINGDOM OF CAMBODIA

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MINISTRY OF HEALTH

Health Equity and Quality Improvement Project (H-EQIP)

ENVIRONMENTAL MANANGEMENT PLAN

for

RENOVATION OF LABORATORY

IN NATIONAL INSTITUTE OF PUBLIC HEALTH

October 28th, 2020

Table of Contents

LIST OF FIGURES

LIST OF TABLES

1. PROJECT DESCRIPTION

The Royal Government of Cambodia (RGC) received fund from the International Development Association (IDA Credit No. 5813-KH; MDTF Grant No. TF0A3114) for the Cambodia Health Equity and Quality Improvement Project (H-EQIP). The objective of project is to improve access to quality health services for the targeted population groups with protection against impoverishment due to the cost of health services in the Kingdom of Cambodia, and to provide immediate and effective response in case of an eligible crisis or emergency. The project has 4 components namely: Component 1: Strengthening Health Service Delivery, Component 2: Improving Financial Protection and Equity, Component 3: Ensuring Sustainable and Responsive Health Systems, and Component 4: Contingent Emergency Response Component (CERC). CERC, with a provisional zero allocation, was created to allow for the reallocation of financing in accordance with the IDA Immediate Response Mechanism to provide an immediate response to an eligible crisis or emergency, as needed. Upon the request from RGC, CERC has been activated on March 27, 2020 and US$14 million was reallocated from other project component budget to finance the implementation of Cambodia National Action Plan for Responding to COVID-19. Action plan prepared to be financed when activating CERC includes supplies of laboratory equipment and reagents, medical equipment and consumables, renovation of hospital and laboratory buildings for testing and treating COVID-19, and ambulances.

In responding to COVID-19, the National Public Health Laboratory (NPHL) has been deployed as the national laboratory to provide COVID-19 testing. Under the CERC action plan, MOH planned to upgrade/renovate NPHL by equipping it with sophisticated laboratory equipment and its associated equipment, consumables, and reagents. Upon the arrival of some procured equipment and machine, National Institute of Public Health will immediately start its laboratory upgrading and renovation activities.

1.1 Description of Project Site

1.1.1 National Institute of Public Health

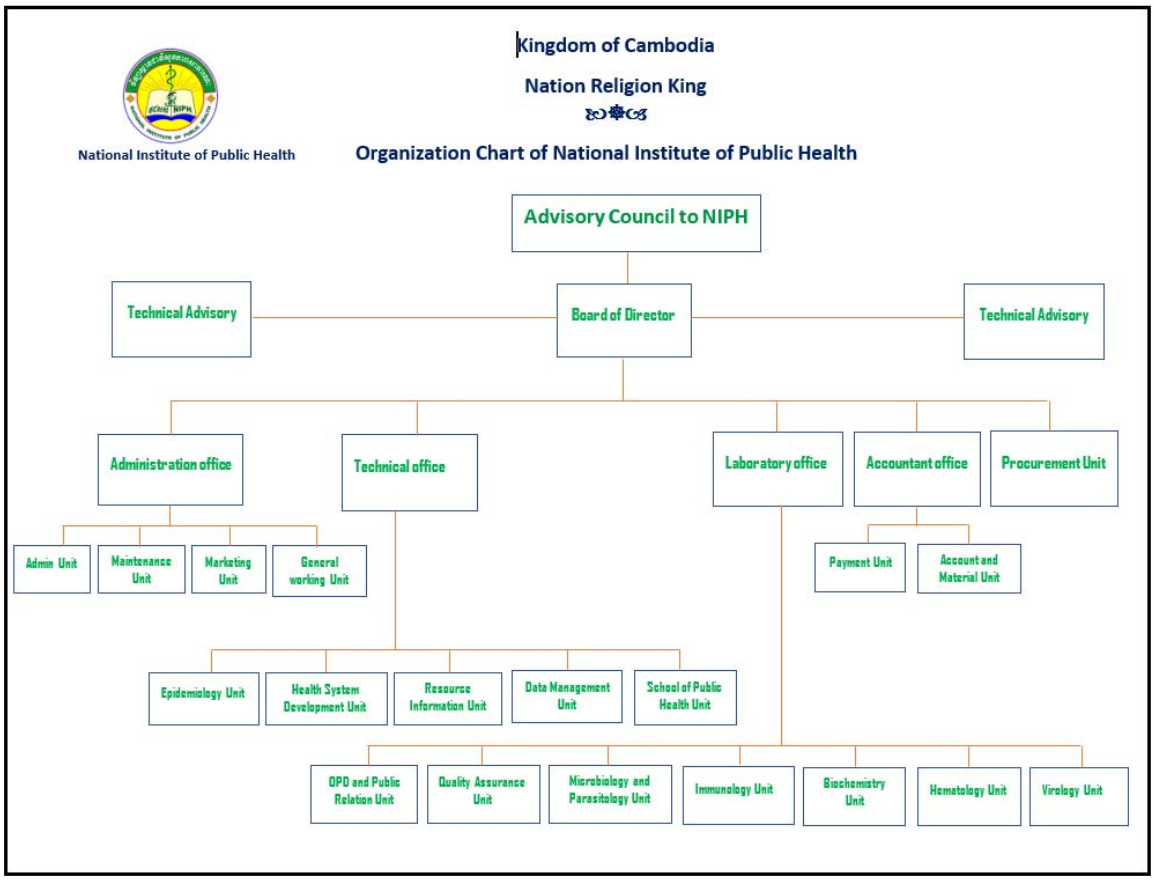
NIPH and its NPHL, known as a national reference laboratory, are working on promoting and strengthening laboratory quality service for public health. With highly qualified and experienced technical staff, NPHL offers high quality services at a reasonable price. Laboratory results used particularly for diagnosis of diseases, are ensured through the up-to-date technologies and the use of Laboratory Quality Management System (LQMS).

1.1.1.1 The organizational structure of NIPH

NIPH was established in 1997 in Phnom Penh, Cambodia, as a successor to the National Center for Hygiene and Epidemiology. NIPH has become a semi-autonomous public institute (or a public administrative establishment) since 2007. Its management structure is governed by a board of directors

and chaired by the Minister of Health. Technically, NIPH is accountable to the Ministry of Health, and financially, is accountable to the Ministry of Economy and Finance. NIPH is composed of a Technical Office, a NPHL, and two supporting offices, the Administrative Office and the Accounting Office. The Technical Office includes a number of health research units and a School of Public Health (SPH) that offers postgraduate degrees in public health. NPHL also has a number of units, including laboratory outpatient service unit. NIPH organizational chart is presented below.

Figure 1: Organizational chart of NIPH



1.1.1.2 NIPH's human resources

There are 118 staff in NIPH. These staff are divided into three groups, government staff (73), government contract staff (20), and contract staff (25). 54 staff out of total 118 work for Laboratory Bureau.

1.1.1.3 NIPH's Services

NIPH provides three types of services including:

(i) public health laboratory services, including serving as a national public health reference laboratory;

(ii) public health training, including Master of Public Health and Master of Science programs in Epidemiology, Nutrition, Hospital Administration, and Health and Community Development; and

(iii) health research and policy support through improving evidence-informed health policy.

1.1.1.4 Strategic plan related to NIPH's laboratory service

One of the four goals of the current NIPH strategic plan 2020-25 is to make NIPH to become a well-known National Public Health Reference Laboratory, providing standard quality public health laboratory services, laboratory training and research, and support in quality improvement, disease surveillance and outbreak investigation. This goal is attended through these strategic objectives and implementations:

- Promote public recognition on laboratory services provided by NPHL through establishing a responsive marketing system
- Support public and private laboratories toward ISO accreditation through LQMS and other short course training programs
- Strengthen NPHL resources to develop and expand External Quality Assurance program to public and private laboratories
- Maintain and expand NPHL service implementation according to ISO 15189 and other accreditations
- Promote NPHL equipment calibration services to public and private laboratories
- Maintain surveillance system and outbreak investigation and response
- Enhance research capacities and activities in NPHL

1.1.2 Location and Site Condition of NIPH

NIPH is located at Lot#: 80, 289, Samdach Penn Nuth Blvd., Phnom Penh, Cambodia. The Institute's location is in the center of Phnom Penh, bordered with Toul Kork Primary School and Street

566 at the North, with the Ministry Of Health (MOH) and Samdach Penn Nuth Blvd. at the East, with street 614 and residential shops at the South, and with street 291 and residential houses/shops at the West. The area size of NIPH is 15,325m^2. NIPH is located in the same compound with MOH.

1.1.3 The Ground Level and Drainage Status

NIPH compound is surrounded by streets and underground public wastewater and stormwater drainage system. NIPH's drainage is connected to the main drainage system of MOH before discharging into the public drainage system. The ground level of NIPH premises is a bit lower than the front and rear buildings and surrounding area. However, NIPH premises never encounter problem related to stormwater flood even during intense rainfall.

1.1.4 Water Supply

The NIPH is connected with the Phnom Penh Water Supply Authority (PPWSA) for domestic water supply. Water intake into laboratories is connected directly from the PPWSA water pipe through two pressure pumps. Water supply provides good quality water and its service is adequate and regular. But sometimes the pressure is low that need to use the pressure pumps to support the need. To secure the availability of water every time, two standby water tanks with 10^3 each have been installed to store water in case of accidental water supply cut off.

1.1.5 Electric Power Supply

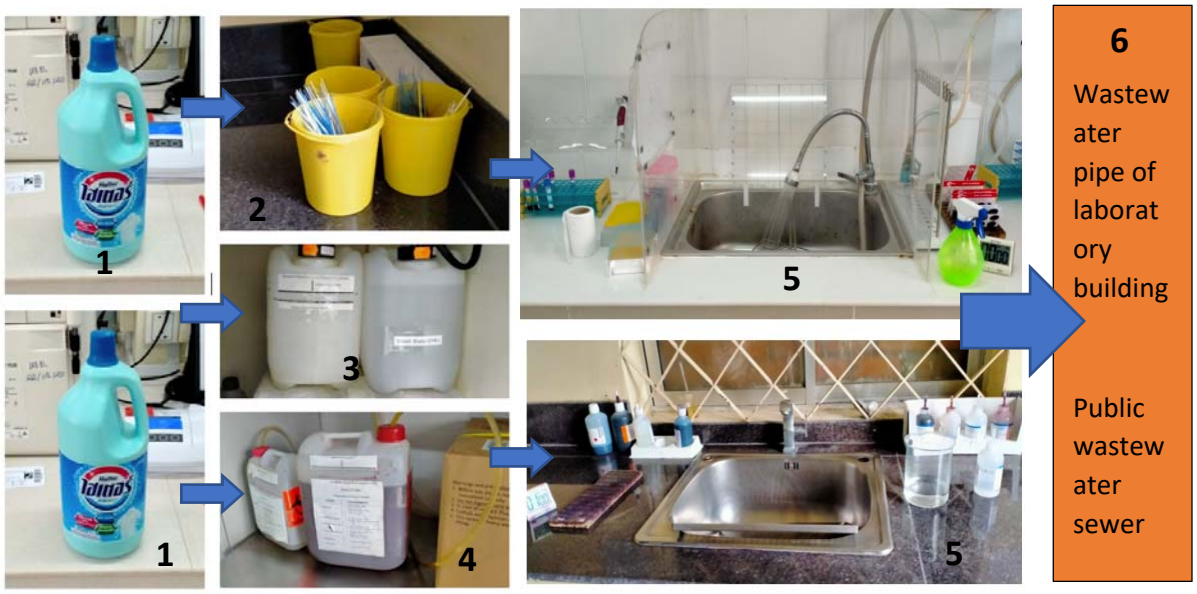
NIPH is connected with the Electricité Du Cambodge (EDC) power supply lines. The electricity input has enough capacity to supply power to all laboratories in NIPH. In addition, NIPH has three standby generators with the capacity of 100KVa, 200KVa and 800KVa to backup power in case the failure from the EDC line. In the laboratory and server room, the UPS backup is installed to secure power sources for about 30 minutes when the power supply is cut off. Small testing machine in micro laboratories is connected to an individual UPS while larger machines in OPD laboratories are connected to central UPS.

1.1.6 Wastewater Collection and Treatment

Wastewater generation in laboratory building is collected from all laboratory facilities to the septic tanks of laboratory building and then to the public wastewater system. No wastewater treatment facility has been installed in laboratory. Wastewater treatment in laboratory is done manually at source. All wastewater collected from analyzer/testing machines, laboratory equipment, and from cleaning contaminated reuse laboratory materials have been collected separately at source and stored in transparent PVC containers of 1L, 2L, 5L, and 10L volumes for treatment (sterilization/disinfection) at source. The existing treatment/disinfection process is practiced manually with bleach solution. Bleach is added into collected infectious wastewater at concentration of 0.5% and kept for a period of time depending on the level of infectious wastewater concentration. After bleach treatment/disinfection

process, treated wastewater is poured into the sinks in the laboratories to discharge into wastewater pipe of the building and then to the public wastewater. Figure 2 below indicates infectious wastewater treatment process in NIPH laboratories.

Figure 2: Infectious wastewater treatment process in NIPH laboratories



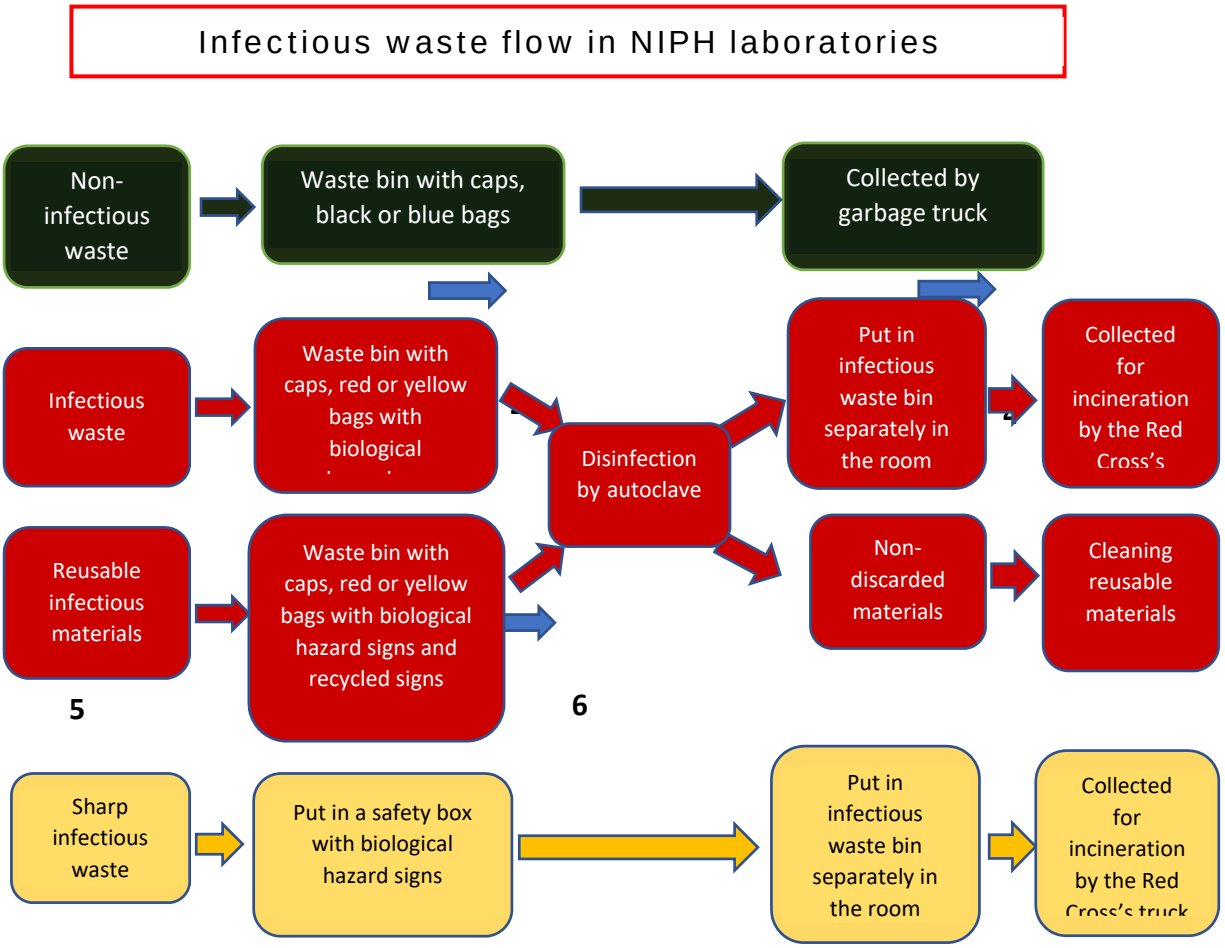
1- Bleach to be added into infectious wastewater;
2- Reuse laboratory materials to be sterilized/decontaminated in bleach solution;
3- Infectious wastewater collected from testing machines;
4- Infectious wastewater collected from test samples, blood and body fluids;
5- Sinks in laboratory to pour treated infectious wastewater;
6- Wastewater from sinks discharge into wastewater pipe of laboratory building.

1.1.7 Solid Waste Collection and Treatment

NIPH separates its generated wastes at source into three types: general waste, infectious waste, and sharp waste. Three types of separated bins with different colors and logos have been designed for waste collection. They are green bin for general waste, red bin for infectious waste, and yellow bin/box for sharp waste. There are two types of waste collection services that NIPH is using: general waste collection service and infectious waste collection service. General waste generated in laboratory building including general and office wastes are collected and stored in a designed location inside the NIPH area for a daily collection from CINTRI, the city general waste collection company, for final disposal at municipality dumpsite. Infectious waste and sharp waste are collected by the Red Cross's truck every Wednesday and Friday for final incineration by Red Cross's incinerator.

For internal infectious waste collection in NIPH laboratories, red plastic bag is used to empty infectious waste from smaller bins that are placed at designated location in laboratory room. Full bags are properly tied and put in larger infectious waste bin for carrying to put in central autoclave room of NIPH for sterilization/decontamination process before they are stored in infectious waste storage room waiting for Red Cross's truck to collect them. The red bag is designed with a printed infectious waste logo outside and indicated safety area where it is safe to touch or carry for collection. Figure 3 presents flow of infectious waste in NIPH laboratories.

Figure 3: Diagram of Infectious waste flow in NIPH laboratories



Infectious waste and sharp waste are collected separately and separated from the general waste. Both types of wastes are put into infectious waste bin and sharp waste bin that are placed at assigned location nearby sources of generation. Then these wastes are collected by putting in red plastic bag for sterilization/decontamination process in central autoclave prior to storing in infected waste storage room of NIPH for final collection by Red Cross truck for final incineration.

Contaminated reuse laboratory materials are sterilized in 0.5% bleach solution and then in mini autoclave for reuse. After completing the process of sterilization and decontamination, treated materials are validated with monitor spore ampoule to make sure that they are completely sterilized for reuse.

1.1.8 Surrounding Natural Environment and Social Conditions

NIPH is located at the center of Phnom Penh, a crowded residential and commercial zone. NIPH compound is surrounded by streets and main street at all directions. Its compound is occupied by several buildings including MOH buildings, NIPH institute building, and NPHL building, and parking spaces. This condition makes the compound of NIPH a bit narrow.

Figure 4: Location of NIPH, surrounding communities, and NIPH buildings

NIPH buildings: 1: Laboratory main building, 2: New OPD laboratories (ISO), 3: Microbiology laboratories, 4: central autoclave room, infectious waste storage room, and laboratory clothes laundry room, 5: NIPH institute building.

Figure 5: NIPH compound

NIPH compound is next to the Toul Kork public primary school in the North. It is also surrounded by residential houses, shops, restaurants, business buildings, markets, and street food vendors in the South, West, and North. NIPH compound is detached from surrounded communities by concrete fences of about 3 meters high. There are four access gates, three from the main street 289 and another from street 566, the entrance of NPHL.

There are some big trees at the front and back sides of NIPH compound. There is no historical place, temple, or community spirit house located near NIPH compound.

1.2 Project Size and Main Activities

1.2.1 Sub-project Cost

Approximated cost of sub-project (i.e. renovation of NIPH laboratories) is estimated at approximately US$410,000.

1.2.2 Main Activities

The establishment of this new Bio Safety Level (BSL) 2+ laboratory room consists of two main activities. The first one is the renovation of new laboratory room focusing on civil work/construction work. The second one is the installation and operation of this new laboratory.

The project will finance the renovation of laboratories within the existing laboratory building. The current BSL2+ laboratory room at NPHL located at the first floor of NIPH main building does not have enough space to accommodate the new analyzer (PCR machine - COBAS 6800 System). Therefore, the renovation of laboratory facility aims at making an additional BSL2+ room in order to expand testing capacity of NPHL up to approximately 600 SARS-CoV-2 testing per day. This new laboratory room is located at the ground floor of NIPH main building.

Renovation: below are renovation activities/works financed by the project:

Preliminary works: Design drawing, mobilization and site installation including site clearance, access road, safety signs, fencing and workers' accommodation with sanitary facility and provision of water & electrical supply to work site, debris transportation.

Structural works: None

Civil works: Removing of existing floor tile and partition wall, painting, repainting on wall, install new brick wall including plastering and painting, apply epoxy on floor, install ceiling board, doors & windows.

Electrical works: Distribution board, lighting fixture, wiring device, Low Voltage cable, cable trunking, Digital Light Pressing trunking, conduit and fittings.

Plumbing works: Water supply system and wastewater pipe system connecting to the existing system

Site works: Site clearance and preparation

Fire fighting works: Fire fighting system

Other works: Extra Low Voltage system and Battery Management System

The renovation of room will take about 6.5 months to complete. For more detailed drawing (civil work & Mechanical Electrical Plumbing work) of renovation work, please see Annex 1.

1.4.3 Provision of Laboratory Equipment

Below is a list of laboratory equipment and supplies for NIPH financed by H-EQIP-CERC

Table 1: Laboratory Equipment, Materials, and Supplies Financed by H-EQIP-CERC

No	Description of Items	Unit items	Quantity
1	Freezer for NIPH (-80degree/480 litter) Brand: Qingdao Haier/ DW-86L486E (-86 oC) (486 L)	Unit	3
2	Reagents for rRT-PCR: QIAamp Viral RNA mini Kit (Kit/250 tests)	Kit/250test	50
3	Reagents for rRT-PCR: Invitrogen, SuperScript™III Platinum® One-Step Quantitative RT-PCR(Kit/500 tests)	Kit/500tests	30
4	Reagents for rRT-PCR: Primers/probe berlin (Pack/96 tests)	Pack/96test	100
5	PCR machine - COBAS 6800 System	Unit	1
6	Reagents for rRT-PCR	Unit	10,000
7	Filter Tips sterile 0.1 to 10µl (ART) pack of 10 x 96	Pack of 960	40
8	Filter Tips sterile 2 to 200 µl (ART) pack of 10 x 96	Pack of 960	40
9	Filter Tips sterile 100 to 1000 µl (ART) pack of 10 x 96	Pack of 960	20
10	Biological Safety Cabinet Class II A2 Brand: Qingdao Haier/HR1500-IIA2 (dimension: 1,680mm X 845mm X 2,160mm)	Unit	1
11	Eppendorf Microcentrifuge 5420 GLP with rotor 24 x 2	Unit	3
12	Chemical indicator tape for autoclave	Unit	1,000

13	Specimen packaging material, (Ice Pack and cooler box)	Unit	300
14	Screw Cap Microcentrifuge Tubes with "O" rings SCT-150-C-S 1.5 ml clear, sterile.	Pack/4000	4
15	Screw Cap Microcentrifuge Tubes with "O" rings SCT-200-C-S 2.0 ml clear, sterile.	Pack/500	60
16	PCR tube strips, clear, with 8-wells and separate strip caps	10xpack/125	20
17	Strip flat caps for 8-wells, 0.2ml PCR tube strips	10xpack/125	
18	Locking Microcentrifuge Tubes, sterile tube	Box/1000	10
19	100-well Microtube storage Boxes 1.5ml to 2.0ml (Blue and Red), split color in half	Pack/5	70
20	Nitrile Exam Gloves (M & L size), case/1000	Box/1000	20
21	Laboratory Marker II, Fine Point (Black and Red), split colors in half	Pack/4	30
22	Parafilm	Roll	34
23	Swab plain aluminum alginate tip sterile Cat: 710-0184	Box/100pcs	50
	MOH local procurement		
1	Universal Viral Transport kits with swabs, box of 50 (confirm for VTM Inactivate) = 25,000 tubes	Tube	25000
2	ANIOS MANUGEL 85	Bottle/500ml	90
3	Anios clean Excel D	Bottle/5 L	30
4	ANIOSPRAY SURF 29	Bottle/5 L	30
5	Surfa'Safe premium	Bottle/750 ml	30
6	WIP'ANIOS PREMIUM = 60 Packs (Pack/100 wipes)	Pack/100wipes	60
7	Refrigerators for NIPH = 2 Units	Unit	2
8	Aircon 5HP (3 units), 2HP (2 units) for NIPH = 5 Units	Unit	5
9	UPS backup, 3 units for NIPH = 3 Units	Unit	3
10	Laptop = 2 units and desktop = 2 units and external hard disk = 2 units for NIPH	set	2
11	Nitrile Exam Gloves (M & L size), case/1000 = 60 Boxes (Box/1000)	Box/1000	120

2. POTENTIAL ENVIRONMENT AND SOCIAL IMPACTS

2.1 Potential Environmental and Social Impacts during Renovation Phase

Potential environmental and social impacts during the renovation phase will be mainly from renovation work on expanding laboratory room.

Without proper design for renovation work, life and fire safety measures and basic environmental hygiene facilities (hand washing facilities, toilets and waste disposal facility) may be neglected.

The renovation activities may generate dust, noise, vibration, and wastes. The renovation activities may cause occupational health and safety issues (e.g. collapse of equipment, heating, inadequate ventilation, etc.).

Another safety issues may involve the impact of existing laboratories on health safety of the construction workers. The impact may come from the risk of workers who may expose themselves to laboratory wastes and who may work closer to crowded people who come to NIPH laboratories for COVID-19 testing. Renovated room is at the ground floor of NIPH main building where the existing BSL2+ is being used for running COVID-19 testing (on the first floor of the same building) as well as for sample taking/collection.

Improper management of construction workers may cause community disturbance (strange behavior, alcohol abuse, noise, local security, local culture). Labors brought from outside may affect local culture and security if they are not properly managed. However, there will be around 10-15 workers needed and most of them are skill workers that have a better education, good experience in construction work in Phnom Penh. In addition, these workers will come to NIPH compound during working hours in day time from 7:00 am to 5:00 pm only. Some overtime works may be implemented between 5pm to 8pm for wall demolishing and removing of existing floor tiles. The contractor will provide the security guards to take care of the security in and around the construction site and to protect all construction workers/other parties who enter the construction site. The renovation activity from 5pm to 8pm is to avoid the disturbance to the government staff during their working hour, and is also non-disturbance to the surrounding community during this time slot. The workers will not stay inside NIPH compound. Thus, social disturbance from construction workers will be minimal.

These impacts are assessed to be of small scale, localized, in short-term period and manageable if good design and work practices are followed, and the schedule of the construction is short (105 days maximum). In this project case, specific Environmental and Social Code of Practices (ESCOPs) will be followed to avoid any possible impacts during renovation works. The contractors, laboratory staff or those who will be carrying out these works will be responsible to implement the ESCOPs.

2.2 Potential Environmental and Social Impacts during Installation and Pre-Operation Phase

For a new established BSL2+ laboratory room:

Inappropriate design of laboratory would create greater issues on biosafety, biosecurity, health safety issues for laboratory staff, workers, and community as a whole.

Improper operation, materials/equipment used, and activities undertook would create potential exposure, health risk and issues to laboratory staff, laboratory workers, visitors, and communities nearby. For instance, inappropriate use of Biological Safety Cabinets (BSCs) would result in greater

exposure of laboratory operator, the laboratory environment, and work materials to infectious aerosols and splashes of infectious agent when manipulating materials containing infectious agents, such as primary cultures, stocks and diagnostic specimens.

2.3 Potential Environmental and Social Impacts during Operation Phase

The project will increase NIPH's COVID-19 testing capacity of NPHL with installation of a PCR-COBAS 6800 machine as well as provision of basic health items and medical instruments (e.g., glove, glasses, laboratory suits) for protecting laboratory staff from infectious agents, wastes, and injuries. Therefore, laboratory waste and relevant wastewater will be slightly increased.

According to WHO's guideline on safe management of waste generated from healthcare activities, between 75% and 90% of the waste produced by healthcare providers is comparable to general waste. The remaining 10-25% of healthcare waste is regarded as "hazardous and bio-infectious" and may pose a variety of environmental and health risks.

Wastes generated in laboratories are mainly hazardous including sharp waste, infectious waste, pathological waste, pharmaceutical waste, cytotoxic waste, chemical waste, and radioactive waste. In epidemiology laboratory, hazardous wastes are mainly sharp waste, infectious waste, sample and testing waste (blood, stool, urine, body fluids), chemical waste, pathogenic waste, and small amount of pharmaceutical waste.

Pathogens in infectious waste and wastewater may enter the human body by a number of routes: through a puncture, abrasion, or cut in the skin; through the mucous membranes; by inhalation; by ingestion. Sharps represent a double risk. They may not only cause physical injury but also infect these wounds if they are contaminated with pathogens. There is concern about infection with human immunodeficiency virus (HIV) and hepatitis viruses B and C, for which there is strong evidence of transmission from injury by syringe needles contaminated by human blood.

Inappropriate use and management of laboratory equipment, personnel protected equipment (PPE), and infectious agents in laboratory may results in a greater exposure of laboratory staff to risk of injury, aerosol, and ventilation of the infectious agent into the environment.

All individuals who are exposed to laboratory wastes would be at risk if these wastes are not managed properly and carefully. These include those within laboratory establishments such as laboratory staff, laboratory workers, waste collectors, and those outside these sources such as workers working in waste disposal facilities, MOH staff, and visitors. NIPH has put in place a standard operation procedure to mitigate the risk described in 3.3.

Laboratory waste gives its hazards to environment and health as well as public sensitivity. Potential impacts of laboratory waste to environment and health are deemed to be site specific, manageable and for which mitigation measures can be readily designed. However, this impacts can be

managed by strict performance on good practice on laboratory waste management, especially infectious and sharp wastes, in all steps including generation, segregation at sources, collection, treatment, handling, storage, and final disposal.

2.4 Potential Environmental and Social Impacts Associated with COVID-19

There is a possibility for infectious microorganisms to be introduced into the environment if they are not contained within the laboratory due to accidents/emergencies or weak compliance with the precaution measures for infection prevention and control. Improper collection of samples and testing for COVID19 and inappropriate laboratory biosafety could result in spread of disease to medical workers or laboratory workers, or population during the transport of potentially affected samples.

The contamination of the laboratory and equipment may result from laboratory procedures: performing and handling of culture, specimens and chemicals. If the contamination is due to a highly infectious agents, it may cause severe human disease, present a serious hazard to workers. Workers in healthcare facilities are particularly vulnerable to contagions like COVID-19. Healthcare-associated infections due to inadequate adherence to occupational health and safety standards can lead to illness and death among health and laboratory workers as well as spreading the disease into the communities.

The expected laboratory infectious/hazardous waste also includes wastes generated from COVID-19 samples. Laboratory wastes also include sharp, infectious agents, chemicals, other hazardous materials used in laboratory testing. In summary, the laboratoty wastes from COVID-19 could cause a high environmental and social risk, if they are not properly handled, treated or disposed.

Wastes that may be generated from laboratories to be supported by this operation - the COVID-19 readiness and response - could include liquid contaminated waste (e.g., blood, other body fluids and contaminated body fluids) and infected materials (e.g., used water, laboratory solutions and reagents, syringes, majority of waste from laboratories which requires special handling and awareness, as it may pose an infectious risk to healthcare workers who are in contact with or handle the waste).

It is also important to ensure that sharps are properly disposed. Given that the medical waste generated by laboratories is a potential vector for the contagion, improper handling of medical waste runs the risk of further spread of the disease. Poor sanitation and improper management of wastewater related to COVID-19 diagnosis can transmit the diseases to the communities and pollute the environment. Without strict adherence of the infection prevention and control measures, laboratory staff and workers could be at high risk of COVID-19 virus transmission.

3. MITIGATION MEASURES

3.1 Measures to Mitigate Impacts during the Design of Laboratory and Installation of Laboratory Equipment

During the renovation phase there will be some impacts from renovation activities including renovation of additional BSL2+ laboratory room and installation of laboratory facilities and equipment in the new laboratory room. Thus the design of this BSL2+ laboratory room had already incorporated the requirement of the Medical Laboratory Biosafety Guidelines. It will strictly include the primary and secondary barrier concept to prevent and protect laboratory staff, laboratory workers, and visitors from contacting and contaminating with infectious agent, used hazardous materials and wastes generated from the laboratory. Measures to be included in the design of this new BSL2+ laboratory room are presented below.

3.1.1 Risk Assessment

This is a new established BSL2+ laboratory room, thus conducting risk assessment prior to operation would be necessary to evaluate the potential exposure to or release of a biological agent and wastes and determine/prioritize risks to be mitigated. The objective of risk assessment is to determine the risks associated with laboratory procedures. It also allows the management to determine the relative risk level of different activities performed in the laboratory, which can be used to make decision on risk mitigation/elimination. The risks and the vulnerabilities in the current biosecurity program will be identified and mitigated/eliminated to ensure that biosecurity risks are reduced to an acceptable level. This risk assessment will be conducted during pre-operation phase after completing the installation of PCR machine and other supporting laboratory equipment. Biosafety and biosecurity team will be in charge in performing this risk assessment. This five-step processes will be adopted for this biosafety risk assessment:

1- Identify hazardous agents and perform an initial assessment of risk;
2- Identify hazardous laboratory procedures;
3- Determine the appropriate biosafety level and select additional precautions indicated by the risk assessment;
4- Evaluate the proficiencies of staff regarding safe practices and the integrity of safety equipment; and
5- Review the risk assessment with a biosafety professional, subject matter expert, and the biosafety committee.

According to Medical Laboratory Biosafety Guidelines, risks from BSL2+ laboratory should match with risk group 2 classification: moderate individual risk, and low community risk. For more

detailed risk assessment to determine the risk associated with laboratory procedures, please see annex 2.11.

The objective of risk assessment is to determine the risks associated with laboratory procedures. Risk assessment allows a laboratory to determine the relative level of risk different laboratory activities pose and help guide risk mitigation/elimination decisions to remove unnecessary risks.

3.1.2 Design Responded Physical Facility of BSL2

A BSL2+ must comply with the following conditions:

- BSL2+ laboratories are often used to study, diagnose, and test pathogens in risk group 2.
- There is a system for collection and treatment of wastewater. The treatment of wastewater from a laboratory shall meet the national standard before being discharged into public wastewater system.
- There must be signage of biological hazard on the entrance of the testing area.
- The laboratory doors shall be closed all the time when tests are being conducted.

3.1.3 Design Incorporated Safety Primary Barrier: Safety Equipment

- Safety equipment includes BSCs, enclosed containers, and other engineering controls designed to minimize exposure to hazardous biological materials.
- Safety equipment includes items for personal protective equipment (PPE), such as gloves, coats, gowns, shoe covers, boots, respirators, face shields, face protection, and safety glasses or goggles.
- Other devices such as hand washing sinks and waste decontamination facilities will be made available to reduce potential environmental contamination.
- Segregate biohazardous waste from other types of waste prior to its disposal. Infectious waste containers serve as primary barriers to protect the worker and to minimize the chance of environmental contamination. This container shall be placed at the appropriate location inside the laboratory room to avoid access and contact from the public.

3.1.4 Design Incorporated Safety Secondary Barrier: Facility Design and Renovation

- The design of the renovation works contributes to the protection of laboratory workers, provides a barrier to protect persons outside the laboratory, and protects persons in the community from infectious agents that may be accidentally released from the laboratory.
- These barriers include separation of the laboratory work area from public access, availability of a decontamination facility (e.g. autoclave) and hand washing facilities.
- Prevent risk of infection by infectious aerosols that are released into the environment; the design features should include special ventilation system to prevent the above risk.

3.1.5 Design Responded Physical Security

- Control and monitoring of access to the building, premises, laboratories, and biological material storage areas to prevent unauthorized access to and removal of biohazardous materials.
- Limit access to authorized and designated employees based on the need to enter sensitive areas. The methods for limiting access include door locking or having a access control door in place.

3.1.6 Designed Incorporated Management Of Personnel, Inventory, and Accountability

- Identify roles and responsibilities of employees who handle, use, store and transport dangerous pathogens and/or other important assets.
- Establish material accountability procedures to track the inventory, storage, use, transfer and destruction of dangerous biological materials and assets when they are no longer needed.

3.2 Measures to Mitigate Impacts during Renovation Work

This section applies the ESCOPs to be performed by the contractor. During civil works, the contractor shall be responsible to implement ESCOPs to mitigate environmental and social impacts (see Table 2).

Table 2: Environmental and Social Code of Practices (ESCOPs)

Environmental and social issues	Mitigation measures
Dust, noise, ventilation and vibration generated from construction works	• The contractor is responsible for compliance with relevant national legislation with respect to ambient air quality, noise and vibration • The contractor shall ensure that the generation of dust is minimized and implement a dust control plan to maintain a safe working environment and minimize disturbances for laboratory staff and surrounding community. • The contractor shall implement dust suppression measures (e.g. water paths, covering of construction material/debris stockpiles, etc.) as required. Construction debris and materials used shall be covered to protect against wind erosion and secured properly during transportation to prevent scattering of soil, sand, materials, or generating dust. • The contractor shall check the air ventilation whether it is adequate during the renovation work that produce dust/lack of natural air through the room. • The contractor should not carry out renovation activities generating high level of noise and vibration during laboratory activities, especially when services are being delivered to the clients.
Wastes generated from renovation works	• The contractor shall ensure that onsite latrine be properly operated and maintained to collect and dispose wastewater from those who do the works; • The contractor shall develop and follow a brief site-specific solid waste control procedure (storage, provision of bins, site clean-up, bin clean-out schedule, etc.) before commencement of any financed rehabilitation works; • The contractor shall use litter bins, containers and waste collection facilities at all places during works; • The contractor may store solid waste temporarily on site in a designated place prior to off-site transportation and disposal through a licensed waste collector; • The contractor shall dispose of waste at designated place identified and approved by NIPH. Open burning or burial of solid waste at the NIPH premises shall not be allowed; • Recyclable materials such as wooden plates for trench works, steel, scaffolding material, site holding, packaging material, etc. shall be segregated and collected on-site from other waste sources for reuse or recycle (sale);

	• When renovation activities are completed, the contractor will clean the site carefully and remove all renovation waste materials and dump it at designated dumping site.
Safety risks during works	• The contractor shall comply with all national and good practice regulations regarding workers' safety including ensuring that no child labor is employed for any renovation works; • The contractor shall prepare and implement a simple action plan to cope with risk and emergency (e.g., fire, earthquake, floods); • The contractor shall have or receive required training on occupational safety regulations and use of personal protective equipment; • Occupational Health and Safety (OHS) management plans will be developed by the contractor where ESCOPs do not suffice. This OHS management plans will include OHS trainings, OHS monitoring at the renovation site and maintaining records of work-related injury statistics and follow up on corrective actions; • The contractor shall provide safety measures as appropriate during works such as installation of fences, safety net, fire extinguishers, first aid kits, restricted access zones, warning signs, overhead protection against falling debris, lighting system to protect laboratory staff, workers and examinees against work risks; • The contractor shall provide training to workers and require them to sign a working code of conduct with appropriate disciplinary actions and penalties for inappropriate behavior including gender-based violence and sexual harassment affecting their peers and community; • Awareness raising about HIV/AIDs among workers and community shall be conducted by the contractor; • Provide information and signage containing information of how grievances can be submitted; • The contractor shall install the ventilation system in the room if the air is found to be inadequate during renovation activity; • Place a gender based violence (GBV) free zone signage at the renovation site; • The contractor shall install the safety nets to protect people working in the compound from debris sparking;

	• All visitors including MOH and laboratory staff shall be required to wear safety helmet and eye glasses during their site visit.
Community disturbance due to improper management of renovation workers	• The contractor shall develop internal rules to manage renovation workers' behaviors, and supervise their compliance; • The contractor shall ensure that workers do not stay inside NIPH compound after working hours; • The contractor shall start demolishing works from 5pm to 8pm to avoid disturbance to laboratory staff during working hours with a provision of one security guard to safeguard the renovation site and the renovation workers.
Health safety risk in exposing to laboratory wastes	• The contractor shall develop internal rules to manage workers movement within the designated area inside NIPH; • The contractor shall know clearly about the designated locations of laboratory infectious waste storage and shall inform their workers not to go closer to these locations; • The workers shall wear face mask all the time when performing their works in NIPH compound; • The contractor shall provide a separate smoking area in the site while the rest of the areas are not allowed for smoking.
Working closely to COVID-19 testing and sample taking laboratories located inside NIPH coupled with workers poor living condition may facilitate COVID-19 transmission for them and other people.	• The contractor shall develop internal rules to manage workers movement within the designated area inside NIPH to prevent being closer to crowded people who come to NIPH for COVID-19 testing; • Renovation site shall be clearly separated from sample taking area and laboratories by thick fences; • The contractor shall review and incorporate interim guideline on COVID-19 prevention in the renovation/construction/civil works project. For the details of this guideline, please see Annex 4. The contractor shall comply with COVID-19 prevention measures as follows: o Consider ways to minimize/control movement in and out of the renovation areas/sites; o If workers stay on site, the contractor shall ask them to minimize their contact with people from outside the renovation areas/sites or prohibit them from leaving the areas/sites for the whole duration of their contract;

	o Follow the procedures to confirm that workers are fit for work before they start working and pay special attention to workers who have underlying health conditions or who may be otherwise at risk; o Check and record temperatures of workers and other people entering the renovation areas/sites or ask for self-reporting before entering the sites; o Provide daily briefing to workers prior to commencing their works, focusing on COVID-19 specific prevention including cough etiquette, hand hygiene and distancing measures; o Request workers to self-monitor for possible symptoms (fever, cough, etc.) and to report to their supervisors if they have symptoms or are feeling unwell; o Prevent workers from an affected area or prevent workers who was in contact with an infected person from entering the renovation areas/sites for 14 days (with an insurance in place to ensure that they can receive their salary, as per the Labor Management Plan); o Prevent sick workers from entering the renovation areas/sites, refer them to local health facilities if necessary, or request them to quarantine at home for 14 days (with an insurance in place to ensure that they can receive their salary, as per the LMP); o Develop a contingency plan with arrangements for accommodation, care and treatment for: ▪ Workers who are self-isolating; ▪ Workers who display symptoms; o Provide adequate water, food and supplies; o Provide workers with PPEs; o Provide workers with accommodation that meets or exceeds IFC/EBRD worker accommodation requirements (e.g. in terms of floor type, proximity/number of workers, number of 'hot bedding', drinking water, washing facility, bathroom facility, etc.), which is in good state, clean and hygienic to minimize the spread of infection; o Washing stations should be provided throughout the site, together with the supply of clean water, liquid soap and paper towels (for hand drying), and waste bins (for used paper towels) that are regularly

	emptied. Washing stations should be provided wherever there is a toilet, canteen, accommodation, waste storage areas, stores, and communal facilities. Where washing stations cannot be provided (for example at remote locations), alcohol-based hand rub should be provided; o Enhanced cleaning arrangements should be put in place, to include regular and deep cleaning using disinfectant of catering facilities/canteens/food/ drink facilities, latrines/toilets/showers, communal areas, including door handles, floors and all surfaces that are touched regularly (ensure that cleaning staff have adequate PPE when cleaning consultation rooms and facilities used to treat infected patients); o Communication materials on COVID-19 prevention and control should be displayed in the workplaces; o Ensure that contracted workers have medical insurance, covering treatment of COVID-19. • All these measures shall be incorporated or attached as a supported document to the contract to make sure that the contractor is aware of all these requirements.
Workers who are under 18 years old can be employed to work with lower salary.	• Child labor or indentured labor is absolutely prohibited in the project. • Labor law prohibits anyone under 18 years to be involved in hazardous work. • The contractor shall ensure that all their workers at the renovation site are over 18 years old.

3.3 Measures to Mitigate Impacts from Laboratory Operations

Measures to mitigate the impacts during laboratory operation include procedures for laboratory biosafety and procedures for laboratory waste management.

3.3.1 Procedures for Laboratory Biosafety

3.3.1.1 Procedure for the use of personal protective equipment

PPE needs are identified, made available, used and appropriately maintained within the facility.

Laboratory clothes: clothing is a barrier to minimize the risk of exposure to aerosols, splashes and accidental inoculation. The clothing and equipment selected depend on the nature of the work performed and shall be based on the risk assessment. Laboratory coat and protective clothing shall be worn when working in the laboratory and removed before leaving the laboratory. Reuse laboratory coat shall be washed in laundry machine by adding bleach for decontamination.

Laboratory coats, gowns, coveralls, aprons: Laboratory coats should preferably be fully buttoned. Long-sleeved, back opening gowns or coveralls give better protection than laboratory coats and are preferred in microbiology laboratories and when working at a Biological Safety Cabinets (BSCs). Aprons may be worn over laboratory coats or gowns where necessary to give further protection against spillage of chemicals or biological materials such as blood or culture fluids. Aprons should also be worn during washing of contaminated materials and over laboratory coats which are not fully buttoned. Laundering services need to be provided at/near the facility. Laboratory coats, gowns, coveralls or aprons should not be worn outside the laboratory areas.

Goggles, safety spectacles, face shields: The choice of equipment to protect the eyes and face from splashes and impacting objects will depend on the activity performed. Safety glasses do not provide adequate splash protection even when side shields are worn with them. Goggles for splash and impact protection should be worn over normal prescription eye glasses and contact lenses (which do not provide protection against biological or chemical hazards). Face shields (visors) are made of shatterproof plastic, fit over the face and are held in place by head straps or caps. Goggles, safety glasses or face shield should not be worn outside the laboratory areas.

Respirators: Respiratory protection may be used when carrying out high-hazardous procedures (e.g. cleaning up a spill of infectious material). The choice of respirator will depend on the type of hazard(s). To achieve optimal protection, respirators should be individually fitted to the operator's face and tested before use. Fully self- contained respirators with an integral air supply provide full protection. Respirators should not be worn outside the laboratory areas.

Gloves: Disposable microbiologically approved latex, vinyl or nitrile surgical-type gloves should be used for general laboratory work, and for handling infectious agents, blood and body fluids. Gloves should be removed and hands should be thoroughly washed after handling infectious materials, working in a BSC and before leaving the laboratory. Used disposable gloves should be discarded with infected laboratory waste. Disposable gloves should not be decontaminated or reused. Gloves should not be worn outside the laboratory areas.

Shoes: Shoe covers or dedicated shoes should be worn where appropriate. All personnel entering areas where infectious materials and/or animals are housed or manipulated should wear boots, shoe covers, or other protective footwear to prevent cross contamination and should only wear them in the restricted laboratory areas.

Figure 6 presents required PPEs for laboratory staff to be taken on and taken off in BSL-2. Hands shall be washed with soap or alcohol after removal of the protective clothing. The instruction for proper use of PPEs in BSL-2 is detailed in SOP-Personal Protective Equipment in Annex 2.1 of this document.

Figure 6: PPEs used in BSL-2 laboratory: take on (left) and take off (right)

ជំនាន់កាលនៃការពាក់ PPE, BSL-2

National Institute of Public Health National Public Health Laboratory	Document code : JA-ALL-01-016	Revision No:00 Issued date: 30/03/2020
ការពាក់ឧបករណ៍ការពារខ្លួនក្នុងសុវត្ថិភាពជីវសាស្ត្រកំរិត២ (BSL-2)		Revised date: N/A

ជំនាន់កាល	សំគាល់ដែលត្រូវពាក់	រូបភាពសំគាល់
១	សំអាតដៃជាមួយអាល់កុល៧០%ឬអាល់កុលជែល	
២	ពាក់អាវបំពង់ដែង (Gown)	
៣	ពាក់ម៉ាស់វះកាត់ (Surgical mask)	
៤	ពាក់ជីនតាសុវត្ថិភាពមានជង (Safety glasses)	
៥	ពាក់មួកគ្របសក់ (Hair cover)	
៦	ពាក់របាំងការពារមុខ	
៧	ពាក់ស្រោមស្បែកជើង	
៨	ពាក់ស្រោមដៃ (មួយជាន់)	

ឆាក់កាលនៃការដោះ PPE, BSL-2

National Institute of Public Health National Public Health Laboratory	Document code : JA-ALL-01-017	Revision No:00 Issued date: 30/03/2020
ការដោះឧបករណ៍ការពារខ្លួនក្នុងសុវត្ថិភាពជីវសាស្ត្រកំរិត២ (BSL-2)		Revised date: N/A

ជំនាន់កាល	សំគាល់ដែលត្រូវដោះ	រូបភាពសំគាល់
១	ដោះស្រោមដៃ (មួយជាន់)	
២	ដោះរបាំងការពារមុខ	
៣	ដោះអាវបំពង់ដែង (Gown)	
៤	ដោះស្រោមស្បែកជើង	
៥	ដោះមួកគ្របសក់ (Hair cover)	
៦	ដោះជីនតាសុវត្ថិភាពមានជង (Safety glasses)	
៧	ដោះម៉ាស់វះកាត់ (Surgical mask)	
៨	សំអាតដៃជាមួយអាល់កុល៧០%ឬអាល់កុលជែល	

Source: NIPH (2017a)

3.3.1.2 Procedure for operation of laboratory safety cabinet

BSCs are designed to protect the operator, the laboratory environment and working materials from exposure to infectious aerosols and splashes that may be generated when manipulating materials containing infectious agents. BSCs also protect the environment in the laboratory. Properly used of BSCs is highly effective in reducing laboratory-acquired infections and cross-contaminations of cultures due to aerosol exposures. Selection of BSC Class 2 is reasonable for the BSL2+.

Locating BSCs in the laboratory

BSCs should be situated in a location remote from traffic and potentially disturbing air currents. A clearance of 30–35 cm above the cabinet is required to provide accurate air velocity measurement across the exhaust filter and to allow convenient exhaust filter change.

Detailed procedure for operation and maintenance of BSCs is elaborated in SOP-Biosafety Cabinet Operation and Maintenance in Annex 2.2 of this document.

3.3.1.3 Procedure for operation of autoclave

Autoclaves are used to decontaminate contaminated reuse laboratory materials, infectious wastes and sharp wastes prior to disposal. For operation and maintenance of autoclave machines, please see the details in SOP-Autoclave Prioclave in Annex 2.3 of this document.

3.3.1.4 Procedures for decontamination, disinfection and sterilization

NIPH will establish and maintain procedures to ensure that appropriate methods for sterilization, disinfection, antisepsis and decontamination are chosen and implemented effectively. Whether preparing an injection site on a patient's skin, or an infectious material for disposal or cleaning up a spill, it is of the utmost importance that the materials be treated properly:

- Sterilization is the use of a physical or chemical procedure to destroy all microbial life, including highly resistant bacterial endospores.
- Disinfection is the elimination of virtually all pathogenic microorganisms on inanimate objects with the exception of large numbers of bacterial endospores, reducing the level of microbial contamination to an acceptable safety level.
- A decontamination procedure can range from sterilization to simple cleaning with soap and water. Sterilization, disinfection and antisepsis are all forms of decontamination.

Bleach, a fast-acting oxidant, is broad-spectrum chemical germicide. It is important to note that bleach is highly alkaline and can be corrosive to metal. Household bleach (original concentration 5% or 6%) should be prepared to the proper concentration and discard daily after use. Procedures on disinfection, decontamination, and sterilization are details in SOP-Disinfection Solutions and Sterilization in Annexes 2.8 and 2.9 of this document.

3.2.1.5 Procedure for packaging, transportation, receipt and process of samples

Ensure that procedures for safe and secure transportation of cultures, specimens, samples and contaminated or potentially contaminated materials are established and maintained in accordance with legal requirements for the transportation of dangerous goods. Policy on transport of materials includes accountability measures for the movement of materials within an institution. Annex 2.6 presents SOP- Sample Package and Transportation.

The triple packaging system

The triple packaging system is the safest packaging system to transport infectious agents/materials. It consists of three layers: a leakproof primary receptacle, a leakproof secondary packaging and a sturdy outer packaging. The primary receptacle is wrapped in enough absorbent material to absorb all fluid in case of breakage or leakage. The secondary receptacle is used to enclose and protect the primary receptacle(s). Several wrapped primary receptacles may be placed in a single secondary receptacle.

Figure 7: Triple package system

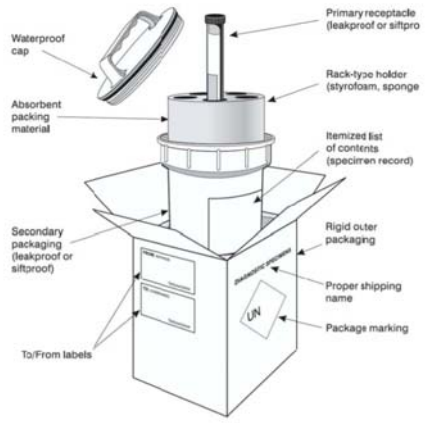


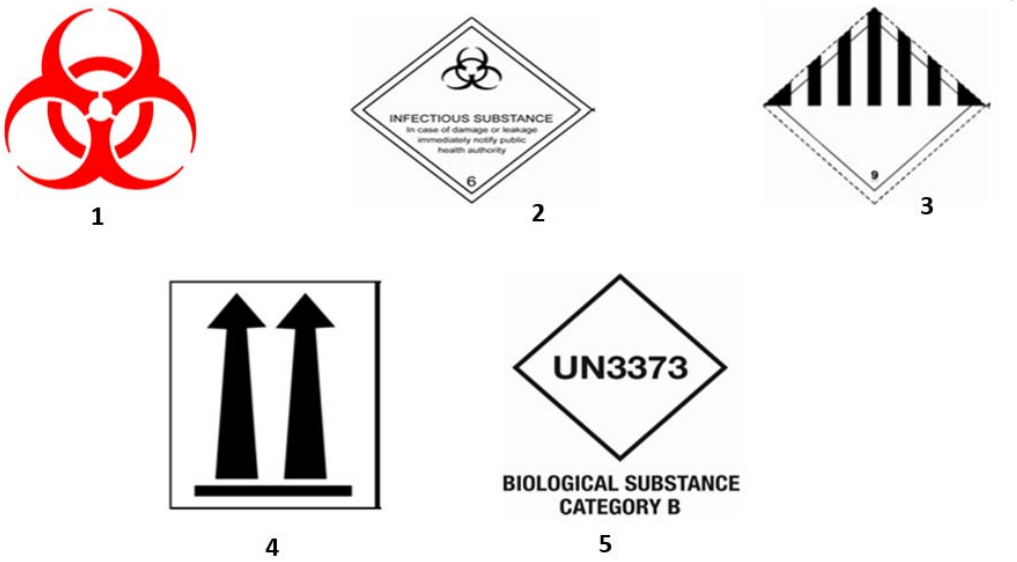
Figure 1. Example of triple packaging system.

Source: MOH (2015).

A. Label on packaging

The below labels describe the infectious substances required to place on the package for transportation.

Figure 8: Labels of infectious substances required to place on package for transportation



1- Biohazard sign: infectious materials, infectious wastes;

2- Hazard label for Category A infectious substances and for genetically modified microorganisms and organisms that meet the definition of an infectious substance;

3- Hazard label for certain noninfectious genetically modified microorganisms and organisms (UN 3245) and for carbon dioxide, solid (dry ice) (UN 1845); substances packed in dry ice (see section on Refrigerants) shall bear this label in addition to the primary risk label (e.g. the label shown in Figure 3 for Category A infectious substances;

4- Orientation label to indicate position of closures on the primary receptacles; for the air transport of quantities of liquid infectious substances in Category A that exceed 50 ml per primary receptacle, this label shall be affixed to two opposite sides of the package with the arrows pointing in the right direction, in addition to the label shown in Figure

5- UN 3373, are human or animal materials that are being transported only for the purpose of diagnosis or investigation.

3.3.2 Procedures for Laboratory Waste Management

NPHL will strictly implement waste management plan and standard operation procedure for waste management, which will follow good practice standards on how to properly manage laboratory wastes. Good practice standards on laboratory waste management, especially infectious and sharp wastes, will be strictly followed. They include generation, segregation at sources, collection, treatment, handling, storage, and final disposal. Below are procedures for laboratory waste management at NIPH.

3.3.2.1 Procedure for waste segregation, collection and preliminary treatment in laboratories

NPHL will implement SOPs for waste management, disposal of chemical waste, disposal and decontamination of sharp wastes, disinfection solution and sterilization including minimization, segregation, storage, transport, treatment and final disposal of solid laboratory wastes. The procedures for laboratory waste management are detailed in SOPs on Waste Management, Disposal of Chemical Waste, and Disposal and Decontamination of Sharp in Annexes 2.7, 2.8, 2.9, and 2.10 of this document. Table 3 mentions mitigation measures and methods to minimize impacts from laboratory generated wastes.

Table 3: Laboratory Waste Management

Environmental issue	**Mitigation measures**
Individual risk associated with exposure to laboratory wastes, infectious wastes and sharp wastes.	- Strictly apply good practices on laboratory waste management, especially infectious and sharp wastes management. - Apply SOPs on waste management such as waste segregation, collection, treatment, handling, storage, and disposal; waste decontamination, disinfection, and sterilization. - Strictly control the practices of wastewater treatment at source through regular monitoring of compliance to good practices and to ensure that treated wastewater meet the standard of laboratory wastewater safe disposable into the public wastewater system.
Solid medical laboratory wastes, especially sharp wastes and infectious	NPHL will apply SOPs on waste management including disposal of chemical wastes, disposal and decontamination of sharp wastes, disinfection, and sterilization including minimization, segregation, storage, transportation, treatment and final disposal of solid laboratory wastes. **Segregation of laboratory wastes** • All type of wastes will be segregated at source.

wastes, generated from laboratory.	• Separated waste containers/bags are clearly designated by color with appropriate logos according to the type of wastes: black color container/bag for general waste, yellow for infectious wastes (i.e. pathological waste, blood, body fluids), double yellow for high risk infectious wastes, red for sharp wastes, and brown for chemical and pharmaceutical wastes. • The waste containers are put at the most appropriate places closer to the sources of generation. • Training is provided to ensure that laboratory staff and workers are well understood on how to segregate wastes. **Labeling** • All waste containers are placed at the source of generation and should be clearly marked with biohazard symbol. • The date when the waste is first generated is written on the waste container with appropriate label for storage. • Laboratory wastes requiring autoclaving or other equivalent treatment will be labelled accordingly. **Storage of laboratory wastes** • Different laboratory wastes will be stored separately in standard storage equipment. • Storage time of laboratory wastes will not exceed 48 hours. • Storage room or place and storage equipment will be cleaned and disinfected at least once a week. • Specific areas will be identified for the initial storage in the laboratory rooms, near the source of waste generation. • Central storage facility for infectious wastes is separated from general waste storage areas and be away from public access. • Waste for sanitary landfill and/or for incineration are stored separately in the central storage area. **Transportation of laboratory wastes** • Waste containers from initial storage area will be emptied regularly. • Manual handling of waste bags will be minimized. • Dedicated wheeled containers, trolleys or carts should be used to transport the waste containers to central storage area. • Transport vehicles shall be reserved only for the transportation of laboratory and healthcare wastes. • Wheeled containers, trolleys or carts should be cleaned and disinfected regularly and immediately after spillage or contamination.

	Central storage facility for laboratory wastes • Central storage facility should be locked and should be accessible only by authorized persons. • It should be well ventilated with sufficient light. • It should be located on a well-drained, impervious hard-standing area, provided with wash down and disinfection facilities. • It should have sufficient storage capacity. **Treatment of laboratory wastes** • Infectious waste will be autoclaved wherever possible before disposal. • Non-autoclave infectious waste will be disinfected by using bleach solution, lime solution, calcium oxide or other chemical disinfectants. • Needle cutter will be used to remove needles from syringes. • Defanged syringes should be disinfected with 2% chlorine solution in order to be recycled. **Autoclave:** is used for the treatment of highly infectious wastes, such as microbial cultures or sharp waste. **Standard incinerator:** Two-chambered incinerators with proper temperature and sufficient chimney height should be used. The temperature must be at least 850C to ensure minimal emission of toxic gases at the primary chamber. **Chemical disinfection:** 0.5% chlorine solution, 5% sodium hypochlorite, 30% hydrogen peroxide, bleaching powder, lime solution, calcium oxide or other chemical disinfectants can be used for non-autoclavable infectious wastes. **Sanitary landfill:** Sanitary landfill is close to the working areas where wastes are generated providing easy access for waste disposal. Landfill site should be at least 50 meters away from the water sources. **Encapsulation and energization:** It is usually used as a disposal method for pharmaceutical wastes and incinerated ash of heavy metals.
Occupational Health issues among laboratory staff	Occupational Health and Safety training program will be developed and provided to laboratory staff on aspects linked to laboratory waste management and infection control. This training program can be offered by biosafety and biosecurity team of NIPH.

3.3.2.2 Biohazardous waste handling and disposal

Hazardous waste poses high risks to the laboratory staff, the general public, and the environment if not handled properly. Therefore, all staff involved with waste handling and disposal should be aware of the potential risks, be trained to mitigate the risks, and receive appropriate tools (e.g. PPEs, waste collection containers, signage, etc.) to safely handle the wastes.

All infectious waste generated from a laboratory should be decontaminated prior to disposal. Decontamination as close as possible to the point or source of generation fosters safer waste handling and minimizes the chance of staff inadvertently coming in contact with infectious materials.

3.3.2.3 Procedure/method for chemical waste treatment and disposal

Incineration is useful for disposal of laboratory wastes, with or without prior decontamination. Proper incineration requires an efficient temperature control and a secondary burning chamber. There are some concerns regarding the possible negative environmental effects of the existing or the proposed incinerators. However, efforts are continuously made to ensure that incinerators are more environmentally friendly and energy - efficient. The procedure for chemical waste treatment and disposal is detailed in SOP- Disposal of Chemical Waste, Annex 2.10.

3.3.2.4 Wastewater collection and treatment system

Wastewater generated from laboratory facilities will be disposed according to the reference guidelines for healthcare and laboratory facilities and WHO's guidelines for safe management of waste from healthcare and laboratory activities. NIPH does not have onsite wastewater treatment facility. All wastewater generates from laboratory facilities/machines and from cleansing/sterilizing of reuse laboratory materials will be collected at source for treatment before discharge to public wastewater. Bleach solution/powder will be used as disinfectant for treating collected wastewater. Concentration and volume of bleach solution used depend on the level of contaminated wastewater and its volume as describe in the SOP-Disinfection Solution and Sterilization in Annex 2.9.

3.3.3 Procedures for Fire Safety

3.3.3.1 Fire detecting system monitoring

Install detective devices such as fire alarm, automatic smoke detectors, and automatic door access. The procedure for fire detecting system monitoring is detailed in the SOP-Fire Detective System Monitoring in Annex 2.4.

3.3.3.2 Emergency evacuation plan

Identify evacuation routes and maps designed in response to emergency situation such as in case of fire, natural disasters, and chemical spills. For the details of the procedure for emergency evaluation plan, please refer to the SOP-Emergency Evacuation Plan in Annex 2.5.

Potential impacts during operation phase will be well managed since risk assessment will be conducted in all procedures related to laboratory testing. Biosafety cabinet class 2 will be used to minimize the potential impacts on laboratory staff and environment. BSL2+ room will be used to perform testing on sample which has high pathogenic risk. In addition, biosafety team will conduct routine monitoring and supervision in the laboratory. All molecular staff who will work in the renovated laboratory facilities have been well trained and passed the staff competency assessment. All technical, management, and biosafety and biosecurity procedures are available for all staff to use in their relevant stations.

4. MONITORING, SUPERVISION AND REPORTING

This section describes procedures and tools to monitor and supervise the implementation of mitigation measures and the compliance with environmental and safety standards/guidelines.

4.1 During Renovation of Additional BSL2+ Laboratory Room

During the renovation of the new BSL2+ laboratory facilities, the Laboratory Facility Management Committee will be responsible for the day-to-day supervision of the implementation of the contractor on mitigation measures as specified in the ESCOPs. The contractor shall submit the contractor environmental management plan (CEMP) including ESCOPs to the Project Director prior to initiating the civil works.

The civil work supervision team and PMD /safeguard focal person will monitor the contractor's compliance with CEMP/ESCOPs and ensure that the contractor incorporate the status of EMP/ESCOPs implementation into the monthly civil work progress reports. The civil work supervision team is a group of NIPH staff who are assigned by NIPH management team to be in charge of site monitoring and supervision during renovation phase.

4.2 During Operation of New BSL2+ Laboratory

Biosafety and biosecurity team are assigned to routinely monitor and supervise the biosafety and biosecurity using a standard checklist developed by the team. In addition to routine monitoring and supervision, the team will periodically conduct the biosafety and biosecurity internal audit by using international standard checklist (ISO 15189 and 15190) to identify any nonconformity (or potential nonconformity) to the standards which may cause other potential risks, particularly on the environment and human. The audit will provide objective evidences for management team to make an efficient and effective preventive measures to stop and minimize those potential risks. The result of monitoring and supervision of the biosafety and biosecurity team should be incorporated in the quarterly and semester monitoring report of laboratory operation prepared by laboratory operators.

5. IMPLEMENTATION OF EMP

5.1 Implementation Arrangement

This Environmental Management Plan (EMP) is prepared in response to the Environmental and Social Safeguard requirements under H-EQIP project, specifically on the renovation of NIPH's laboratory. It lists down potential environmental and social impacts that would occur during the renovation and operation phases of the laboratory and proposes measures to mitigate the identified risks and impacts to an acceptable standard. NIPH management team and PMD shall ensure the implementation of mitigation measures at all phases including renovation and operation phases. Biosafety and biosecurity team of NIPH will perform routing monitoring and supervision of the laboratory during installation and operation. Laboratory chief and laboratory staff will involve in the implementation of measures dealing with daily operation, especially with wastes and personnel safety measures. The contractor is responsible for implementing ESCOPs during renovation period and ensure that workers are aware of the internal rules and health safety measures and strictly follow the occupational and health safety measures and the contractor's internal rules during their work at NIPH.

5.2 Budget for Implementation of EMP

For the implementation of EMP, a budget needs to be allocated for mitigation measures. Budget to cover the contractor's compliance with EMP and ESCOPs shall be included in the bidding budget. The civil works supervision team and biosafety/biosecurity team will responsible for monitoring and supervising the implementation of measures, and this will not require any budget given it located within NIPH and MOH compounds. During operation, the budget to avail laboratory equipment, laboratory materials, and PPEs shall be covered by project budget.

5.3 Grievance Redress Mechanism

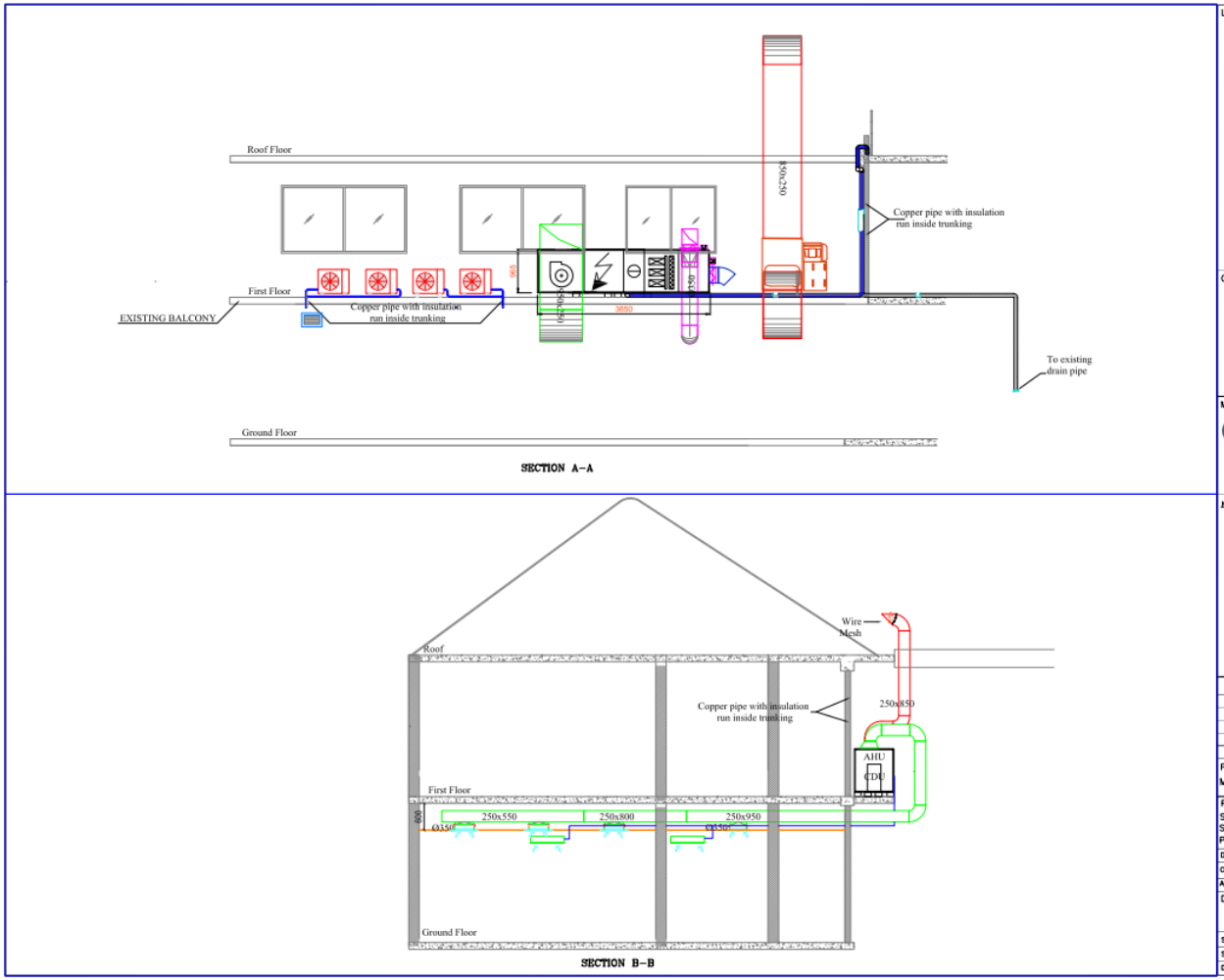
A grievance redress mechanism (GRM) needs to be established within the context/scope of this subproject. This GRM is established to address any complaints that may occur during the subproject implementation. If someone finds out that the project creates negative impact on the community, individual, or environment, s/he can raise a respective grievance and submit a complaint to the Grievance Redress Committee for solution. The GRM has 3 steps.

- Step 1: The complainant discusses respective grievance with the NIPH focal person for a solution;
- Step 2: If the complainant is not satisfied with the solution offered, s/he can raise the grievance to the Project Director (PD);
- Step 3: If both parties are not satisfied with the solution made by the PD, they can go for a legal recourse.

Step 1 and 2 have no cost to the complainant.

ANNEXES

Annex 1: Detail Drawing for Civil work and MEP Work



SECTION A-A

SECTION B-B

LEGEND:

- CDU - CONDENSING UNIT
- AHU - AIR HANLING UNIT
- EF - EXHAUST AIR FAN
- SUPPLY AIR GRILLE
- RETURN AIR GRILLE
- EXHAUST AIR GRILLE WITH HEPA FILTER H14
- MANUAL DAMPER
- SUPPLY AIR DUCT
- RETURN AIR DUCT
- EXHAUST AIR DUCT
- MOTORIZED DAMPER

OWNER: MINISTRY OF HEALTH

MEP CONTRACTOR

ComInKhmere

PHNOM PENH OFFICE:
N° 86, Down town Road N° 7, P.O. Box 28.
Tel: (855) (0)23 885 640~6
Fax: (855) (0)23 885 651
Email:www.cominkhmere.com

NOTE :

Rev.	Date	Description
00	05-08-2020	FOR CONSTRUCTION

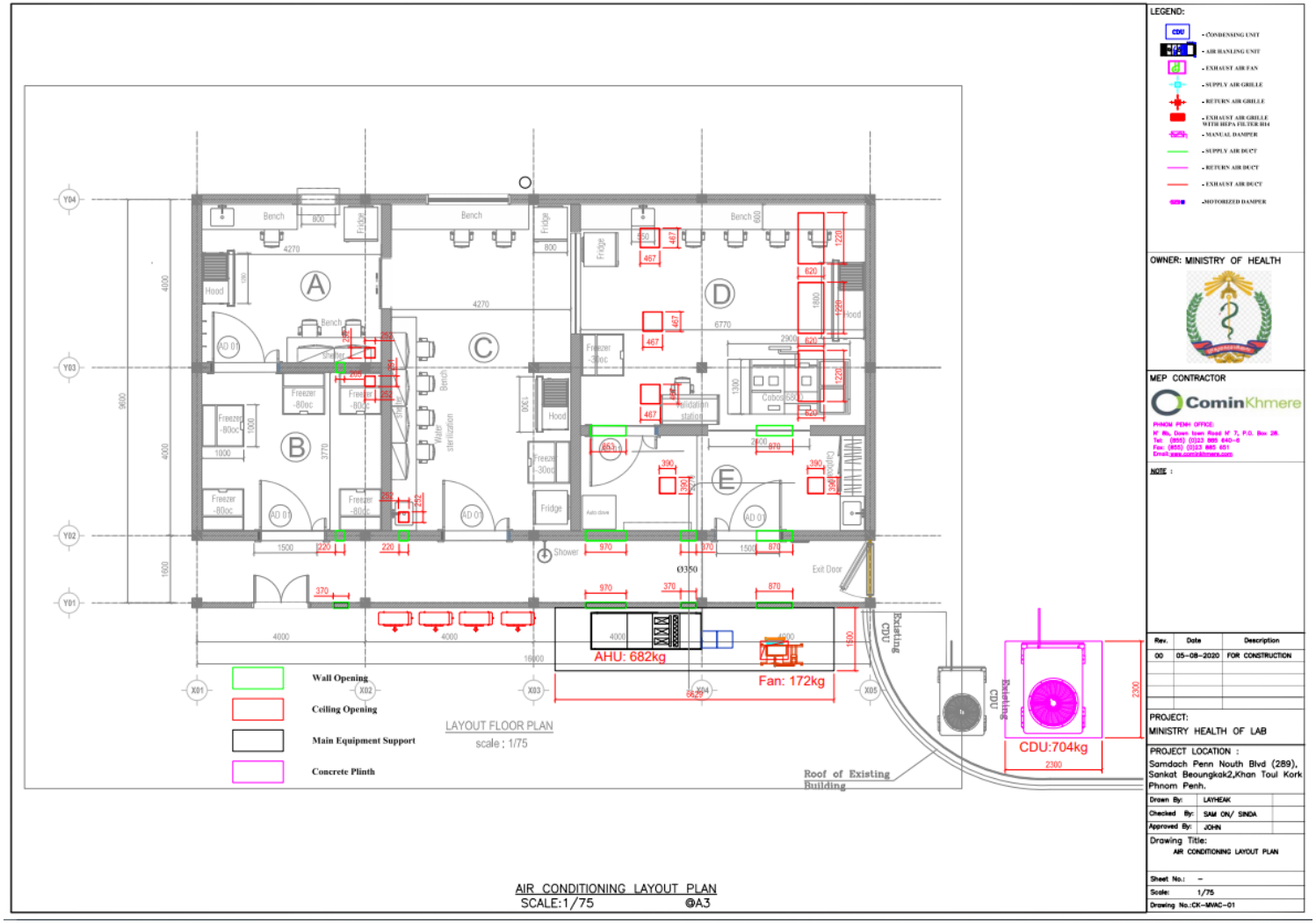
PROJECT:
MINISTRY OF HEALTH OF LAB

PROJECT LOCATION :
Samdach Penn Nouth Blvd (289), Sankat Beungkok2,Khan Toul Kork Phnom Penh.

Drawn By:	LAYHEAK
Checked By:	SAM ON/ SINDA
Approved By:	JOHN

Drawing Title:
MVAC SECTION

Sheet No.: –
Scale: NTS@A3
Drawing No.:CK-MVAC-03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- CONDENSING UNIT
- AIR HANLING UNIT
- EXHAUST AIR FAN
- SUPPLY AIR GRILLE
- RETURN AIR GRILLE
- EXHAUST AIR GRILLE WITH HEPA FILTER H14
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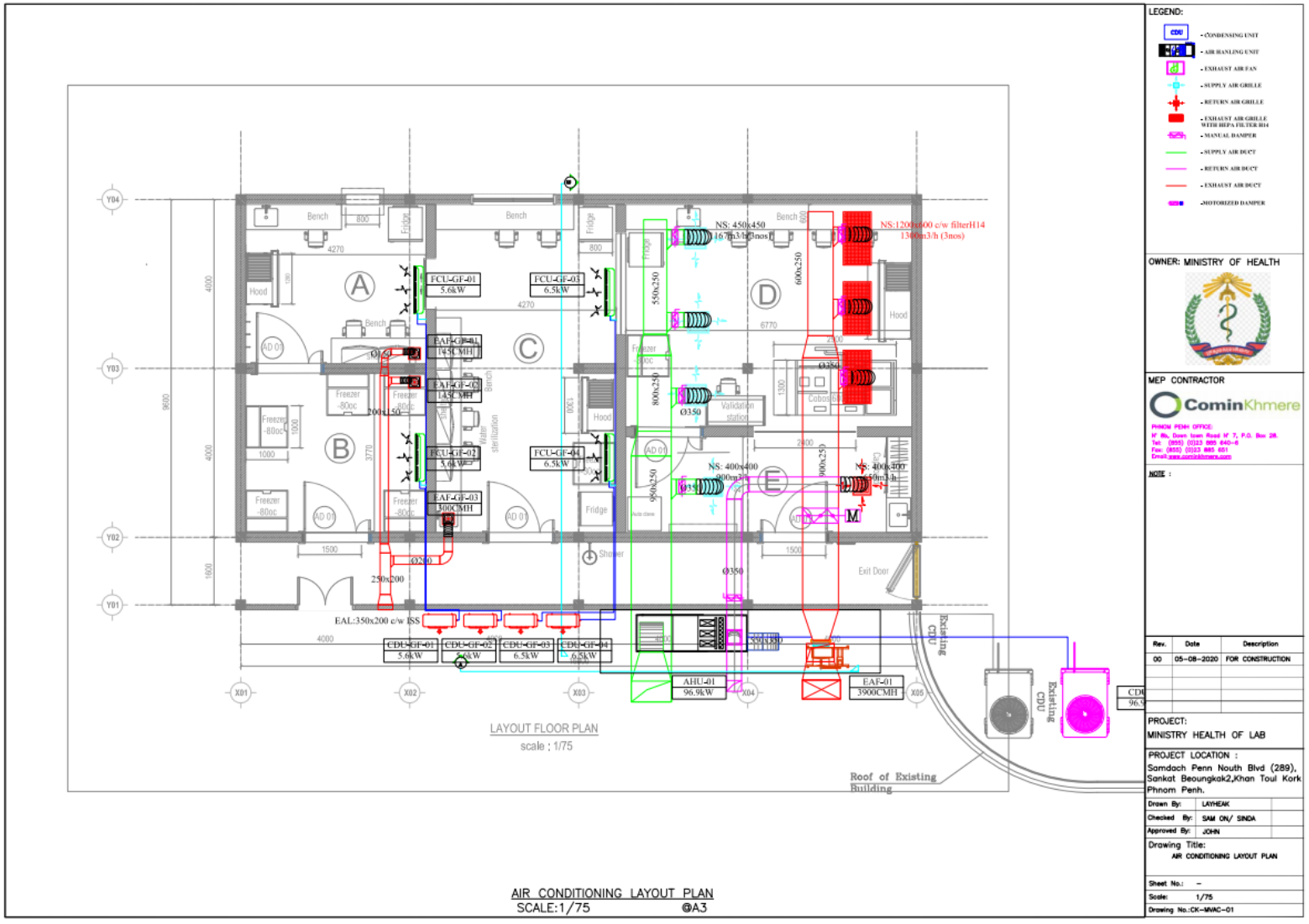
OWNER: MINISTRY OF HEALTH
MEP CONTRACTOR
CominKhmere
NOTE :
Rev. Date Description
00 05-08-2020 FOR CONSTRUCTION
PROJECT:
MINISTRY HEALTH OF LAB
PROJECT LOCATION :
Samdach Penn Nouth Blvd (289), Sankat Beoungkak2,Khan Toul Kork Phnom Penh.
Drawn By: LAYHEAK
Checked By: SAM ON/ SINDA
Approved By: JOHN
Drawing Title:
AIR CONDITIONING LAYOUT PLAN
Sheet No.: –
Scale: 1/75
Drawing No.:CK-MVAC-01
Wall Opening
Ceiling Opening
Main Equipment Support
Concrete Plinth
LAYOUT FLOOR PLAN
scale : 1/75
AHU: 682kg
Fan: 172kg
CDU:704kg
Existing CDU
Roof of Existing Building
Exit Door
Shower
Bench
Fridge
Hood
Freezer -80oc
AD 01
A
B
C
D
E
AIR CONDITIONING LAYOUT PLAN
SCALE:1/75 @A3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- CONDENSING UNIT
- AIR HANLING UNIT
- EXHAUST AIR FAN
- SUPPLY AIR GRILLE
- RETURN AIR GRILLE
- EXHAUST AIR GRILLE WITH HEPA FILTER H14
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PROJECT:
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PROJECT LOCATION :
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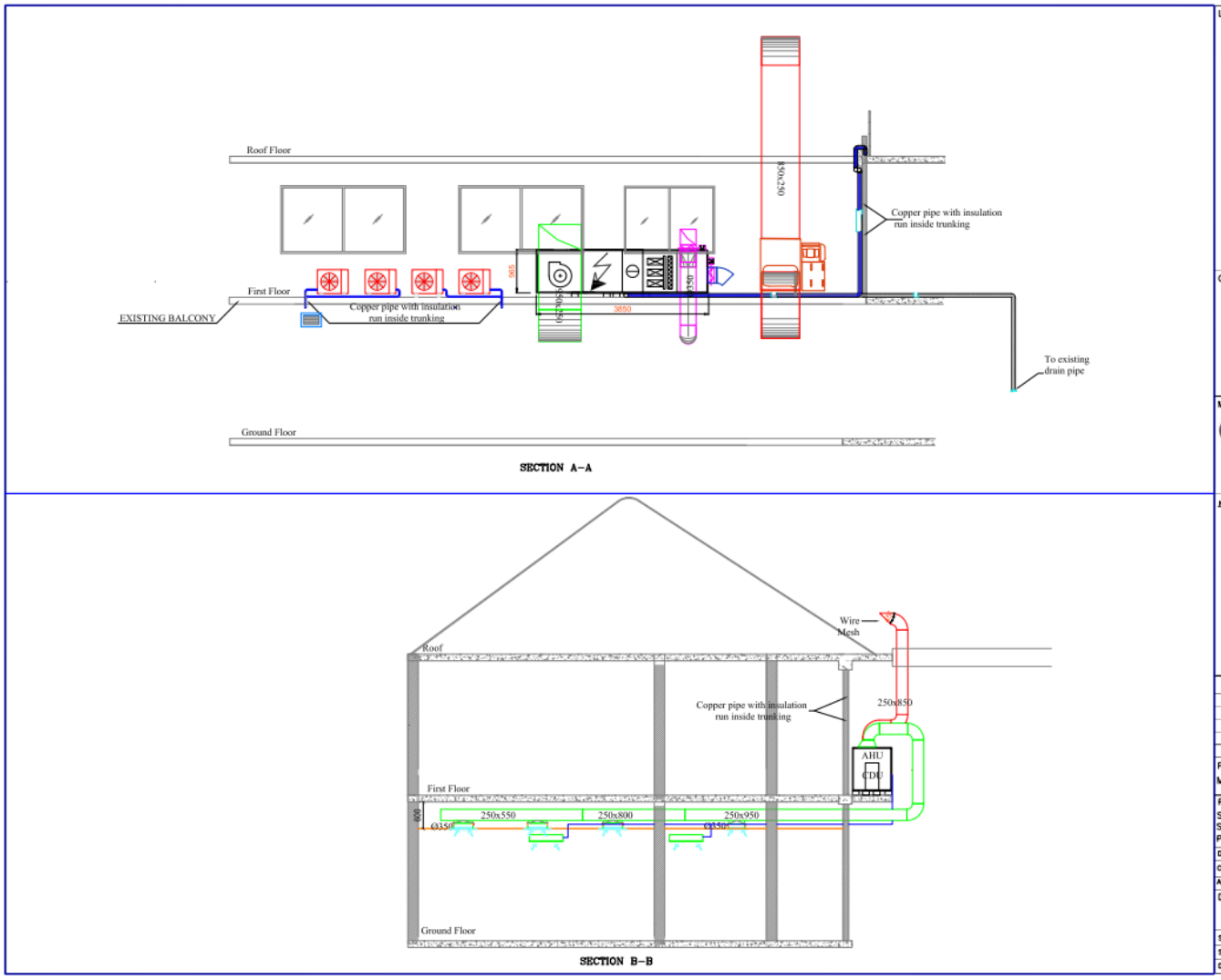
Drawn By: LAYHEAK
Checked By: SAM ON/ SINDA
Approved By: JOHN
Drawing Title:
AIR CONDITIONING LAYOUT PLAN
Sheet No.: –
Scale: 1/75
Drawing No.:CK-MVAC-01
FCU-GF-01 5.6kW
FCU-GF-02 5.6kW
FCU-GF-03 6.5kW
FCU-GF-04 6.5kW
EAF-GF-01 145CMH
EAF-GF-02 145CMH
EAF-GF-03 300CMH
EAF-01 3900CMH
AHU-01 96.9kW
CDU-GF-01 5.6kW
CDU-GF-02 5.6kW
CDU-GF-03 6.5kW
CDU-GF-04 6.5kW
NS: 450x450 1167m3/h 3nos
NS:1200x600 c/w filterH14 1340m3/h (3nos)
NS: 400x400 800m3/h
EAL:350x200 c/w ISS
Existing CDU
Roof of Existing Building
LAYOUT FLOOR PLAN
scale ; 1/75
AIR CONDITIONING LAYOUT PLAN
SCALE:1/75 @A3

sderrtr



LEGEND:

- CDU - CONDENSING UNIT
- AHU - AIR HANLING UNIT
- EF - EXHAUST AIR FAN
- SUPPLY AIR GRILLE
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- EXHAUST AIR GRILLE WITH HEPA FILTER H14
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Drawn By:	LAYHEAK
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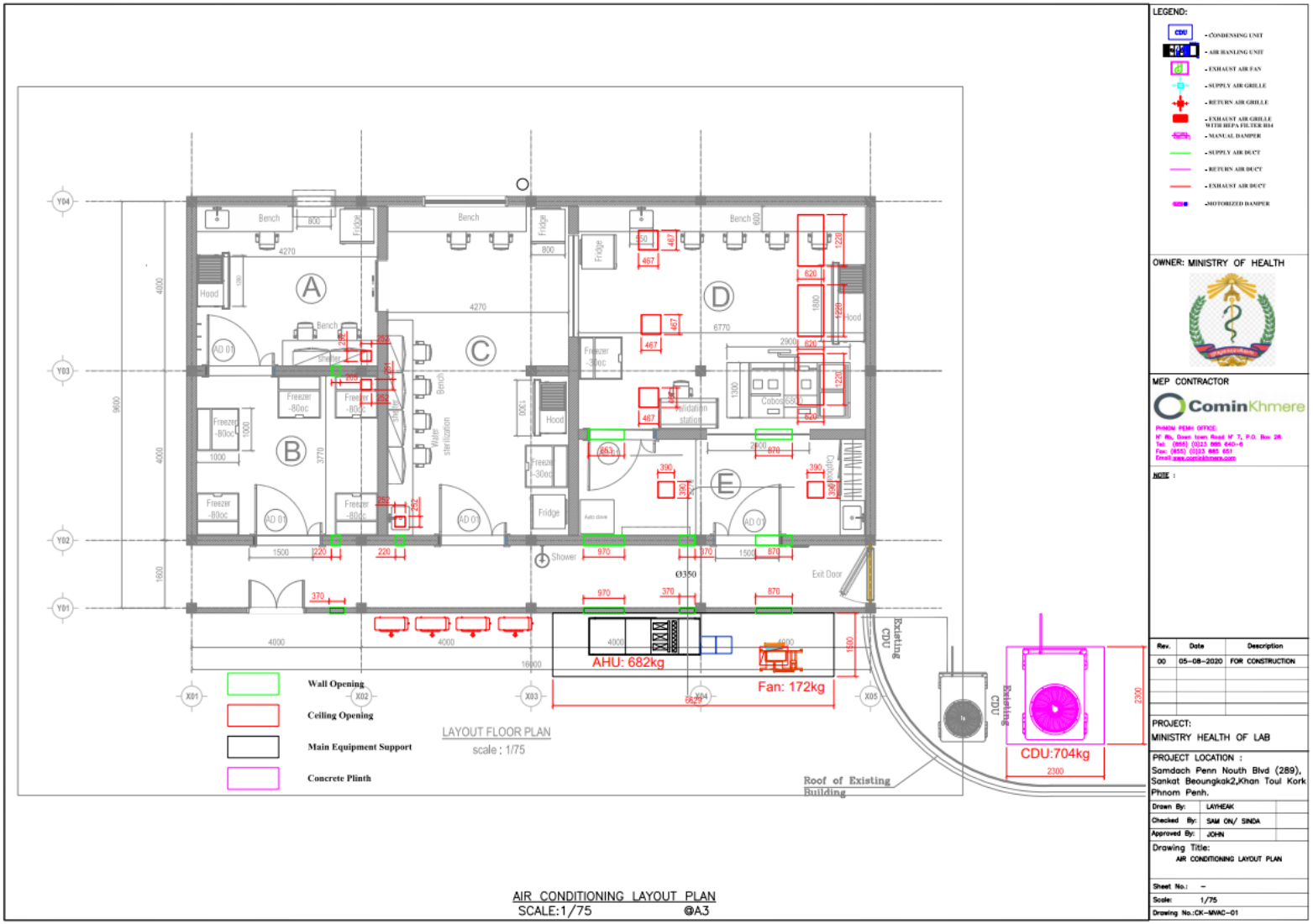
Approved By:	JOHN

Drawing Title:
MVAC SECTION

Sheet No.: –
Scale: NTS@A3
Drawing No.:CK-MVAC-03


LEGEND:
CDU - CONDENSING UNIT
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Drawing Title:
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Sheet No.: -
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AHU: 682kg
Fan: 172kg
CDU:704kg
Existing CDU
Existing CDU
Roof of Existing Building
Exit Door
Shower
Wall Opening
Ceiling Opening
Main Equipment Support
Concrete Plinth
LAYOUT FLOOR PLAN
scale : 1/75
AIR CONDITIONING LAYOUT PLAN
SCALE:1/75 @A3

Annex 2: Standard Operation Procedure (SOPs) of NIPH Laboratories

Annex 2.1: SOP-Personal Protective Equipment (PPE)

National Institute of Public Health

National Public Health Laboratory

PERSONAL PROTECTIVE EQUIPMENT (PPE)

SOP-ALL-01-008

Revision 01

Prepared by: Dr. NGUON VUTHY Date: 11 Dec 2017

(Deputy Head of biosafety Team)

Reviewed by: Mr. KEAT CHHEANGHENG Date: 15 Dec 2017

(Head of Biosafety Team)

Approved by: Dr. CHAU DARAPHEAK Date: 19 Dec 2017

(Chief of National Public Health Laboratory)

Issued Date: 27 Dec 2017

1. **Objective**

To ensure the proper uses standard PPE necessary to protect staff from biological and chemical hazards.

2. **Responsibility**

All NPHL personnel.

3. **Principle**

- Hazards exist in every clinical laboratory so strategies to protect laboratory staff are essential.
- When a hazard **cannot be removed or controlled adequately**, Personal Protective Equipment (PPE) may be used to protect laboratory staff.

4. **Material**

- Laboratory coat/ Gown/ Coverall
- Disposable gloves
- Shoe Covers
- Eye protection
- Hair cover
- Apron

Reagent: N/A

Standard and control: N/A

Sample: N/A

Procedure

There are many difference type of using PPE in laboratory. instructions for their use and maintenance are included in the text of the safety precautions in each SOP. The following describe how to wear PPE properly:

Protective clothing in the laboratory:

- All staff should wear a clean laboratory coat/gown/coverall.
- Clean laboratory coats should be hung in laboratory when not in use, DO NOT BRING LABORATORY COAT HOME.
- Laboratory coats should be cleaned and disinfected at appropriate intervals or if soiled (CLEANING LABORATORY COAT SOP) DO NOT WASH AT HOME.
- Disposable laboratory coats can be worn if available.

Protective clothing outside of laboratory in reception area, patient consultation rooms and phlebotomy room:

- Phlebotomist, physician and receptionist must wear clean laboratory coat

Coverall

- All staff should wear a clean coverall incase needed (Ex: COVID-19 or EBOLA outbreak).

- After coverall is being used, discard it into biological trash bin.

Face Protection

- Face shield and/or safety glasses/safety goggles should be worn when handling hazardous materials that can generate splash or aerosol

Gloves

- Disposable gloves should be worn for protection from chemicals, biological hazards, product contamination, sharps and abrasions.
- After disposable gloves are used they must be discarded in the biohazardous trash bin.
- Heat/cold protective gloves should be worn when handling hot and cold material.

Footwear

- All shoes worn in laboratory should be closed toed and ankle, open toed sandals are inappropriate and kept at the laboratory, DO NOT BRING HOME.
- Laboratory safety boots can be worn to clean large chemical or biological spills.

Eye and Respiratory Protection

- Wear face shield, safety glasses, and/or safety goggles and disposable surgical mask/ mask N95 respirator when required.
- **Hair cover**
- Wear hair cover to cover your hair and both side ears.
- After the hair cover was used it must be discarded in the biohazardous trash bin.

Apron

- Wear apron to cover your body.
- After apron is used it must be discarded in the biohazardous trash bin.

Reporting results: N/A

Normal Reference Range: N/A

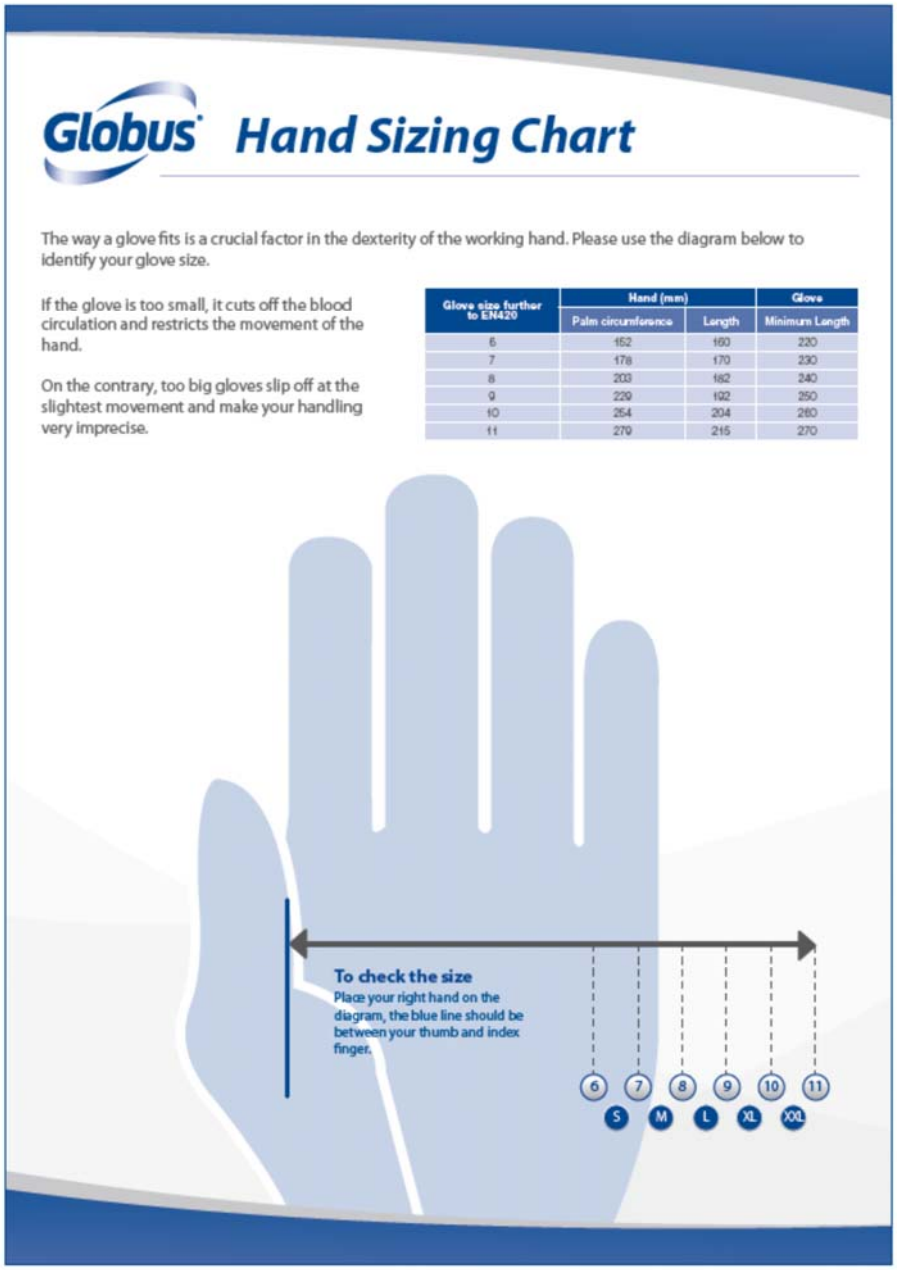
Reference

- ASEAN biosafety network establishment meeting (video PPE)
- http://www.free-training.com/osha/ppe/ppemenu.htm
- Infection Prevention and Control MOH guideline, 2018
- Biosafety and Biosecurity Guideline BMLS, March 2016

Safety precaution

Wear appropriate PPE while working in the laboratory and dispose it properly follow procedures.

Supplementary notes



Globus Hand Sizing Chart

The way a glove fits is a crucial factor in the dexterity of the working hand. Please use the diagram below to identify your glove size.

If the glove is too small, it cuts off the blood circulation and restricts the movement of the hand.

On the contrary, too big gloves slip off at the slightest movement and make your handling very imprecise.

Glove size further to EN420	Hand (mm)		Glove
	Palm circumference	Length	Minimum Length
6	152	160	220
7	178	170	230
8	203	182	240
9	229	192	250
10	254	204	260
11	279	215	270

Donning gloves

Hand hygiene
Select size, check for tears
Open glove at the cuff

Insert hand
Move fingers down into glove

Properly align glove

Ensure a snug fit

Roll cuff down wrist until secure

Repeat with second glove on other hand

slcpbiosafety@cdc.gov

Doffing gloves

Grasp glove near the cuff. Fold over, peal away from hand

Carefully pull glove off
Turning it inside out

Hold the glove in the palm of the still gloved hand

Remove 2nd glove placing bare fingers inside the cuff

Do not touch gloves exterior.
Peel it off from the inside

Turn it inside out.
Envelope the other glove.

Pull off inside out.

Dispose of gloves safely
Perform hand hygeine

slcpbiosafety@cdc.gov

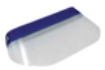
ដំណាក់កាលនៃការពាក់ PPE, BSL-2

	National Institute of Public Health National Public Health Laboratory	Document code : JA-ALL-01-016	Revision No:00 Issued date: 30/03/2020
ការពាក់ឧបករណ៍ការពារខ្លួនក្នុងសុវត្ថិភាពជីវសាស្ត្រកំរិត ២ **(BSL-2)**			Revised date: N/A

ដំណាក់កាល	សំភារៈដែលត្រូវពាក់	រូបភាពសំភារៈ
១	សំអាតដៃជាមួយអាល់កុល៧០%ឬអាល់កុលជែល	
២	ពាក់អាវបំពង់ដែង (Gown)	
៣	ពាក់ម៉ាស់វះកាត់ (Surgical mask)	
៤	ពាក់ជីនតាសុវត្ថិភាពមានដង (Safety glasses)	
៥	ពាក់មួកគ្របសក់ (Hair cover)	
៦	ពាក់របាំងការពារមុខ	
៧	ពាក់ស្រោមស្បែកជើង	
៨	ពាក់ស្រោមដៃ (មួយជាន់)	

ដំណាក់កាលនៃការដោះ PPE, BSL-2

	National Institute of Public Health National Public Health Laboratory	Document code : JA-ALL-01-017	Revision No:00 Issued date: 30/03/2020
ការដោះឧបករណ៍ការពារខ្លួនក្នុងសុវត្ថិភាពជីវសាស្ត្រកំរិត ២ (BSL-2)			Revised date: N/A

ដំណាក់កាល	សំភារៈដែលត្រូវដោះ	រូបភាពសំភារៈ
១	ដោះស្រោមដៃ (មួយជាន់)	
២	ដោះរបាំងការពារមុខ	
៣	ដោះអាវបំពង់វែង (Gown)	
៤	ដោះស្រោមស្បែកជើង	
៥	ដោះមួកគ្របសក់ (Hair cover)	
៦	ដោះវ៉ែនតាសុវត្ថិភាពមានដង (Safety glasses)	
៧	ដោះម៉ាសវះកាត់ (Surgical mask)	
៨	សំអាតដៃជាមួយអាល់កុល៧០%ឬអាល់កុលជែល	

ដំណាក់កាលនៃការពាក់ PPE, BSL-3

	National Institute of Public Health National Public Health Laboratory	Document code : JA-ALL-01-013	Revision No:00 Issued date: 30/03/2020
ការពាក់ឧបករណ៍ការពារខ្លួនក្នុងសុវត្ថិភាពជីវសាស្ត្រកំរិត ៣ (BSL-3)			Revised date: N/A

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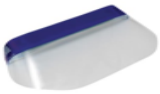
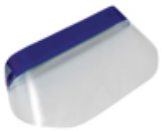
១	សំអាតដៃជាមួយអាល់កុល៧០%ឬអាល់កុលជែល	
២	ពាក់ស្រោមដៃទីមួយ (ជាន់ទី១)	
៣	ពាក់មួកគ្របសក់និងត្រចៀក	
៤	ពាក់ម៉ាសចម្រោះខ្យល់ (Mask N95/3M)	
៥	ពាក់ឈុតអាវជាប់ខោ (Coverall)	
៦	រុំដៃអាវដោយស្អុតក្រដាស	
៧	ពាក់ស្រោមជើង	
៨	ពាក់ជីនតាសុវត្ថិភាពមានខ្សែ (goggles)	

៩	ពាក់អៀមផ្លាស្ទីក	
១០	ពាក់របាំងការពារមុខ	
១១	ពាក់ស្រោមដៃទី២ (ជាន់ទី២)	

ដំណាក់កាលនៃការដោះ PPE, BSL-3

	National Institute of Public Health National Public Health Laboratory	Document code : JA-ALL-01-014	Revision No:00 Issued date: 30/03/2020
ការដោះឧបករណ៍ការពារខ្លួនក្នុងសុវត្ថិភាពជីវសាស្ត្រកំរិត ៣ (BSL-3)			Revised date: N/A

ដំណាក់កាល	សំភារៈដែលត្រូវដោះ	រូបភាពនៃសំភារៈ
១	ដោះស្រោមដៃទី២	
២	ដោះរបាំងការពារមុខ	
៣	ដោះអៀមផ្លាស្ទីក	
៤	ដោះវ៉ែនតាការពារភ្នែក (goggles)	
៥	ដោះស្រោមស្បែកជើង	
៦	ដោះស្តុតក្រដាសរុំដៃអាវ	 

៧	ដោះឈុតអាវជាប់ខោ (Coverall)	
៨	ដោះស្រោមដៃជាន់ទីមួយរួចលាងដៃជាមួយអាល់កុល៧០%	 
៩	ដោះម៉ាស់ចម្រោះខ្យល់ (Aspirator mask: N95/3M)	 
๑๐	ដោះមួកគ្របសក់និងត្រចៀក	
๙๙	សំអាតដៃដោយល្បាយសំលាប់មេរោគ	

Annex 2.2: SOP-Biological Safety Cabinet (BSC) Operation and Maintenance

National Institute of Public Health

National Public Health Laboratory

BIOSAFETY CABINET (BSC) OPERATION AND MAINTENANCE

SOP-IMM-04-016

Revision 00

Prepared by: Ph. UNG SEREY SOPHEAK Date: 20 Dec 2017

(Deputy Head of IMM Unit)

Reviewed by: Mr. AM CHANTHAN Date: 21 Dec 2017

(Head of IMM Unit)

Approved by: Dr. CHAU DARAPHEAK Date: 22 Dec 2017

(Chief of National Public Health Laboratory)

Issued Date: 29 Dec 2017

1. Objective

To provide staff an appropriate procedure for the operation and maintenance of the Biological Safety Cabinet (BSC).

2. Responsibility

All laboratory personnel in clinical laboratory (new OPD laboratory): are able to perform this procedure.

3. Principle

To protect personnel, product and the environment from exposure to biohazards and cross contamination during routine procedures.

4. Material

- Laboratory Coat
- Gloves
- Soft cloth, detergent, water, nylon scrubber
- Tissue

5. Reagent

- 70 % alcohol solution
- 5% bleach solution

6. Standard and control: N/A

7. Sample: N/A

8. Procedure

8.1. Operation (NU-540-300E)

8.1.1. To turn the unit on, press and hold the **ON** key until the blowers start

8.1.2. Move the window to the work position, lift it to the top dimple (by the mark as- shown in the picture below)

8.1.3. Wait until the green LED lights “airflow is steady”

8.1.4. The unit is ready for operation.

8.1.5. Press the BULB key to turn on or off the light

8.1.6. Press the outlet key to access the electricity in the chamber

Figure 1-5. Work Position

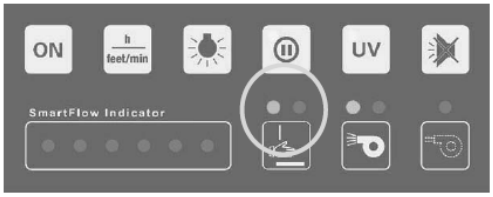


Figure 1-6. Lighted Green LED

8.1.7. Place needed work materials into the work-area and avoid blocking the air-intake grill.

8.1.8. Load the work tray with samples.

Note: For extended breaks in experimental phases, switch the device to standby mode by pulling down and closing the window.

Warning: personnel, product and the environment protection are ensured only if the airflow system of the device is working properly. If the alarm system issues a failure message for more than a few minutes while the front window is in the work position, stop all applications that may jeopardize worker safety.

Working and Recommendations

During operation:

- Place samples only within the defined work area of the work tray.
- Do not place unnecessary items into the sample chamber.
- Use only disinfected and cleaned accessories for the work process.
- Do not cause air turbulence by quick hand, arm or body movements in the sample chamber or in front of the work opening.
- Do not place accessories into the sample chamber that cause air turbulence or emit excessive heat.
- Do not block air circulation at the ventilation slots of the work tray.

Proper sitting position

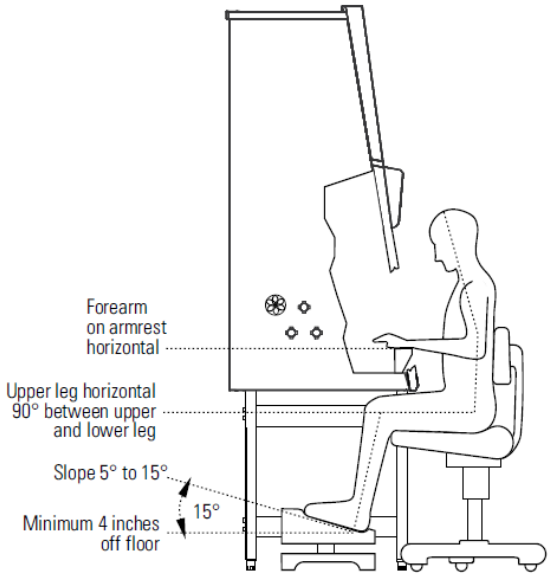


Figure 4-2. Sitting Posture

After completing a procedure

- Remove samples from the chamber and store them properly.
- Clean and disinfect work tray, window, chamber surface etc.
- Clean and disinfect all materials after use.

Note: use 70% alcohol solution to clean and disinfect BSC before and after routine operations. If using 5% bleach solution, the chamber must be rinsed again with water to avoid corrosion of chamber.

Harmful substance or pathogen spills on the surface of work area during a procedure must be cleaned up with a 5% bleach solution on the spill-spot and covered with paper towel, which is impregnated with 5% chloride for at least 15 minute.

8.1.9. Turn off unit

8.1.9.1. Pull the window down to the bottom dimple (to the mark as shown in the picture below)

8.1.9.2. Press and hold the ON key until the unit is shut down

8.2. Maintenance

8.2.1. Daily maintenance (after each run):

Figure 1-7. Fully Closed Position (UV, if applicable)

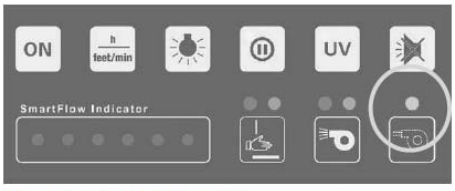


Figure 1-8. Lighted Blue LED

8.2.1.1. Disinfect the surfaces with 70% alcohol or 5 % bleach solution before and after use

8.2.1.2. Turn off the window alarm

8.2.2. Monthly maintenance:

8.2.2.1. Clean the exterior surface of the BSC with 70% alcohol solution and a paper towel.

8.2.2.2. Remove dirt/dust from the top outer surface using paper towel or a soft, clean cloth and 70% alcohol solution.

8.2.2.3. Lift the work tray to clean and remove dirt beneath the tray using 5% bleach solution with paper towel or soft, clean cloths. After using bleach, the BSC must be cleaned with water thoroughly after bleach solution to avoid corrosion. If this operation requires a lot of water, drain water out through the drain port, then dry thoroughly.

8.2.3. Technical maintenance and inspection:

8.2.3.1. BSC is certified every year by NAMRU-2.

9. Reporting results: N/A

10. Normal Reference Range: N/A

11. Reference

Instruction Manual Revision 6 (01.2016)

12. Safety precaution

- Failure to read, understand and follow the instruction in this Biological Safety Cabinet (BSC) Operation and Maintenance may result in damage to the unit, injury to operating personnel, and poor equipment performance.
- All internal adjustments and maintenance must be performed by qualified service personnel.
- Always use the proper protective equipment (PPE, etc.)
- Do not block the inflow of air to the BSC.
- Each individual is responsible for his or her own safety.
- Make sure wire is properly placed in the socket.

13. Supplementary notes

BSC Maintenance record form F-MCU-005

National Institute of Public Health National Public Health Laboratory	Document code: F-IMM-041	Prepared date: 11/Sep/17	Revision No: 00 Issued date: 02/Oct/17
TITLE: BSC maitenance records			Revised date: N/A

Equipement ID:_____ Month:_____ Year:_____

Model:_____ Responsible person:_____ Unit:_____

Serial N°:_____

Daily maintenance/ Date	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
☞Desinfection with 70% ethanol																															
☞Record down flow																															
☞Record In flow																															
☞Record pressure gauge if available																															
Performmance Factor, LED Indicator if available																															
☞Red																															
☞Yellow																															
☞Green																															
Performed by (staff initial)																															

Monthly	Date	Name
Lift and clean and desinfect under the work surface (with 70% ethanol)		
Clean outside surface with soft tissue paper or cloth		
Check drain valve		

Note: Desinfect before and after use. BSC : Range for inflow 105 and down flow 63

Note: Annually have the cabinet re-certified by a qualified certification technician

Date	Problem	Corrective action

Reviewed by:_____ Reviewed date:_____

Annex 2.3: SOP-Autoclave Prioclave

National Institute of Public Health

National of Public Health Laboratory

AUTOCLAVE PRIOCLAVE

SOP-ALL-01-029

Revision 01

Prepared by: Mr. KEAT CHHEANGHENG Date: 05 Sep 2019

(Head of Biosafety Team)

Reviewed by: Dr. NGUON VUTHY Date: 09 Sep 2019

(Deputy Head of biosafety Team)

Approved by: Dr. CHAU DARAPHEAK Date: 11 Sep 2019

(Chief of National Public Health Laboratory)

Issued Date: 17 Sep 2019

1. **Objective**

   To describe how to operate and maintain the Prioclave autoclave.

2. **Responsibility**

   - Laboratory technician and phlebotomist in OPD are responsible for sterilizing biohazardous waste using the Prioclave autoclave.
   - Biosafety Officer will provide training and maintain the autoclave log.

3. Principle

   - The Autoclave is used to sterilize or kill microorganism using steam and hot water. In clinical laboratories the autoclave is used for decontamination biohazardous waste or to sterilization laboratory equipment.
   - The backup autoclaves are located in Microbiology Unit.

4. **Materials**

   - Laboratory coat
   - Heat resistance gloves
   - Heavy duty face shield
   - Disposable gloves

5. **Reagents**

   - Water
   - Spore ampule
   - Chemical indicator tape

6. **Standard control**

Chemical Indicator tape.

Biological Indicator: Spore ampule.

Remarks: If the internal quality control fail after the cycle finished. The staff have to report the cycle again and record in Occurrence Report Form.

7. Sample: N/A

8. Procedure

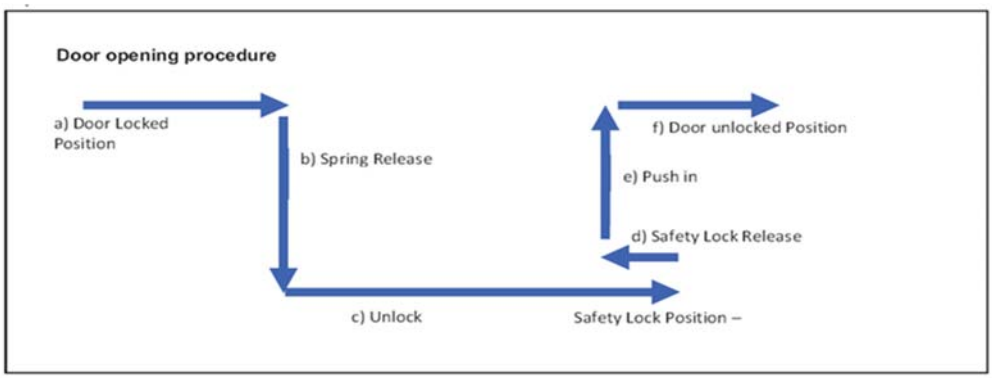
8.1 Operation

8.1.1. Check electricity supply is **ON**, and that the power is switched **on**.

8.1.2. Check the water supply is available and is turned **on**.

8.1.3. Open the autoclave door as described below:

Door opening procedure



a. Move the locking handle to the right
b. The handle will now spring out into its unlocking position
c. Move the handle fully to the right to unlock the door. The handle is now in its safety lock position, allowing any residue of pressure inside the autoclave to escape harmlessly.
d. Move the handle slightly to the right to release it from the safety position
e. Push the handle in as far as it will go
f. Move the handle fully to the right to its parked position

With the door unlocked, carefully lift to the door.

Take care whilst the door is open that it is fully open and does not fall. The door is heavy and could cause harm if it falls.

Top up with the water if necessary until the water level touches the water indicator tag on the load support plate.

ALWAYS CHECK THE WATER LEVEL BEFORE STARTING A CYCLE

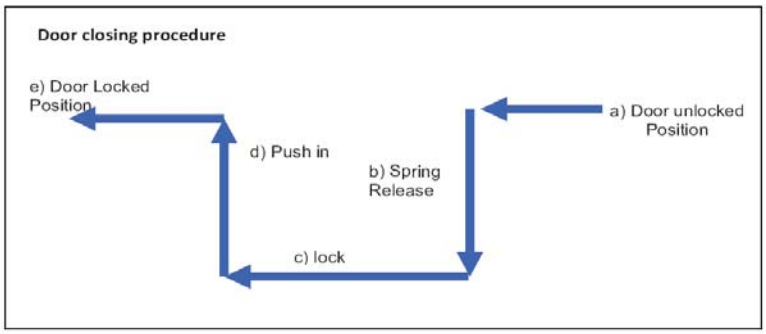
- Load the autoclave
- Set the temperature as required below for sterilization using the up/ down keys.
    - Please remember that the sterilizing temperature and time settings are use according to the research carried out by UK Medical research council which is recommended the following temperature and times as being sufficient for complete sterilization in autoclave:

      126 °C for 10 minutes.

      121°C for 30 minutes.

      115 °C for 30 minutes.
- Set the process time as required using the up/ down keys.
- Carefully lower the pressure door and secure as follows:

Door closing procedure



a. Move the locking handle to the left to release it from its parked position
b. The locking handle will now spring out to its locking position
c. Move the locking handle fully to the left to lock the autoclave door
d. Push the handle in fully against the spring
e. Move the handle fully to the left into its "park" position

Wait a few seconds for the **"start"** indicator to illuminate, and press the **"start"** button to begin the cycle.

Cycle Abort and Thermal Lock Override

- **Aborting a cycle**

  To abort the cycle at any stage, press the **"start"** Button

- **Thermal Lock Override**
  - **First abort the cycle as above.**
    - After checking that there is no pressure within the autoclave turn the thermal lock key to the right hold it there.
    - Press the "door" button once, keeping the thermal lock key held over.
    - Wait during the "Hold" display until there is a beep and the "Door" indicator illuminates.
    - Keep the key held and press the "Door" button once to unlock the door.
    - The key-switch can now be released and the door opened as above.
    - If the key is released at any stage the procedure must be repeated to open the door and reset the display.

8.2 Maintenance

8.2.1 Daily Maintenance

LOW and FILL level water level Probes

To ensure protection from boiling dry, the insulated section of the low water probe between stainless steel tip and the pressure vessel wall should be scrubbed clean to prevent it from being short circuited. The sensor tip should also be kept clean to ensure good contact.

8.2.2 Weekly Maintenance

Check exterior of machine and the inside walls of the pressure vessel for general cleanliness, particularly around operation parts and external switches and pins. Use anti-bacterial wipes to clean exterior paneling.

8.2.3 Monthly Maintenance

Check exterior of machine and the inside pressure vessel for general cleanliness, particularly around operation parts and external switches and pins. Wipe overall surfaces using clean damp cloth.

Bi-Annual Maintenance

Hinges

With the pressure lid in the open position the hinges should be cleaned and lubricated with high melting point grease.

Checking Temperature control and pressure gauge

During the **DWELL** stage of a running autoclave cycle when the **Process Time** has run for at least five minutes, check the reading shown by the temperature display against that of the steam Table in the manual.

Reporting results: N/A

Normal Reference Range: N/A

Reference

- Installation and Operating Manual Top Loading, Electrically Heated QCS Priorclaves. Priorclave. July 2014.

Safety precaution

- In case of running further cycles, please switch off the power and then switch on to reset system again.
- After autoclave the instrument still hot, wear PPE and heat protection glove to take items from the instrument.
- Do not touch surface outside of autoclave during run
- Wear proper PPE as the following:
    - laboratory coat
    - Glove

- Cover shoe
- Face shield

Supplement note

F-ALL-201: Autoclave Maintenance and QC Log Sheet

	National Institute of Public Health National Public Health Laboratory	Document code: F-ALL-201	Prepared date: 14/03/18	Revision No: 00 Issued date: 15/03/18
	TITLE: Autoclave Maintenance & QC Log Sheet			Revised date: N/A

Month/ Year: .....

TYPE OF EQUIPMENT: ..... BRAND: .....

SERIAL NUMBER: ..... RESPONSIBLE PERSON: .....

Maintenance Procedure:

For maintenance, turn the breaker and power supply off for safety. If the chamber is hot, wait for it to cool. Wipe off any dirt on the exterior with a damp cloth. Do not use benzene, thinner or cleanser to wipe, nor scrub with a brush.

Date	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
Top up with water until the water level touches the water indicator tag																															
Time started usage																															
Time ended usage																															
Indicator tape Pass																															
Wipe off exterior & interior																															
Performced by																															

Remark : _____

Weekly QC:

Procedure:

1. Place biological indicator in an appropriate process.
2. After completion of the cycle, fully open the sterilizer door for a minimum of 5 minutes prior to removing the biological indicator and then allow it to cool for an additional 10 minutes.
3. Incubate and readinng result for 3 hours which following procedure.
4. With a processed biological indicator,

- Postive: «red light on Auto-reader or plus symbol (+) on the LCD display» mean a sterilize process failure has occurred.
- Negative: «green light on Auto-reader or minus symbol (-) on the LCD display» after 3 hours of incubation indicate an acceptable sterilization process.

Biological indicator	*Week*			
	1	*2*	*3*	4
Pass QC (green light)				
Fail QC (red light)				
Performced by				
Performed date				

Corrective Action: _____

Reviewed by: _____

Annex 2.4: SOP-Fire Detection System Monitoring

National Institute of Public Health

National Public Health Laboratory

FIRE DETECTION SYSTEM MONITORING

SOP-ALL-01-028

Revision 00

Prepared by: Mr. NOV VANDARITH Date: 03 Jul 2018

(Member of BST and Microbiology Staff)

Reviewed by: Mr. KEAT CHHEANGHENG Date: 05 Jul 2018

(Head of Biosafety Team)

Approved by: Dr. CHAU DARAPHEAK Date: 06 Jul 2018

(Chief of National Public Health Laboratory)

Issued Date: 16 Jul 2018

1. **Objective**

This SOP provides detailed instructions on how to monitor the laboratory fire detection system.

2. **Responsibility**

Biosafety Team in NPHL.

3. **Principle**

Fire alarm systems shall be regularly tested. Ensure that responsible persons are aware of the necessary fire alarm systems, including checking of their functionality and ensuring personnel awareness.

4. **Material**

- Moving stair
- EN-Air flow tester (CH 00216)

5. **Reagent:** N/A
6. **Standard and control:** N/A
7. **Sample:** N/A
8. **Procedure**

a. Fire Alarm

8.1.1. Inform to all staff in the Laboratory to know about the fire alarm testing.

8.1.2. Press the button of fire alarm (red box) and activating alarm.

8.1.3. Check and make sure that the alarm sounding to alert properly.

8.1.4. How to stop the alarm after the testing:

8.1.4.1. Go to the cabin controller at the door gate of NIPH, and press the screen button following the guidance below:

8.1.4.2. Press the word **"Reset"**

8.1.4.3. Typing password: **1234**

8.1.4.4. Press **"OK"**

8.1.4.5. Press the word **"Reset"**

8.1.4.6. Press the word **"Silence"**

b. Automatic Smoke Detectors

8.2.1. Prepare the material including EN-Air flow tester (CH 00216) and moving stair.

8.2.2. Define the location of Smoke detector.

8.2.3. Use the EN-Air flow tester (CH 00216) for testing as follows:

8.2.3.1. Break off both tips of the tube in the tube opener.

8.2.3.2. Insert the tube tightly in the rubber bulb, the direction is irrelevant.

8.2.3.3. Seal the hole in the rubber bulb with your thumb and squeeze the air from the bulb through the tube.

8.2.3.4. The tubed can be used repeatedly until visible smoke no longer emerges. Used tubes must be seal with the caps provided however, they should not be stored more than 3 days.

8.2.3.5. When tubes are reused, care must be taken to ensure that liquid sulphuric acid does not drop out of the caps onto skin or clothing. Observe the hazard and safety instruction on the packaging.

c. Automatic Access Door

8.3.1. Take two card access doors: one is activated and one is inactivated.

8.3.2. Test inactivated card to chip on control door and notice that the door is opened or not. If the doors are not open, it means the door is work properly. If it is not, need to take corrective action.

8.3.3. Test activated card to chip on control door and notice that the door is opened or not. If the doors are opened, it means the door is work properly. If it is not, need to take corrective action.

8.3.4. Testing all access control doors in order to make sure that it is worked properly in every three months.

9. Reporting results

Record the result into Fire Detection System Form Monitoring F-ALL-175

10. Normal Reference Range: N/A

11. Reference

Instruction Manual: EN-Air Flow Tester (CH00216), Edition10-05/ 2014.

12. Safety Precaution

Be careful when climb the ladder.

13. Supplementary notes

Fire Detection System Monitoring Form F-ALL-175

National Institute of Public Health National Public Health Laboratory	Document code: F-ALL-175	Prepared date: 02/Jul/18	Revision No: 00 Issued date: 08/Jul/18
TITLE: Fire Detection System Monitoring			Revised date: N/A

Buliding: Clinical OPD Lab (Building C) **Month:……..**

Note: the system must be checked monthly.

Date	Fire Alarm		Automatic Smoke Detectors		Automatic Access Door		Remedial Action Taken	Signature & name
	Building	Functioning Yes/No	Location	Functioning Yes/No	Location	Functioning Yes/No		
	C		Clinical Lab		Exit door of Clinical Lab			
			Waiting Area		Entry door of Clinical Lab			
			Phlebotomy		Calibration			
			QA		Main entry door			
			Calibration					
			Head of Lab					

Reviewed by:……

Reviewed date:……

Annex 2.5: SOP-Emergency Evacuation Plan

National Institute of Public Health

National Public Health Laboratory

EMERGENCY EVACUATION PLAN

SOP-ALL-01-026

Revision 01

Prepared by: Mr. KEAT CHHEANGHENG Date: 03 Sep 2019

(Head of Biosafety Team)

Reviewed by: Dr. NGUON VUTHY Date: 05 Sep 2019

(Deputy Head of biosafety Team)

Approved by: Dr. CHAU DARAPHEAK Date: 09 Sep 2019

(Chief of National Public Health Laboratory)

Issued Date: 17 Sep 2019

1. **Objective**:

The purpose of this document is to provide a clear exit plan in case of emergency such as fire.

2. **Responsibility:**

Biosafety Officer:

- Conducting regular fire drills
- Keeping the evacuation plan up to date
- Maintaining up to date emergency contact information

ALL NPHL personnel:

- Responsible for knowing what to do if an evacuation is necessary
- Ensure patients safety during an evacuation
- Practicing fire drills

3. **Principle**

Having an organized and practiced evacuation plan in case of an emergency ensures safety if an emergency should occur.

4. **Material:** N/A
5. **Reagent**: N/A
6. **Standard and control**: N/A
7. **Sample**: N/A
8. **Procedure**

a. Key Emergency personnel

Designated responsible official (Highest Ranking Manager at NIPH):

Name: Chau Darapheak/Phone number: 012 93 94 41

Emergency coordinator/Biosafety Officer:

Name: Biosafety Officer: Keat Chheangheng/Phone number: 011 85 47 66

Area monitors:

OPD patient area: Dr. Mam Sothoeurn/Phone: 011 86 32 36

OPD clinical Laboratory: Mr. Ung Sereysopheak/Phone: 012 669 045

Assistants for physically challenged:

Name: Mr. Or Channarith/Phone: 098 273 272

Name: Mr. Chheng Vannak/Phone: 012 416 948/096 819 1168

b. Evacuation routes are posted in every room near exit door. The following information is marked on evacuation maps

1. Emergency exits
2. Primary and secondary evacuation routes
3. Locations of fire extinguishers

4. Fire alarm pull stations' location

5. Assembly points

c. FIRE EMERGENCY is procedure:

i. Activate the nearest fire alarm near front and rear door in OPD by breaking glass of fire alarm (red box) and activating alarm. If the fire alarm is not available, notify the site personnel about the fire emergency by the following means yelling "fire".

ii. Notify the local Fire Department (dial 118 or 666: fire rescue).

iii. Fight the fire ONLY if:

- The Fire Department has been notified.
- The fire is small and is not spreading to other areas.
- Escaping the area is possible by backing up to the nearest exit.
- The fire extinguisher is in working condition and personnel are trained to use it.

iv. Upon being notified about the fire emergency, occupants must:

- Leave the building using the designated escape routes ensuring no one is left behind.
    - QA staff ensure no one left in QA room or Director and calibration room
    - Director check calibration room and QA room to confirm everyone has left
    - Laboratory staff ensure all laboratory staff have exited
    - OPD and phlebotomy staff ensure all NPHL personnel and patients exit the building check also in the restrooms before leaving.
- Assemble in the designated area: car parking area under sign "EMERGENCY ASSEMBLY POINT".
- Remain outside until the Designated Official or designee announces that it is safe to reenter the OPD.

v. Designated Official, Emergency Coordinator or supervisors must:

- Determine a rescue method to locate missing personnel.
- Provide the Fire Department personnel with the necessary information about the facility.

vi. All NPHL OPD personnel must:

- Ensure that all employees have evacuated the area/floor.
- Report any problems to the Emergency Coordinator at the assembly area.

vii. Assistants for the physically disabled should:

- Assist all physically disabled patients in emergency evacuation using OPD wheel chair and lifting the physically disabled patient down the front stairs of the OPD and to the evacuation point.

d. EXTENDED POWER LOSS EMERGENCY

i. In the event of extended power loss to a facility certain precautionary measures should be taken depending on the geographical location and environment of the facility:

• Unnecessary electrical equipment and appliances should be turned off in the event that power restoration would surge causing damage to electronics and effecting sensitive equipment.

e. Chemical Spill

Every unit has its own chemical spill kit with necessary PPE and SDS.

i. When a Large Chemical Spill has occurred:

• Immediately notify the Biosafety Officer or member of Biosafety team.

• Contain the spill with available equipment (e.g., pads, booms, absorbent powder, etc.).

• Secure the area and alert other laboratory unit personnel.

• Do not attempt to clean the spill unless trained to do so.

• Attend to injured personnel and contact OPD medical doctor, if required.

• Evacuate building as necessary

ii. When a Small Chemical Spill has occurred:

• Notify the Biosafety Officer or member of Biosafety team.

• If toxic fumes are present, secure the area (with caution tapes or cones) to prevent other personnel from entering.

• Deal with the spill in accordance with the instructions described in the SDS.

• Small spills are handled in a safe manner, while wearing the proper PPE.

• Review the general spill cleanup procedures.

f. Severe weather and natural disasters

i. Earthquake:

• Stay calm and await instructions from the Biosafety Officer.

• Keep away from overhead fixtures, windows, filing cabinets, and electrical power.

• Assist people with disabilities in finding a safe place.

• Evacuate as instructed by the Biosafety Officer.

ii. Flood:

If indoors/house:

• Be ready to evacuate as directed by the Emergency Coordinator and/or the designated official.

• Follow the recommended primary or secondary evacuation routes.

If outdoors:

• Climb to high ground and stay there.

• Avoid walking or driving through flood water.

• If car stalls, abandon it immediately and climb to a higher ground.

9. Reporting results: N/A

10. **Normal Reference Range:** N/A

11. **Reference**

    CDC Emergency Action Plan (Template). 2004. https://**www.cdc.gov**/niosh/docs/2004-101/emrgact/emrgact.pdf

12. **Safety Precautions:** N/A

13. **Supplementary notes**

- Emergency exit of building C Ground floor : F-ALL-120
- Emergency exit of building A & B Ground floor : F-ALL-121
- Emergency exit of building A & B First floor : F-ALL-122
- Map of direction from building C to emergency assembly point: F-ALL-123
- Map of direction from building A & B to emergency assembly point: F-ALL-124

Annex 2.6 : SOP-Sample Packing and Transportation

National Institute of Public Health

National Public Health Laboratory

SAMPLE PACKING & TRANSPORTATION

SOP-ALL-00-023

Revision 01

Prepared by: PA KIMSORN Date: 14 Apr 2020

(Quality Manager)

Reviewed by: Mr. KEAT CHHEANGHENG Date: 24 Apr 2020

(Head of Biosafety Unit)

Approved by: Dr. CHAU DARAPHEAK Date: 12 Apr 2018

(Chief of National Public Health Laboratory)

Issued Date: 20 Apr 201

1. Objective

To ensure that laboratory sample are packed and transported in a proper packaging system to provide the highest level of safety and quality of sample during transportation.

2. Responsibility

- National packing & transportation: Laboratory personnel.
- International packing & transportation: Shipping Company with IATA license.

3. Principle

Procedure for monitoring the transportation of sample ensure laboratory sample are transported within a time frame appropriate to nature of request examination and the laboratory discipline concerned, within the temperature interval specified for sample collection and handling and with the designated preservative to ensure the integrity of sample and in a manner that ensures the integrity of the sample and the safety for the carrier, the general public and the receiving laboratory in compliance with establish requirement.

4. Material

- Primary receptacle: Specimen container
- Secondary shipping container: Zip lock bag or box
- Outer shipping container: Cooler box or appropriate container with closed lid and biohazard label
- Ice pack or Dry Ice if necessary
- 70% alcohol(ethanol)

5. Reagent: N/A

6. Standard and control: N/A

7. Sample: N/A

8. Procedure

Sample are packed by using triple package systems for either local or international shipping.

a. **Local packaging and from OPD to other units in NPHL:** the process of three package systems are:

i. Sample is collected and put in sample container (primary receptacle). Make sure that the container will not leak, and close the sample cap tightly.

ii. Then sample containers are kept in a zip lock bag or box with closed lid and biohazard labels (secondary container). Put absorbent material on the bottom of the container to absorb fluid in case of breakage.

iii. Finally place secondary container in cooler box or appropriate container box with closed lid (outer shipping container) labeled with biohazard symbol. Attach specimen request form to the outer container. Use plastic scot tap to seal the container properly, and disinfection the container with 70% alcohol/ethanol

iv. F- ALL- 062: Specimen Shipping Form will be used for transportation from NHL laboratory to other referral laboratory.

b. **International shipping:** Sample shipped internationally are packaged by a company with an IATA license using the international Triple package system with required documents (packing invoice , authorization letter , delegation of shipper to company ship out, custom declaration and entry permitted letter)

c. **Decontaminating shipping packages for use:**

Before packaging can be reused it must be appropriate disinfected with 70% alcohol or 0.1 % bleach.

Note: Triple package system consists of three layers which describe as below:

- Primary receptacle: A primary watertight, leak-proof receptacle containing the specimen. The receptacle is packaged with enough absorbent material to absorb all fluid in case of breakage.
- Secondary packaging: A second durable, watertight, leak-proof packaging to enclose and protect the primary receptacle(s). Several cushioned primary receptacles may be placed in one secondary packaging, but sufficient additional absorbent material shall be used to absorb all fluid in case of breakage.
- Outer packaging: Secondary packaging is placed in outer shipping packaging with suitable cushioning material. Outer packaging protects their contents from outside influences, such as physical damage, while in transit. Each completed package is normally required to be correctly marked, labeled and accompanied with appropriate shipping documents (as applicable).

9. Reporting results: **N/A**

10. Normal Reference Range: N/A

11. Reference

- IATA infectious substances shipping guideline 10th edition, January 2009.
- Guideline on regulations for the transport of infectious substances 2009-2010, World Health Organization.
- ISO 15189, Medical Laboratory- Requirements for quality and competence, Third edition, 2012-11-01.

12. Safety Precautions

All necessary PPE should be worn when packing and transporting samples.

13. Supplementary notes

a. **Label**

- **Figure 1: Biohazard sign**
- **Figure 2:** Hazard label for Category A infectious substances and for genetically modified microorganisms and organisms that meet the definition of an infectious substance, Category
- **Figure 3:** Hazard label for certain noninfectious genetically modified microorganisms and organisms (UN 3245) and for carbon dioxide, solid (dry ice) (UN 1845); substances packed in dry

ice (see section on Refrigerants) shall bear this label in addition to the primary risk label (e.g. the label shown in Figure 3 for Category A infectious substances

- **Figure 4:** Orientation label to indicate position of closures on the primary receptacles; for the air transport of quantities of liquid infectious substances in Category A that exceed 50 ml per primary receptacle, this label shall be affixed to two opposite sides of the package with the arrows pointing in the right direction, in addition to the label shown in Figure
- **Figure 5:** UN 3373, are human or animal materials that are being transported only for the purpose of diagnosis or investigation.

Figure 1

Figure 2

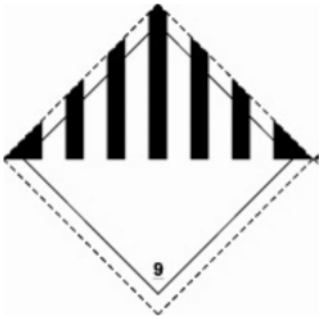


Figure 3

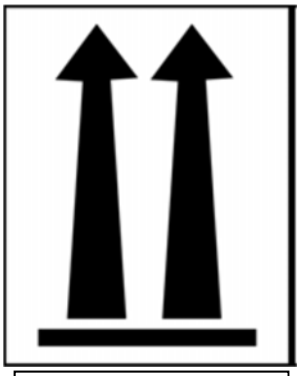


Figure 4

Figure 5

Annex 2.7: SOP- Waste Management

National Institute of Public Health

National Public Health Laboratory

WASTE MANAGEMENT

SOP-ALL-01-010

Revision 00

Prepared by: Mr. KEAT CHHEANGHENG Date: 06 Nov 2017

(Head of Biosafety Team)

Reviewed by: Dr. NGUON VUTHY Date: 08 Nov 2017

(Deputy Head of biosafety Team)

Approved by: Dr. CHAU DARAPHEAK Date: 17 Nov 2017

(Chief of National Public Health Laboratory)

Issued Date: 27 Nov 2017

1. **Objective**

To provide information on how to properly segregate and dispose of waste in the laboratory.

2. **Responsibility**

Biosafety Officer:

- Maintaining up to date guidance pertaining to disposal of biohazardous waste.
- Addressing questions or concerns pertaining to biohazard waste disposal.

Laboratory personnel:

- Responsible for safe and proper segregation and disposal of waste in their respective units.

3. **Principle**

The segregation of waste is the first important step in handling waste. Decontamination of biohazardous waste is a critical second step. There are four categories of waste in the laboratory; non-hazardous, biohazardous, sharps and chemical.

4. **Material**

Labeled Waste bins

Biohazard bags

Regular Trash bags

Sharps containers

5. **Reagent**: N/A
6. **Standard and control**: N/A
7. **Sample**: N/A
8. **Procedure**

General Requirements:

- Disposing of laboratory waste has the potential to expose laboratory personnel to contaminated items if handled incorrectly. Wear appropriate personal protective equipment (PPE) when handling laboratory waste. At a minimum when handling biohazardous waste, PPE will include a laboratory coat, eye protection, close toed shoes and gloves.
- Wash hands after handling laboratory waste and whenever leaving the laboratory.
- Each unit is responsible autoclaving their own waste.
- Unit personnel are responsible for unloading the autoclave after the run is completed.
- Autoclave rooms are for laboratory waste only. Do not place office waste or store equipment within this room. Autoclave bags are used for contaminated waste only and never as storage bags. Autoclave tape is to be used only on items to be autoclaved and not for general taping purposes.
- Refer to the Autoclave SOP for details on how to package and handle items requiring autoclaving.

- Food or drink material is never taken into the laboratory, so empty food or drink containers should never be found inside ordinary trash bin inside laboratory or biohazardous waste bin.

8.1. Non-hazardous Waste/Ordinary Waste

- Documents, supply, chemical shipping containers and boxes taken into the laboratory that are not contaminated with chemical/biological material can be removed from the laboratory and placed into a ordinary waste receptacle for disposal.
    - All biohazard symbols and shipping warning labels on the containers or boxes listed above must be removed from any container prior to placing it into the general waste stream.
- Ordinary waste bins are clearly labeled and distinct from biohazardous waste bins.
- Ordinary laboratory waste is picked from all units by janitor placed into a large trash bin for pickup by a trash pickup.

8.2. Biohazardous waste

Contaminated Reusable Items

- Reusable glassware will be autoclaved in autoclave basket, be sure to add autoclave indicator and spore ampule.
- Do not mix reusable items with disposable waste.

Contaminated Waste – Soft Items

- Soft contaminated waste (PPE, boxes, tissue, laboratory surface pad, etc.) consists of material that doesn't have hard edges or the ability to break and create a sharp edge that can poke through an autoclave bag. This material is placed into a biohazard waste bin for autoclaving.
- All PPE (such as gloves, face mask, shoe covers) removed from its packaging/shipping box is treated as contaminated waste and autoclaved regardless if used or not.
- After waste is properly autoclaved and sterilized the autoclaved waste is stored in the waste storage area for pick up by Cambodian Red Cross to be incinerated.

Contaminated Waste – Hard Items

- Hard contaminated waste consists of material that could poke through an autoclave bag which isn't contained within an autoclave pan (pipette tips, serological pipettes, petri dishes, etc.).
- Unbroken glass tubes (test tubes, biological media tubes, glass vials, etc.) are placed in a autoclaved bag for autoclaving before disposal. Always loosen container caps to prevent tubes from exploding during autoclaving.
- The laboratory staff pack the waste and transfer to the container and take it to the autoclave room daily or as necessary or at least two or three time per week.

8.3. Sharps Waste

- Sharps contaminated waste consists of material with sharp edges that could easily penetrate an autoclave bag (scalpels, glass slides, needles, glass pipets, broken glass, etc.).
- The staff using the sharp container will indicate 75% of container using a marker to know when the sharp container is full.
- Ensure the sharp container is maximum 75% full and replaced with new sharps container (do not overfill).
- When sharps container is 75% full close the lid to the container and place in the waste storage area (NPHL waste room) for Cambodian Red Cross to pick up and incinerate. Do not place sharps material into autoclave bags.

8.4. Miscellaneous Waste and chemical waste

- Expired unused media plates which are heat sealed wrapped and uncontaminated should be taken out of the box and placed into a biohazard waste barrels, pail or can for disposal.
- Chemical waste disposal and management is contained in the chemical Waste Management SOP.

8.5 Decontamination and Disposal Procedures

All biohazardous non-sharp waste in autoclave able bag must be autoclaved prior to being placed in the waste storage facility for pick up by Cambodian Red Cross and incineration.

- Please contact biosafety officer if you need further guidance.

8.6 Documentation

- Autoclaved waste records must be maintained in a log book.
- All waste picked up by the Cambodian Red Cross must be logged.
- All deviations from this procedure need to be captured systematically so that tracking and trending reports can be generated. It is the responsibility of all laboratory personnel to report deviations from defined methods, or incidents that could impact the safety of personnel. The person who first identifies or is made aware of a nonconforming event should document the occurrence and notify the laboratory team lead and biosafety officer.

9. Reporting results: N/A

10. Normal Reference Range:N/A

11. Reference

Laboratory Waste Disposal Operational Procedure. United States CDC, 2014.

12. Safety Precautions

- Follow standard precautions as outlined in SOP
- Use clearly marked containers for each type of waste as noted in this SOP to ensure optimal safety.
- Locate containers in the immediate area of use.

- Wear proper personnel protective equipment appropriate to the task when handling any regulated waste, including water resistant gloves.
- Wash hands immediately after removing gloves.

13. **Supplementary notes**: N/A

Annex 2.8: SOP-Disposal and Decontamination of Sharp Wastes

National Institute of Public Health

National Public Health Laboratory

DISPOSAL AND DECONTAMINATION OF SHARPS

SOP-ALL-01-013

Revision 00

Prepared by: Mr. KEAT CHHEANGHENG Date: 04 Apr 2018

(Head of Biosafety Team)

Reviewed by: Dr. NGUON VUTHY Date: 06 Apr 2018

(Deputy Head of biosafety Team)

Approved by: Dr. CHAU DARAPHEAK Date: 12 Apr 2018

(Chief of National Public Health Laboratory)

Issued Date: 23 Apr 201

1. **Objective**

The purpose of this document is to provide information and procedures to properly decontaminate and dispose of sharps waste in compliance with government guidelines.

2. **Responsibility**

Biosafety Officer:

- Maintaining up to date guidance pertaining to disposal of sharps.
- Addressing questions or concerns pertaining to sharps disposal.

Laboratory personnel:

- Responsible for safe and proper disposal of sharps in their respective units.

3. **Principle**

Safe disposal of sharps waste is an essential step in the management of hazardous laboratory materials. Proper management of sharps waste prevents personal injury, prevents contamination of personnel and the environment and ensures proper containment of laboratory and infectious waste during collection, transfer, and disposal.

4. **Material:** N/A
5. **Reagent**: N/A
6. **Standard and control**: N/A
7. **Sample**: N/A
8. **Procedure**

Sharps are any object with corners, edges, or projections that when inappropriately handled or disposed are capable of cutting or piercing skin or regular trash bags or waste containers. Examples of sharps include:

- Hypodermic needles, syringes, tubing
- Blades (scalpels, razors)
- Microscope slides and covers
- Glass capillary tubes
- Pasteur pipettes
- Glass slides or cover slips
- Laboratory glassware or plastic pipette tips contaminated with an infectious agent
- 'Plasticware' made from plastic polymers which shatter on breakage (culture flasks, petri dishes)
    - Please see supplementary note for visual and separation of sharps waste

Sharps Containers

All sharps containers must meet the following standards:

- rigid
- non-breakable and puncture resistant
- impervious to moisture and leak proof
- have lid
- with a universal biohazard label

Card board is acceptable for non-contaminated broken glassware or clean empty bottles and can be discarded with regular trash no need for decontamination.

Collection Procedures

- Sharps containers MUST BE stored near where the waste is generated and segregated from other waste.
- Sharps containers MUST NOT:

• be filled greater than 3/4 full

• be discarded in the regular trash

• contain free liquids, such as full culture tubes or filled syringes

Decontamination and Disposal Procedures

Decontaminate sharps by adding a 10% bleach solution to the sharps container prior to sealing and disposal (added solution should fill 10% of the containers volume). This will ensure no active biological material is being removed from the laboratory area when the containers enter the waste pick up area for incineration by the Cambodia Red Cross.

Important** If bleach solution is added then the container cannot be autoclaved.

- Please contact biosafety officer if you need further guidance.

9. **Reporting results**: N/A
10. **Normal Reference Range** :N/A
11. **Reference**

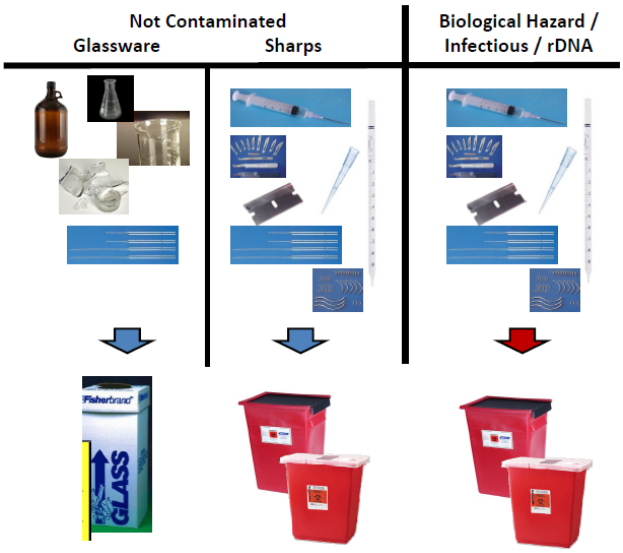
SOP for the disposal of sharp objects in laboratories. , University of Pennsylvania, 2012.

12. **Safety Precautions**

Use proper PPE to decontaminate and dispose of sharps.

13. **Supplementary notes**

Chart for the sorting of sharps waste.


Not Contaminated
Glassware
Sharps
Biological Hazard /
Infectious / rDNA
Fisherbrand
GLASS

Annex 2.9: SOP-Disinfection Solutions and Sterilization

National Institute of Public Health

National Public Health Laboratory

DISINFECTION SOLUTION AND STERILIZATION

SOP-ALL-01-017

Revision 00

Prepared by: Mr. NOV VANDARITH Date: 09 Jan 2018

(Member of BST and Microbiology Staff)

Reviewed by: Mr. KEAT CHHEANGHENG Date: 11 Jan 2018

(Head of Biosafety Team)

Approved by: Dr. CHAU DARAPHEAK Date: 15 Jan 2018

(Chief of National Public Health Laboratory)

Issued Date: 22 Jan 2018

1. **Objective**

To describe the disinfection and sterilization processes that are essential to biosafety at NPHL.

2. Responsibility

All NPHL personnel.

3. Principle

Biological hazards are present in clinical laboratories however; the risk of exposure and subsequent infection by these agents can be significantly reduced using specific protocols for decontamination/cleaning/disinfection after spills, before working, and at the end of each shift. Specific decontamination requirements will depend on the type of work and the nature of the infectious agent(s) handled.

4. **Material**: N/A

5. **Reagent**

Household Bleach

Ethanol

6. **Standard and control**: N/A

7. **Sample**: N/A

8. **Procedure**

8.1 Types of Disinfectants:

Bleach (sodium hypochlorite):

Bleach, a fast-acting oxidant, is broad-spectrum chemical germicide. It is important to note bleach, is highly alkaline and can be corrosive to metal. Household bleach (original concentration 5% or 6%) should be prepared to the proper concentration and discard daily after use.

Recommended dilutions of chlorine for different purpose

Household bleach (Sodium hypochlorite)	**Concentration of Bleach Solution**	**How to dilution**	**Purpose**
5%	0.5%	1 part of household bleach with 9 parts of water	To disinfect spilled biological samples or highly concentrated biological materials (contact time at least 10 min)
	0.1%	1 part of household bleach with 49 parts of water	Daily surface disinfection (contact time at least 5 min)

6%	0.5%	1 part of household bleach with 11 parts of water	Disinfecting spill samples or high concentration materials (contact time at least 10 min)
	0.1%	1 part of household bleach with 59 parts of water	Surface disinfection for daily use (contact time at least 5 min)

8.2 Alcohols

Ethanol is effective against vegetative bacteria, fungi and lipid-containing viruses but not against spores. 70% alcohol (700 ml of alcohol add 300 ml Distilled water) is used for highest effectiveness, higher or lower concentrations may not be as germicidal. Alcohols do not leave any residue on treated items. Prepared alcohol solutions can be kept for one month in sealed container.

8.3 Dry Heat Disinfection and Sterilization

A sterilization oven can be used to sterilize re-usable laboratory glassware at temperatures of 160°C or higher for 2 to 4 hours.

8.4 Autoclaving

Autoclaving is the most effective and reliable means of sterilizing biohazardous waste. Material for autoclaving must be loosely packed in the chamber for easy steam penetration and air removal. All biological waste in NPHL must be autoclaved prior to Red Cross Pick up.

9. **Reporting results**: N/A

10. **Normal Reference Range**: N/A

11. **Reference**

Laboratory biosafety manual, third edition. Geneva, World Health Organization, 2004.

12. Safety Precaution: N/A

13. Supplementary notes

National Institute of Public Health National Public Health Laboratory	Document code : JA-ALL-01-015	Revision No:00 Issued date: 30/03/2020
TITLE: DISINFECTION SOLUTION BLEACH AND ALCOHOL		Revised date: N/A

Recommended dilutions of chlorine for different purpose			
Household bleach (Sodium hypochlorite)	**Concentration of Bleach Solution**	**How to dilution**	**Purpose**
5%	0.5%	1 part of household bleach with 9 parts of water	To disinfect spilled biological samples or highly concentrated biological materials (contact time at least 10 min)
	0.1%	1 part of household bleach with 49 parts of water	Daily surface disinfection (contact time at least 5 min)
6%	0.5%	1 part of household bleach with 11 parts of water	Disinfecting spill samples or high concentration materials (contact time at least 10 min)
	0.1%	1 part of household bleach with 59 parts of water	Surface disinfection for daily use (contact time at least 5 min)

Table of amount ethanol water and water for final solution ethanol 70%		
% Ethanol	**Amount of ethanol added to make 1000 ml**	**Amount of water added to make 1000 ml**
99	707	293
98	714	286
97	722	278
96	729	271
95	737	263

Annex 2.10: SOP-Disposal of Chemical Waste

National Institute of Public Health

National Public Health Laboratory

CHEMICAL DISPOSAL

SOP-ALL-01-016

Revision 00

Prepared by: Mr. KEAT CHHEANGHENG Date: 10 Jan 2018

(Head of Biosafety Team)

Reviewed by: Dr. NGUON VUTHY Date: 12 Jan 2018

(Deputy Head of biosafety Team)

Approved by: Dr. CHAU DARAPHEAK Date: 15 Jan 2018

(Chief of National Public Health Laboratory)

Issued Date: 22 Jan 2018

1. **Objective**:

   The purpose of this document is to provide information and procedures to properly manage/dispose of chemical waste in compliance with government guidelines.

2. **Responsibility:**

Biosafety Officer:

- Maintaining up to date guidance pertaining to disposal of chemicals.
- Addressing questions or concerns pertaining to chemical disposal.

Laboratory personnel:

- Responsible for safe and proper disposal of chemicals in their respective units.
- Asking the biosafety team questions about chemical waste disposal when procedures are unclear.

3. **Principle** :

   Safe disposal of chemical waste is an essential step in the management of hazardous chemicals. Proper management of waste requires understanding how chemicals can be disposed of or neutralized.

4. **Material:** N/A
5. **Reagent**: N/A
6. **Standard and control**: N/A
7. **Sample**:N/A
8. **Procedure** :

General Comments about Chemical Waste Management:

- When you order a chemical, you have the responsibility for its disposal.
- Always label the date of opening on chemical bottle because many chemicals have limited shelf life. After which they decompose, give off fumes, absorb water or CO_2, or form peroxides. Watching the storage time can minimize disposal of "reactive" materials by disposing of them when they are stable.
- If you have any questions about chemicals or their proper disposal ask a biosafety officer.

Hazardous Characteristics

Chemicals which have the following four characteristics are considered to be **hazardous:**

IGNITABILITY

- A liquid which has a flash point of less than 60 deg C is considered ignitable by the EPA. This includes almost all organic solvents. Some examples are:Ethyl ether, Methanol, Ethanol, Acetone, Toluene, Benzene, Pentane, Hexane, Skelly B, Xylene, Formaldehyde, Heptane,

Ethyl Acetate, Petroleum Ether. Instructions for the disposal of organic solvents are given below.

CORROSIVITY

- An aqueous solution having a pH of less than or equal to 2, or greater than or equal to 12.5 is considered corrosive by the EPA. Instructions for the disposal of concentrated solutions of acids or bases are given below. Corrosive materials also include thionyl chloride, solid, sodium hydroxide and other nonaqueous acids or bases.

REACTIVITY

- Chemicals that react violently with air or water are considered reactive. An example is sodium metal. Reactive materials also include strong oxidizers, such as perchloric acids, and chemicals capable of detonation when subjected to an initiating source, such as old picric acid and phosphorous.
- Solutions of cyanide or sulfide that could generate toxic gases are also classified as a reactive

Other Hazardous Wastes

- Aqueous Solutions of Toxic Metals
- Special Precautions for Lead, Mercury and Silver
- Lead, mercury and silver require special precautions for disposal. If you discharge any of these metals, their compounds or aqueous solutions of their compounds into the sewer system, make sure you meet these concentrations:
- Lead 2.0 mg/l
- Mercury 0.02 mg/l
- Silver 0.4 mg/l
- Lead, mercury and silver are especially important pollutants. Filtering and precipitation for some other type of collection must be routine procedure for your laboratory if you use them.

Label large waste collecting containers in the laboratory and all chemical waste discard bottles:

- A label must be affixed to each container. You must list the major chemical components of your waste especially if it contains the following:
- Halogenated compounds (e.g., $CHCl_3$, CH_2CL_2, CCl_4, and solutes)
- Metals (e.g., Pb, Hb, Ag, Cr)
- Sulfur compounds (e.g., CS_2, DMSO, and solutes)
- Solvents

Disposal of Chemicals

Chemicals for the Normal Trash

You can safely dispose of many solid chemicals in the normal trash if the containers are tightly capped and of good integrity. Examples are given below:

- have oral rat LD50 toxicity values higher than 500 mg/kg and
- have no positive determination for carcinogenicity
- please read specific SDS sheet for the chemical if you are unsure

Chemicals for the Sanitary Sewer System

You can safely dispose of many chemicals into the sanitary sewer system if they are water soluble, degradable in the sanitary sewer and are properly diluted. Examples are given below. Chemicals in solid form should be followed by twenty (20) parts of water.

- Aqueous solutions of chemicals described under "chemicals for the normal trash"
- Very dilute aqueous solutions of water soluble organic solvents. (i.e., <10% solutions) Examples are:
    - Allyl Alcohol Propanol
    - Glycerine Propylene Glycol
- Neutralized solutions of acids or bases (see procedure below)
  *You should take special care when neutralizing strongly oxidizing acids such as perchloric acid and fresh chromic acid.
- Small amount of methanol can be disposed into the sink.

General Neutralization Procedures

CAUTION: FUMES AND HEAT ARE GENERATED

1. Do your neutralizations in a well-ventilated hood and behind a safety shield.
2. Keep containers cool while neutralizing.
3. You should be wearing an apron, goggles, and gloves.
4. Perform all steps SLOWLY.
5. Neutralize concentrated solutions of acids and bases to within a pH range of greater than 2 and lower than 12.5 and then flush them into the sanitary sewer with at least twenty (20) parts of water.

Acid Neutralization

While stirring, add acids to large amounts of an ice-water solution of base such as sodium carbonate (soda ash), calcium hydroxide (slaked lime), or 8M sodium hydroxide (for concentrated acids). When a pH above 2 is achieved, dispose of the solution into the sewer system followed by twenty (20) parts of water.

Base Neutralization

Neutralize by first adding the base to a large vessel containing water. Slowly add a 1M solution of HCL. When a pH of 12.5 is achieved, dispose of into the sewer system followed by twenty parts of water.

Solutions to be collected by the Biosafety Team for proper disposal:

Organic Solvents

Place your organic solvents in glass bottles the solvents originally came in. Don't put them in the sewer. Halogenated solvents (e.g., chloroform, carbon tetrachloride and dichloromethane) and their mixtures should be kept separate as they are more difficult to dispose of. Be sure to deface or remove original label and attach Chemical Discard tag to bottle and are shipped off for proper incineration contact Biosafety Team for proper disposal.

SUBSTANCES THAT SHOULD NOT BE PUT INTO SOLVENT WASTE CONTAINERS

The following substances are **inappropriate** for incineration. Don't put them into your organic waste containers. They should be collected in separate containers.

Solutions of acids or bases

Aqueous solutions of toxic organic chemicals

Metals (e.g., Sb, As, Ba, Cd, Cr, Pb, Hg, Ni, Se, Ag)

Vacuum pump oil

Sulfides or inorganic cyanides

Strong oxidizers or reducers

Water reactive substances

Unknowns

Large amounts of water

Peroxide Forming Agents

Peroxides are low power explosives and very sensitive to shock and heat. A variety of organic compounds react with oxygen from the air to form unstable peroxides. Well-known peroxide forming compounds include:

Diethyl Ether

Tetrahydrofuran

Isopropyl Ether

Other ethers

Other peroxide forming agents include:

Aldehydes

Compounds with benzylic hydrogens

Compounds with allyl groups

Vinyls

Peroxide Formation and Safety Tips

- Exposure of any of the peroxide-forming agents to light or air increase the rate of peroxide formation. Therefore, store these agents in full, light-tight containers.

- Refrigeration does not prevent peroxide formation
- Order small amounts frequently to decrease storage time.
- Date new containers when opened.
- Be particularly cautious with materials of unknown vintage. Do not attempt to remove caps from containers that may cause sparks. Call biosafety officer for advice or assistance when such containers are found.
- Never distill peroxide-forming solvents unless they are known to be free of peroxides.
- Peroxides concentrated in the residue can pose a serious explosion hazard.

Peroxide Testing and Disposal

- Before beginning work with a peroxide-forming agent, determine its peroxide content.
- Dispose of agents containing greater than 80 ppm peroxide. Easy-to-use quantitative peroxide test strips are available from Scientific Products or Aldrich.
- Materials found to contain peroxides (greater than 80 ppm) should be treated prior to disposal.
- Methods for removal of peroxides involve the addition of reducing agent such as ferrous sulfate (for diethyl ether peroxides) or sodium metabisulfite (for isopropyl peroxides).
- The treated solvent should be placed in a waste container and the empty container rinsed with water. Most peroxides are water soluble and the rinsate can be put in the sewer system.

Strong Oxidizers and Reducers

The best way to dispose of oxidizers and reducers is to chemically neutralize them. You should treat the chemicals listed below in your laboratory. For information on treatment techniques, please call us. If you choose not to neutralize these chemicals, contact biosafety officer for pickup and disposal.

STRONG OXIDIZERS

Chromic acid (fresh)

Metallic chlorates

Metallic nitrates

Metallic perchlorates

Metallic permanganates

Perchloric acid

STRONG REDUCERS

n-Butyl lithium Calcium hydride

Metallic sulfides Sodium hydride

Stannous chloride

Other Reactive (Including Water Reactive)

Listed below are a variety of reactive materials that you should **contact the biosafety officer** for disposal. Package any liquids separately from solids and please note special hazards and/or handling precautions on each box.

Acetyl chloride

Benzoyl peroxide

Bromine

Calcium metal

Lithium metal

Phosphorous (yellow)

Potassium metal

Sodium metal

Thionyl chloride

Unknown Chemicals

You must make every effort to provide an accurate description of all chemicals need to discard. Unknown chemicals present serious problems for the NPHL. Without a description, we can't handle or dispose of a chemical in a safe manner. Disposal companies will not accept chemical waste without an analysis, and an analysis of one sample could easily cost $1,000.

- Investigation of Unknown Chemicals

Any information you can provide about an unknown chemical you wish to dispose of greatly aids identification. For example, even knowing whether or not a chemical is organic or inorganic is helpful.

- Procedure

Don't move it from its location if possible. A biosafety team member will come to your laboratory to investigate.

- Reducing the Problem

You can reduce the occurrence of unknown chemicals by being thorough in maintaining labels on chemical containers. Periodic review of chemical stock and careful record keeping lessens the chance of discovering containers with missing labels.

9. **Reporting results**: N/A
10. **Normal Reference Range**: N/A
11. **Reference**

Waste Handling & Disposal SOP, University of Notre Dame, 2010.

12. **Safety Precautions:** N/A
13. **Supplementary notes**: N/A

Annex 2.11: SOP-Laboratory Risk Assessment

National Institute of Public Health

National Public Health Laboratory

LABORATORY RISK ASSESSMENT

SOP-ALL-01-004

Revision 00

Prepared by: Mr. KEAT CHHEANGHENG Date: 07 Dec 2017

(Head of Biosafety Team)

Reviewed by: Dr. NGUON VUTHY Date: 08 Dec 2017

(Deputy Head of biosafety Team)

Approved by: Dr. CHAU DARAPHEAK Date: 19 Dec 2017

(Chief of National Public Health Laboratory)

Issued Date: 27 Dec 20

1. **Objective:**

The objective of risk assessment is to determine the risks associated with laboratory procedures. Risk assessment allows a laboratory to determine the relative level of risk different laboratory activities pose and help guide risk mitigation/elimination decisions to remove unnecessary risks.

2. Responsibility

- Biosafety Team (BST) conduct risk assessment using the NPHL risk assessment checklist in each laboratory unit.
- Head of Unit will assist the BST while performing the risk assessment and follow up to ensure all staff in unit are following risk assessment guidelines.
- Laboratory staff in each unit will follow the biosafety risk assessment guidelines.

3. Principle

- Risk assessment is a procedure that analyzes a particular process or situation in order to determine the likelihood and consequences of a certain adverse event and is unique to each laboratory unit.
- To be comprehensive, a laboratory risk assessment should consider every activity and procedure conducted in a laboratory that involves infectious disease agents or hazardous chemicals as a possible risk.

4. Materials: N/A

5. Reagents: N/A

6. Standard control: N/A

7. Sample: N/A

8. Procedure

1. The BST contact the Head of Unit to obtain information the following information prior to conducting the risk assessment in a given unit:
    - List of testing procedure performed in unit, including all applicable safety practices
    - List of potential hazardous pathogens that could be encountered in the laboratory unit
    - Chemical hazards found in unit
2. Using the risk assessment tool (see supplementary notes) developed by NPHL, the BST will perform risk assessments for all laboratory procedures that might potentially expose laboratory workers to hazardous pathogens or chemicals.
3. The information gathered from the assessment will be used to determine avoidable or acceptable risks for each unit and to develop safety procedures to minimize risks.
4. A copy of every completed risk assessment shall be kept in the BST cabinet.

9. Reporting results: N/A

10. Normal Reference Range: N/A

11. Reference

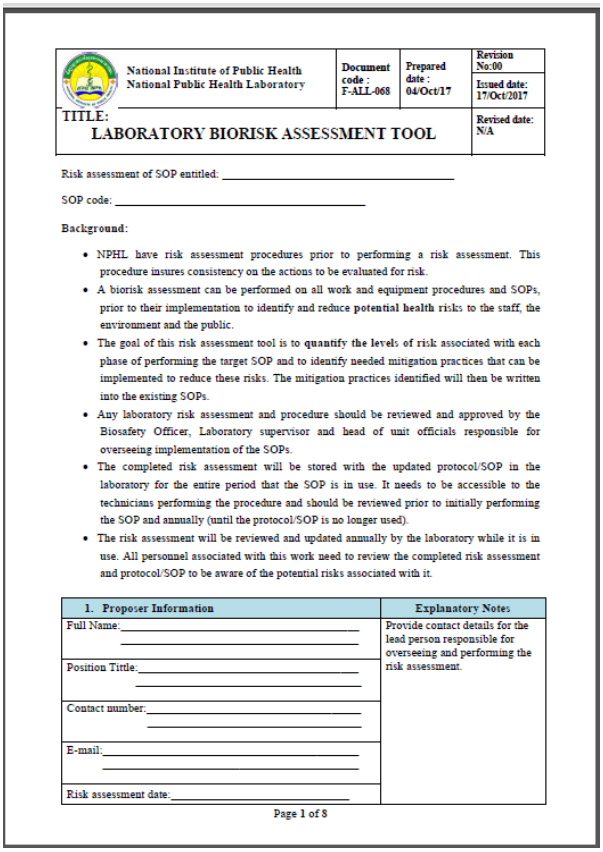
- ISO 15189, Medical Laboratory-Requirements for quality and competence, Third edition, 2012-11-01.

- Sandia International Laboratory website: biosecurity.sandia.gov/gbrmc
- Risk assessment tool developed by Gerald J. Pellegrini Jr.,US-CDC

12. Safety precaution: N/A

13. Supplementary notes

Form and Code of form of Laboratory Biorisk Assessment tool: F-ALL-068



National Institute of Public Health National Public Health Laboratory	Document code : F-ALL-068	Prepared date : 04/Oct/17	Revision No:00 Issued date: 17/Oct/2017
TITLE: LABORATORY BIORISK ASSESSMENT TOOL			Revised date: N/A

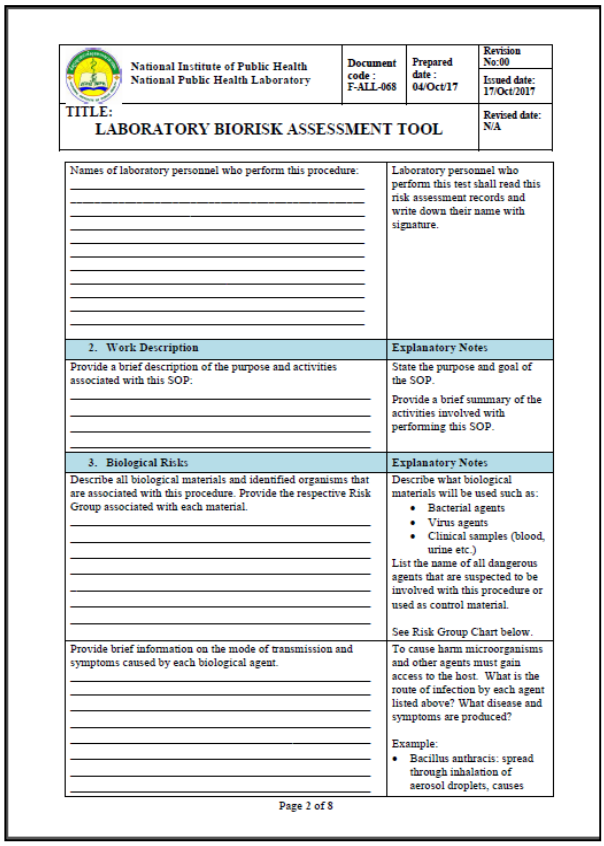
Risk assessment of SOP entitled: _____

SOP code: _____

Background:

- NPHL have risk assessment procedures prior to performing a risk assessment. This procedure insures consistency on the actions to be evaluated for risk.
- A biorisk assessment can be performed on all work and equipment procedures and SOPs, prior to their implementation to identify and reduce **potential health** risks to the staff, the environment and the public.
- The goal of this risk assessment tool is to **quantify the levels** of risk associated with each phase of performing the target SOP and to identify needed mitigation practices that can be implemented to reduce these risks. The mitigation practices identified will then be written into the existing SOPs.
- Any laboratory risk assessment and procedure should be reviewed and approved by the Biosafety Officer, Laboratory supervisor and head of unit officials responsible for overseeing implementation of the SOPs.
- The completed risk assessment will be stored with the updated protocol/SOP in the laboratory for the entire period that the SOP is in use. It needs to be accessible to the technicians performing the procedure and should be reviewed prior to initially performing the SOP and annually (until the protocol/SOP is no longer used).
- The risk assessment will be reviewed and updated annually by the laboratory while it is in use. All personnel associated with this work need to review the completed risk assessment and protocol/SOP to be aware of the potential risks associated with it.

1. Proposer Information	Explanatory Notes
Full Name:_____ _____	Provide contact details for the lead person responsible for overseeing and performing the risk assessment.
Position Tittle:_____ _____	
Contact number:_____ _____	
E-mail:_____ _____	
Risk assessment date:_____	



National Institute of Public Health National Public Health Laboratory	Document code : F-ALL-068	Prepared date : 04/Oct/17	Revision No:00 Issued date: 17/Oct/2017
TITLE: LABORATORY BIORISK ASSESSMENT TOOL			Revised date: N/A

Names of laboratory personnel who perform this procedure: _____ _____ _____ _____ _____ _____ _____ _____ _____ _____ _____	Laboratory personnel who perform this test shall read this risk assessment records and write down their name with signature.
2. Work Description	**Explanatory Notes**
Provide a brief description of the purpose and activities associated with this SOP: _____ _____ _____ _____	State the purpose and goal of the SOP. Provide a brief summary of the activities involved with performing this SOP.
3. Biological Risks	**Explanatory Notes**
Describe all biological materials and identified organisms that are associated with this procedure. Provide the respective Risk Group associated with each material. _____ _____ _____ _____ _____ _____ _____ _____	Describe what biological materials will be used such as: • Bacterial agents • Virus agents • Clinical samples (blood, urine etc.) List the name of all dangerous agents that are suspected to be involved with this procedure or used as control material. See Risk Group Chart below.
Provide brief information on the mode of transmission and symptoms caused by each biological agent. _____ _____ _____ _____ _____ _____ _____ _____	To cause harm microorganisms and other agents must gain access to the host. What is the route of infection by each agent listed above? What disease and symptoms are produced? Example: • Bacillus anthracis: spread through inhalation of aerosol droplets, causes

_____ _____ _____ _____ _____	respiratory infection with symptoms similar to pneumonia, treatment with antibiotics.
Identify any vaccines available: _____ _____	List any vaccines available to protect against the biological material in this SOP.
What will be used to decontaminate the agents and workspace during this work? _____ _____ _____ _____	Example: • 10% Bleach made fresh daily • 70% Alcohol (give brand names)
What will happen to the biological material after testing? _____ _____ _____ _____ _____	Describe how this biological material will be inactivated, disposed or stored.
List all protective equipment needed when performing this procedure to mitigate risk associated with the biological material: _____ _____ _____ _____ _____ _____ _____ _____	Example: • Gloves • N95 Respirator • Lab coat • Eye Protection • Double latex gloves • Sleeve protectors • Gown • Class II BSC.
Definition of Biological materials: For the purpose of this document "Biological materials" means any biologically-derived materials or materials which, either by accident or design, contain biological agents including bacteria, viruses, microorganism, genetically modified organisms/micro-organisms (GMOs, GMMs), prions, or any other biological agents which might pose a risk to health and safety or the environment.	

National Institute of Public Health
National Public Health Laboratory

Document code : F-ALL-068	Prepared date : 04/Oct/17	Revision No:00
		Issued date: 17/Oct/2017
		Revised date: N/A

TITLE:
LABORATORY BIORISK ASSESSMENT TOOL

Risk Group: The Risk Group is based on the likelihood of significant disease resulting from infection by the pathogen	
Risk Group 1:	A biological agent unlikely to cause human disease.
Risk Group 2:	A biological agent that can cause human disease and may be a hazard to employees; it is unlikely to spread to the community and there is usually effective prophylaxis or effective treatment available.
Risk Group 3:	A biological agent that can cause human disease and presents a serious hazard to employees; it may present a risk of spreading to the community, but there is usually effective prophylaxis or treatment available.
Risk Group 4:	A biological agent that causes severe human disease and is a serious hazard to employees; it is likely to spread to the community and there is usually no effective prophylaxis or treatment available. This category is highly specialized and restricted to research hospitals or infectious disease research institutes
4. Equipment	
List the equipment that will be used in this protocol: _____ _____ _____ _____ _____ _____ _____ _____	Example: • Vortex • Centrifuge • pH Meter • Shaker • Pipette (20-200µl, 500-1000µl) • Any sharps
List any potential risks associated with equipment being used. Categorize each risk as Low (L), Medium (M), or High (H) potential _____ _____ _____ _____ _____ _____ _____ _____	Examples: • Vortex=aerosol & splash (H) • Centrifuge=contact contamination (H) (list any risk possible-no matter how small)
List the safety steps that will be put in place to mitigate the above risks: _____ _____ _____ _____ _____ _____	Examples: • Latex gloves worn during work. • Sealed centrifuge cups will be opened in the BSC • Vortex will be done inside a Class II BSC

5. Mechanical Risks	
Identify all possible risks that could occur involving equipment or facility malfunctions occurring during the performance of this SOP. Categorize each risk as Low (L), Medium (M), or High (H) potential. _____	Examples: 1. Vortex-platform comes loose. (M) 2. Centrifuge-instrument fire (L), rotor breaks loose (L), rotor cap comes loose (M), broken tube during spin (H). 3. Power outage of biosafety cabinet (M) 4. Power surge on analyzer (M)
For each potential risk identified above list the mitigation safety steps that will be put in place to reduce the risk: _____	For each numbered risk identified above list the mitigation steps that will be implemented to reduce the potential risk. Examples: 1. Vortex step-perform behind safety shield. 2. Centrifuge fire-fire extinguisher available in room. 3. Power failure-backup generator & emergency action SOP in place for loss of power.
6. Hazardous Chemicals	
List hazardous chemicals involved with this SOP: _____	List Chemicals which are: • Toxic • Corrosive • Carcinogens • Flammable • Oxidizers • Environmental poisons • Explosive
List the risks involved with any chemicals listed above: _____	This information can be obtained from the chemical MSDS/SDS sheets

National Institute of Public Health
National Public Health Laboratory

Document code : F-ALL-068	Prepared date : 04/Oct/17	Revision No:00
		Issued date: 17/Oct/2017
		Revised date: N/A

TITLE:
LABORATORY BIORISK ASSESSMENT TOOL

_____	
Is there an MSDS/SDS sheet available for each chemical listed – yes or no. What safety steps will be put in place to reduce the risks listed above: _____	Example: • Face shield used to protect from splashes • Chemical fume hood used • Chemical MSDS/SDS sheets are available • Splash shield used to prevent splashes. (see chemical MSDS/SDS sheets for safety equipment requirements)
7. Biosecurity Risks	
List any agents, chemicals or materials can be used to intentionally harm people in this protocol/SOP? List any… _____	List identified hazardous agents, chemicals or materials here.
Can someone who doesn't work in the lab get access to lab samples? How? _____ Can someone working in a different section of the lab get access to lab samples, culture samples? How? _____ Can someone who doesn't work in the lab get access to culture samples? How? _____	• Taken from the trash • Taken from the bench top • Given to them by a technician • Break into lab at night

What security measures can be used to prevent the above actions? _____ _____ _____	• Doors locked at night • Security guards • Cameras • Restricted area signs
8. Permits & Special permissions	
List any permits, Licensing, Government permissions or Board reviews needed to perform this protocol/SOP: _____ _____ _____ _____ _____ _____ _____ _____ _____ _____ _____	Example: • Permission granted by the CDC Ethics Committee (03/09/04) • Meets DSAT select agent regulations review and approval • Ministry or Government Approvals required for this work • Dual use research review and approval if needed • IRB review and approval is required
State the current status of required permissions listed above and any restrictions imposed on this protocol/SOP. _____ _____ _____	
9. Worker Restrictions	
Are there any health restrictions placed on workers who will be performing this SOP? _____ _____ _____	Example: No immunocompromised, sick or pregnant technicians due to risk of infection
What training and operational requirements must the technician have to perform this SOP? _____ _____ _____ _____ _____	Example: • Pass competency testing • Formal microbiology training • Two person protocol (high risk pathogen such as Ebola…etc)
Conclusion:_____ _____ _____ _____	

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_____	
Recommendation: _____ _____ _____ _____ _____	
Attached Annexes (example license, doctor certificate…etc):	
Annex 1	
Annex 2	

Reviewers/biosafety officer signature	
Name/Position:	
Date:	
☐ Approved ☐ Approved with change (express in the recommendation part) ☐ Disapproved	
Approval signature of chief of NPHL:	
Name:	
Date:	

ANNEX 3: Checklist for Environmental and Social Safeguards Supervision for Renovation of Laboratories in National Institute of Public Health

Objectives:

To supervise/monitor status of Environmental and Social Codes Practice (ESCOP) implementation and social safeguards implementation during renovation of NPHL

To suggest time-bound corrective actions for activities which create adverse impacts on the environment and people

Location:	National Institute of Public Health
Person involved:	
Name of other Institution/ Organization involved:	
Filled out by:	
Date:	
Summary of the finding:	

	Question on Environmental- Social Safeguards Implementation	**Yes**	**No**	**Comments/ Information (Propose Time-bound corrective actions if No)**
1.	Unexploded Ordnances' (UXO, landmines, unexploded remnants of remnants etc.) at the construction sites.			
2	Chemicals, sanitary wastewater, spoil waste oil and concrete agitator washings is not deposited in the watercourses.			
3.	No Asbestos based materials are used in the construction			
4.	Asbestos product such as roofing sheets, old structure to be demolished are not stored in the health facilities compound.			
5.	If Asbestos products such as roofing sheets are found on site, or present in old structures that are to be demolished, they must be removed carefully from site, if possible, without breaking. The Asbestos is to be wetted to prevent dust and if any cutting or abrading is necessary, then the material must be kept wet during working to prevent dust.			
6.	The contractor protects sites of known antiquity by placing barriers and fencing to prevent access or damage to the site			
7.	The construction materials/ equipment is stored on site in the property constructed area, in good			

	working condition and do not produce excessive noise			
8.	The demolition activities do not generate visible airborne dust			
9.	The site potable drinking water for construction workers is provided			
10.	The privy facilities available for construction workers are constructed and operational at the sites. The privy is located more than 30 meters of any existing water supply wells/surface water body			
11.	Noise disturbance of patients, HFs staff, residents or surrounded area due to prolong construction			
12.	Request for obtaining an agreement for disposal of construction waste			
13.	Proper location of construction site/camp			
14.	Availability of proper storage for fuel, oil and construction materials			
15.	Proper maintenance of construction machinery and equipment (prevent leakage of fuel, oil, lubricants, etc.)			
16.	Availability of temporary storage areas for excavated and demolished materials and construction wastes within health facility			
17.	Timely removal of excavated and demolished materials and construction waste from the temporary storage areas to planned and agreed places			
18.	Use covered trucks for transportation of construction materials and waste			
19.	Clean the surrounding area from dust by water sprinkling in construction zone (when necessary)			
20.	Clean/ wash tires of vehicles before they get to dwellings and/or drive on highways (when necessary)			
21.	Implementation of works at the established time (e.g. work during daytime 06.00 to 18.00)			
22.	Ensure proper safety of workers at the construction site (e.g. wearing construction helmet or other protective materials)			
23.	Installation of warning signs/safety signs in construction site, worker camps and access roads			
24.	Ensure proper sanitary/ hygienic conditions for workers at the construction site			
25.	Restoration of the area of construction sites and camps when the construction works are over			
26.	Replanting/planting of finished work areas			
27.	The construction site is properly fencing/ proper use of net construction			
28.	Having enough warning signs at danger areas (e.g. construction site, holes, construction wastes storage areas, etc.)			
29.	Electrical equipment and wires are in good conditions and properly kept (no damage, cuts, found in the wire, put it above the ground when it is flooded), proper Personal Protective Equipment			

	(PPE) provided for works expose to electrical hazard. Prohibit works that involve electrical hazard to be carried out during raining or on a wet floor.			
30.	Ensure appropriate and respectful behavior of workers towards individuals in and around the construction area and the surrounding communities (ex. sexual harassment etc.).			
31.	During the construction/ground breaking, etc. in the event of unanticipated discovery of cultural or historical artifacts (human remain, antiquity, sacred artifact etc.).			
32.	Before/during working at height place, the arrangement of scaffoldings, supports, platforms, ladders and handrails to be provided, and using of safety belt be applied.			
33.	Conducting of monthly safety training to the construction workers to each site by the supervision engineers, and always training when the new construction workers recruited to work at sites.			
34.	There is no employment of children under eighteen years old at the construction site.			
Note: (Other issues found related to the social and environmental issues found at the construction sites).				

Date: ……/……/2019

Safeguard Coordinator: Signature
and Name of Implementer

ESF/SAFEGUARDS INTERIM NOTE: COVID-19 CONSIDERATIONS IN CONSTRUCTION/CIVIL WORKS PROJECTS

This note was issued on April 7, 2020 and includes links to the latest guidance as of this date (e.g. from WHO). Given the COVID-19 situation is rapidly evolving, when using this note it is important to check whether any updates to these external resources have been issued.

1. INTRODUCTION

The COVID-19 pandemic presents Governments with unprecedented challenges. Addressing COVID-19 related issues in both existing and new operations starts with recognizing that this is not business as usual and that circumstances require a highly adaptive responsive management design to avoid, minimize and manage what may be a rapidly evolving situation. In many cases, we will ask Borrowers to use reasonable efforts in the circumstances, recognizing that what may be possible today may be different next week (both positively, because more supplies and guidance may be available, and negatively, because the spread of the virus may have accelerated).

This interim note is intended to provide guidance to teams on how to support Borrowers in addressing key issues associated with COVID-19, and consolidates the advice that has already been provided over the past month. As such, it should be used in place of other guidance that has been provided to date. This note will be developed as the global situation and the Bank's learning (and that of others) develops. This is not a time when 'one size fits all'. More than ever, teams will need to work with Borrowers and projects to understand the activities being carried out and the risks that these activities may entail. Support will be needed in designing mitigation measures that are implementable in the context of the project. These measures will need to take into account capacity of the Government agencies, availability of supplies and the practical challenges of operations on-the-ground, including stakeholder engagement, supervision and monitoring. In many circumstances, communication itself may be challenging, where face-to-face meetings are restricted or prohibited, and where IT solutions are limited or unreliable.

This note emphasizes the importance of careful scenario planning, clear procedures and protocols, management systems, effective communication and coordination, and the need for high levels of responsiveness in a changing environment. It recommends assessing the current situation of the project, putting in place mitigation measures to avoid or minimize the chance of infection, and planning what to do if either project workers become infected or the work force includes workers from proximate communities affected by COVID-19. In many projects, measures to avoid or minimize will need to be implemented at the same time as dealing with sick workers and relations with the community, some of whom may also be ill or concerned about infection. Borrowers should understand the obligations that contractors have under their existing contracts (see Section 3), require contractors to put in place appropriate organizational structures (see Section 4) and develop procedures to address different aspects of COVID-19 (see Section 5).

2. CHALLENGES WITH CONSTRUCTION/CIVIL WORKS

Projects involving construction/civil works frequently involve a large work force, together with suppliers and supporting functions and services. The work force may comprise workers from international, national, regional, and local labor markets. They may need to live in on-site accommodation, lodge within communities close to work sites or return to their homes after work. There may be different contractors

permanently present on site, carrying out different activities, each with their own dedicated workers. Supply chains may involve international, regional and national suppliers facilitating the regular flow of goods and services to the project (including supplies essential to the project such as fuel, food, and water). As such there will also be regular flow of parties entering and exiting the site; support services, such as catering, cleaning services, equipment, material and supply deliveries, and specialist sub-contractors, brought in to deliver specific elements of the works.

Given the complexity and the concentrated number of workers, the potential for the spread of infectious disease in projects involving construction is extremely serious, as are the implications of such a spread. Projects may experience large numbers of the work force becoming ill, which will strain the project's health facilities, have implications for local emergency and health services and may jeopardize the progress of the construction work and the schedule of the project. Such impacts will be exacerbated where a work force is large and/or the project is in remote or under-serviced areas. In such circumstances, relationships with the community can be strained or difficult and conflict can arise, particularly if people feel they are being exposed to disease by the project or are having to compete for scarce resources. The project must also exercise appropriate precautions against introducing the infection to local communities.

3. DOES THE CONSTRUCTION CONTRACT COVER THIS SITUATION?

Given the unprecedented nature of the COVID-19 pandemic, it is unlikely that the existing construction/civil works contracts will cover all the things that a prudent contractor will need to do. Nevertheless, the first place for a Borrower to start is with the contract, determining what a contractor's existing obligations are, and how these relate to the current situation.

The obligations on health and safety will depend on what kind of contract exists (between the Borrower and the main contractor; between the main contractors and the sub-contractors). It will differ if the Borrower used the World Bank's standard procurement documents (SPDs) or used national bidding documents. If a FIDIC document has been used, there will be general provisions relating to health and safety. For example, the standard FIDIC, Conditions of Contract for Construction (Second Edition 2017), which contains no 'ESF enhancements', states (in the General Conditions, clause 6.7) that the Contractor will be required:

- to take all necessary precautions to maintain the health and safety of the Contractor's Personnel
- to appoint a health and safety officer at site, who will have the authority to issue directives for the purpose of maintaining the health and safety of all personnel authorized to enter and or work on the site and to take protective measures to prevent accidents
- to ensure, in collaboration with local health authorities, that medical staff, first aid facilities, sick bay, ambulance services and any other medical services specified are available at all times at the site and at any accommodation
- to ensure suitable arrangements are made for all necessary welfare and hygiene requirements and for the prevention of epidemics

These requirements have been enhanced through the introduction of the ESF into the SPDs (edition dated July 2019). The general FIDIC clause referred to above has been strengthened to reflect the requirements of the ESF. Beyond FIDIC's general requirements discussed above, the Bank's Particular Conditions include a number of relevant requirements on the Contractor, including:

- to provide health and safety training for Contractor's Personnel (which include project workers and all personnel that the Contractor uses on site, including staff and other employees of the Contractor and Subcontractors and any other personnel assisting the Contractor in carrying out project activities)
- to put in place workplace processes for Contractor's Personnel to report work situations that are not safe or healthy
- gives Contractor's Personnel the right to report work situations which they believe are not safe or healthy, and to remove themselves from a work situation which they have a reasonable justification to believe presents an imminent and serious danger to their life or health (with no reprisal for reporting or removing themselves)
- requires measures to be in place to avoid or minimize the spread of diseases including measures to avoid or minimize the transmission of communicable diseases that may be associated with the influx of temporary or permanent contract-related labor
- to provide an easily accessible grievance mechanism to raise workplace concerns

Where the contract form used is FIDIC, the Borrower (as the Employer) will be represented by the Engineer (also referred to in this note as the Supervising Engineer). The Engineer will be authorized to exercise authority specified in or necessarily implied from the construction contract. In such cases, the Engineer (through its staff on site) will be the interface between the PIU and the Contractor. It is important therefore to understand the scope of the Engineer's responsibilities. It is also important to recognize that in the case of infectious diseases such as COVID-19, project management – through the Contractor/subcontractor hierarchy – is only as effective as the weakest link. A thorough review of management procedures/plans as they will be implemented through the entire contractor hierarchy is important. Existing contracts provide the outline of this structure; they form the basis for the Borrower to understand how proposed mitigation measures will be designed and how adaptive management will be implemented, and to start a conversation with the Contractor on measures to address COVID-19 in the project.

4. WHAT PLANNING SHOULD THE BORROWER BE DOING?

Task teams should work with Borrowers (PIUs) to confirm that projects (i) are taking adequate precautions to prevent or minimize an outbreak of COVID-19, and (ii) have identified what to do in the event of an outbreak. Suggestions on how to do this are set out below:

- The PIU, either directly or through the Supervising Engineer, should request details in writing from the main Contractor of the measures being taken to address the risks. As stated in Section 3, the construction contract should include health and safety requirements, and these can be used as the basis for identification of, and requirements to implement, COVID-19 specific measures. The measures may be presented as a contingency plan, as an extension of the existing project emergency and preparedness plan or as standalone procedures. The measures may be reflected in revisions to the project's health and safety manual. This request should be made in writing (following any relevant procedure set out in the contract between the Borrower and the contractor).

- In making the request, it may be helpful for the PIU to specify the areas that should be covered. This should include the items set out in Section 5 below and take into account current and relevant

guidance provided by national authorities, WHO and other organizations. See the list of references in the Annex to this note.

- The PIU should require the Contractor to convene regular meetings with the project health and safety specialists and medical staff (and where appropriate the local health authorities), and to take their advice in designing and implementing the agreed measures.

- Where possible, a senior person should be identified as a focal point to deal with COVID-19 issues. This can be a work supervisor or a health and safety specialist. This person can be responsible for coordinating preparation of the site and making sure that the measures taken are communicated to the workers, those entering the site and the local community. It is also advisable to designate at least one back-up person, in case the focal point becomes ill; that person should be aware of the arrangements that are in place.

- On sites where there are a number of contractors and therefore (in effect) different work forces, the request should emphasize the importance of coordination and communication between the different parties. Where necessary, the PIU should request the main contractor to put in place a protocol for regular meetings of the different contractors, requiring each to appoint a designated staff member (with back up) to attend such meetings. If meetings cannot be held in person, they should be conducted using whatever IT is available. The effectiveness of mitigation measures will depend on the weakest implementation, and therefore it is important that all contractors and sub-contractors understand the risks and the procedure to be followed.

- The PIU, either directly or through the Supervising Engineer, may provide support to projects in identifying appropriate mitigation measures, particularly where these will involve interface with local services, in particular health and emergency services. In many cases, the PIU can play a valuable role in connecting project representatives with local Government agencies, and helping coordinate a strategic response, which takes into account the availability of resources. To be most effective, projects should consult and coordinate with relevant Government agencies and other projects in the vicinity.

- Workers should be encouraged to use the existing project grievance mechanism to report concerns relating to COVID-19, preparations being made by the project to address COVID-19 related issues, how procedures are being implemented, and concerns about the health of their co-workers and other staff.

5. WHAT SHOULD THE CONTRACTOR COVER?

The Contractor should identify measures to address the COVID-19 situation. What will be possible will depend on the context of the project: the location, existing project resources, availability of supplies, capacity of local emergency/health services, the extent to which the virus already exist in the area. A systematic approach to planning, recognizing the challenges associated with rapidly changing circumstances, will help the project put in place the best measures possible to address the situation. As discussed above, measures to address COVID-19 may be presented in different ways (as a contingency plan, as an extension of the existing project emergency and preparedness plan or as standalone procedures). PIUs and contractors should refer to guidance issued by relevant authorities, both national

and international (e.g. WHO), which is regularly updated (see sample References and links provided in the Annex).

Addressing COVID-19 at a project site goes beyond occupational health and safety, and is a broader project issue which will require the involvement of different members of a project management team. In many cases, the most effective approach will be to establish procedures to address the issues, and then to ensure that these procedures are implemented systematically. Where appropriate given the project context, a designated team should be established to address COVID-19 issues, including PIU representatives, the Supervising Engineer, management (e.g. the project manager) of the contractor and sub-contractors, security, and medical and OHS professionals. Procedures should be clear and straightforward, improved as necessary, and supervised and monitored by the COVID-19 focal point(s). Procedures should be documented, distributed to all contractors, and discussed at regular meetings to facilitate adaptive management. The issues set out below include a number that represent expected good workplace management but are especially pertinent in preparing the project response to COVID-19.

(a) ASSESSING WORKFORCE CHARACTERISTICS

Many construction sites will have a mix of workers e.g. workers from the local communities; workers from a different part of the country; workers from another country. Workers will be employed under different terms and conditions and be accommodated in different ways. Assessing these different aspects of the workforce will help in identifying appropriate mitigation measures:

- The Contractor should prepare a detailed profile of the project work force, key work activities, schedule for carrying out such activities, different durations of contract and rotations (e.g. 4 weeks on, 4 weeks off).
- This should include a breakdown of workers who reside at home (i.e. workers from the community), workers who lodge within the local community and workers in on-site accommodation. Where possible, it should also identify workers that may be more at risk from COVID-19, those with underlying health issues or who may be otherwise at risk.
- Consideration should be given to ways in which to minimize movement in and out of site. This could include lengthening the term of existing contracts, to avoid workers returning home to affected areas, or returning to site from affected areas.
- Workers accommodated on site should be required to minimize contact with people near the site, and in certain cases be prohibited from leaving the site for the duration of their contract, so that contact with local communities is avoided.
- Consideration should be given to requiring workers lodging in the local community to move to site accommodation (subject to availability) where they would be subject to the same restrictions.
- Workers from local communities, who return home daily, weekly or monthly, will be more difficult to manage. They should be subject to health checks at entry to the site (as set out above) and at some point, circumstances may make it necessary to require them to either use accommodation on site or not to come to work.

(b) ENTRY/EXIT TO THE WORK SITE AND CHECKS ON COMMENCEMENT OF WORK

Entry/exit to the work site should be controlled and documented for both workers and other parties, including support staff and suppliers. Possible measures may include:

- Establishing a system for controlling entry/exit to the site, securing the boundaries of the site, and establishing designating entry/exit points (if they do not already exist). Entry/exit to the site should be documented.
- Training security staff on the (enhanced) system that has been put in place for securing the site and controlling entry and exit, the behaviors required of them in enforcing such system and any COVID - 19 specific considerations.
- Training staff who will be monitoring entry to the site, providing them with the resources they need to document entry of workers, conducting temperature checks and recording details of any worker that is denied entry.
- Confirming that workers are fit for work before they enter the site or start work. While procedures should already be in place for this, special attention should be paid to workers with underlying health issues or who may be otherwise at risk. Consideration should be given to demobilization of staff with underlying health issues.
- Checking and recording temperatures of workers and other people entering the site or requiring self-reporting prior to or on entering the site.
- Providing daily briefings to workers prior to commencing work, focusing on COVID-19 specific considerations including cough etiquette, hand hygiene and distancing measures, using demonstrations and participatory methods.
- During the daily briefings, reminding workers to self-monitor for possible symptoms (fever, cough) and to report to their supervisor or the COVID-19 focal point if they have symptoms or are feeling unwell.
- Preventing a worker from an affected area or who has been in contact with an infected person from returning to the site for 14 days or (if that is not possible) isolating such worker for 14 days.
- Preventing a sick worker from entering the site, referring them to local health facilities if necessary or requiring them to isolate at home for 14 days.

(c) GENERAL HYGIENE

Requirements on general hygiene should be communicated and monitored, to include:

- Training workers and staff on site on the signs and symptoms of COVID-19, how it is spread, how to protect themselves (including regular handwashing and social distancing) and what to do if they or other people have symptoms (for further information see WHO COVID-19 advice for the public).
- Placing posters and signs around the site, with images and text in local languages.
- Ensuring handwashing facilities supplied with soap, disposable paper towels and closed waste bins exist at key places throughout site, including at entrances/exits to work areas; where there is a toilet, canteen or food distribution, or provision of drinking water; in worker accommodation; at waste stations; at stores; and in common spaces. Where handwashing facilities do not exist or are not adequate, arrangements should be made to set them up. Alcohol based sanitizer (if available, 60-95% alcohol) can also be used.
- Review worker accommodations, and assess them in light of the requirements set out in IFC/EBRD guidance on Workers' Accommodation: processes and standards, which provides valuable guidance as to good practice for accommodation.
- Setting aside part of worker accommodation for precautionary self-quarantine as well as more formal isolation of staff who may be infected (see paragraph (f)).

(d) CLEANING AND WASTE DISPOSAL

Conduct regular and thorough cleaning of all site facilities, including offices, accommodation, canteens, common spaces. Review cleaning protocols for key construction equipment (particularly if it is being operated by different workers). This should include:

- Providing cleaning staff with adequate cleaning equipment, materials and disinfectant.
- Review general cleaning systems, training cleaning staff on appropriate cleaning procedures and appropriate frequency in high use or high-risk areas.
- Where it is anticipated that cleaners will be required to clean areas that have been or are suspected to have been contaminated with COVID-19, providing them with appropriate PPE: gowns or aprons, gloves, eye protection (masks, goggles or face screens) and boots or closed work shoes. If appropriate PPE is not available, cleaners should be provided with best available alternatives.
- Training cleaners in proper hygiene (including handwashing) prior to, during and after conducting cleaning activities; how to safely use PPE (where required); in waste control (including for used PPE and cleaning materials).
- Any medical waste produced during the care of ill workers should be collected safely in designated containers or bags and treated and disposed of following relevant requirements (e.g., national, WHO). If open burning and incineration of medical wastes is necessary, this should be for as limited a duration as possible. Waste should be reduced and segregated, so that only the smallest amount of waste is incinerated (for further information see WHO interim guidance on water, sanitation and waste management for COVID-19).

(e) ADJUSTING WORK PRACTICES

Consider changes to work processes and timings to reduce or minimize contact between workers, recognizing that this is likely to impact the project schedule. Such measures could include:

- Decreasing the size of work teams.
- Limiting the number of workers on site at any one time.
- Changing to a 24-hour work rotation.
- Adapting or redesigning work processes for specific work activities and tasks to enable social distancing, and training workers on these processes.
- Continuing with the usual safety trainings, adding COVID-19 specific considerations. Training should include proper use of normal PPE. While as of the date of this note, general advice is that construction workers do not require COVID-19 specific PPE, this should be kept under review (for further information see WHO interim guidance on rational use of personal protective equipment (PPE) for COVID-19).
- Reviewing work methods to reduce use of construction PPE, in case supplies become scarce or the PPE is needed for medical workers or cleaners. This could include, e.g. trying to reduce the need for dust masks by checking that water sprinkling systems are in good working order and are maintained or reducing the speed limit for haul trucks.
- Arranging (where possible) for work breaks to be taken in outdoor areas within the site.
- Consider changing canteen layouts and phasing meal times to allow for social distancing and phasing access to and/or temporarily restricting access to leisure facilities that may exist on site, including gyms.

- At some point, it may be necessary to review the overall project schedule, to assess the extent to which it needs to be adjusted (or work stopped completely) to reflect prudent work practices, potential exposure of both workers and the community and availability of supplies, taking into account Government advice and instructions.

(f) PROJECT MEDICAL SERVICES

Consider whether existing project medical services are adequate, taking into account existing infrastructure (size of clinic/medical post, number of beds, isolation facilities), medical staff, equipment and supplies, procedures and training. Where these are not adequate, consider upgrading services where possible, including:

- Expanding medical infrastructure and preparing areas where patients can be isolated. Guidance on setting up isolation facilities is set out in WHO interim guidance on considerations for quarantine of individuals in the context of containment for COVID-19). Isolation facilities should be located away from worker accommodation and ongoing work activities. Where possible, workers should be provided with a single well-ventilated room (open windows and door). Where this is not possible, isolation facilities should allow at least 1 meter between workers in the same room, separating workers with curtains, if possible. Sick workers should limit their movements, avoiding common areas and facilities and not be allowed visitors until they have been clear of symptoms for 14 days. If they need to use common areas and facilities (e.g. kitchens or canteens), they should only do so when unaffected workers are not present and the area/facilities should be cleaned prior to and after such use.
- Training medical staff, which should include current WHO advice on COVID-19 and recommendations on the specifics of COVID-19. Where COVID-19 infection is suspected, medical providers on site should follow WHO interim guidance on infection prevention and control during health care when novel coronavirus (nCoV) infection is suspected.
- Training medical staff in testing, if testing is available.
- Assessing the current stock of equipment, supplies and medicines on site, and obtaining additional stock, where required and possible. This could include medical PPE, such as gowns, aprons, medical masks, gloves, and eye protection. Refer to WHO guidance as to what is advised (for further information see WHO interim guidance on rational use of personal protective equipment (PPE) for COVID-19).
- If PPE items are unavailable due to world-wide shortages, medical staff on the project should agree on alternatives and try to procure them. Alternatives that may commonly be found on constructions sites include dust masks, construction gloves and eye goggles. While these items are not recommended, they should be used as a last resort if no medical PPE is available.
- Ventilators will not normally be available on work sites, and in any event, intubation should only be conducted by experienced medical staff. If a worker is extremely ill and unable to breathe properly on his or her own, they should be referred immediately to the local hospital (see (g) below).
- Review existing methods for dealing with medical waste, including systems for storage and disposal (for further information see WHO interim guidance on water, sanitation and waste management for COVID-19, and WHO guidance on safe management of wastes from health-care activities).

(g) LOCAL MEDICAL AND OTHER SERVICES

Given the limited scope of project medical services, the project may need to refer sick workers to local medical services. Preparation for this includes:

- Obtaining information as to the resources and capacity of local medical services (e.g. number of beds, availability of trained staff and essential supplies).
- Conducting preliminary discussions with specific medical facilities, to agree what should be done in the event of ill workers needing to be referred.
- Considering ways in which the project may be able to support local medical services in preparing for members of the community becoming ill, recognizing that the elderly or those with pre-existing medical conditions require additional support to access appropriate treatment if they become ill.
- Clarifying the way in which an ill worker will be transported to the medical facility, and checking availability of such transportation.
- Establishing an agreed protocol for communications with local emergency/medical services.
- Agreeing with the local medical services/specific medical facilities the scope of services to be provided, the procedure for in-take of patients and (where relevant) any costs or payments that may be involved.
- A procedure should also be prepared so that project management knows what to do in the unfortunate event that a worker ill with COVID-19 dies. While normal project procedures will continue to apply, COVID-19 may raise other issues because of the infectious nature of the disease. The project should liaise with the relevant local authorities to coordinate what should be done, including any reporting or other requirements under national law.

(h) INSTANCES OR SPREAD OF THE VIRUS

WHO provides detailed advice on what should be done to treat a person who becomes sick or displays symptoms that could be associated with the COVID-19 virus (for further information see WHO interim guidance on infection prevention and control during health care when novel coronavirus (nCoV) infection is suspected). The project should set out risk-based procedures to be followed, with differentiated approaches based on case severity (mild, moderate, severe, critical) and risk factors (such as age, hypertension, diabetes) (for further information see WHO interim guidance on operational considerations for case management of COVID-19 in health facility and community). These may include the following:

- If a worker has symptoms of COVID-19 (e.g. fever, dry cough, fatigue) the worker should be removed immediately from work activities and isolated on site.
- If testing is available on site, the worker should be tested on site. If a test is not available at site, the worker should be transported to the local health facilities to be tested (if testing is available).
- If the test is positive for COVID-19 or no testing is available, the worker should continue to be isolated. This will either be at the work site or at home. If at home, the worker should be transported to their home in transportation provided by the project.
- Extensive cleaning procedures with high-alcohol content disinfectant should be undertaken in the area where the worker was present, prior to any further work being undertaken in that area. Tools used by the worker should be cleaned using disinfectant and PPE disposed of.
- Co-workers (i.e. workers with whom the sick worker was in close contact) should be required to stop work, and be required to quarantine themselves for 14 days, even if they have no symptoms.

- Family and other close contacts of the worker should be required to quarantine themselves for 14 days, even if they have no symptoms.
- If a case of COVID-19 is confirmed in a worker on the site, visitors should be restricted from entering the site and worker groups should be isolated from each other as much as possible.
- If workers live at home and has a family member who has a confirmed or suspected case of COVID-19, the worker should quarantine themselves and not be allowed on the project site for 14 days, even if they have no symptoms.
- Workers should continue to be paid throughout periods of illness, isolation or quarantine, or if they are required to stop work, in accordance with national law.
- Medical care (whether on site or in a local hospital or clinic) required by a worker should be paid for by the employer.

(i) CONTINUITY OF SUPPLIES AND PROJECT ACTIVITIES

Where COVID-19 occurs, either in the project site or the community, access to the project site may be restricted, and movement of supplies may be affected.

- Identify back-up individuals, in case key people within the project management team (PIU, Supervising Engineer, Contractor, sub-contractors) become ill, and communicate who these are so that people are aware of the arrangements that have been put in place.
- Document procedures, so that people know what they are, and are not reliant on one person's knowledge.
- Understand the supply chain for necessary supplies of energy, water, food, medical supplies and cleaning equipment, consider how it could be impacted, and what alternatives are available. Early pro-active review of international, regional and national supply chains, especially for those supplies that are critical for the project, is important (e.g. fuel, food, medical, cleaning and other essential supplies). Planning for a 1-2 month interruption of critical goods may be appropriate for projects in more remote areas.
- Place orders for/procure critical supplies. If not available, consider alternatives (where feasible).
- Consider existing security arrangements, and whether these will be adequate in the event of interruption to normal project operations.
- Consider at what point it may become necessary for the project to significantly reduce activities or to stop work completely, and what should be done to prepare for this, and to re-start work when it becomes possible or feasible.

(j) TRAINING AND COMMUNICATION WITH WORKERS

Workers need to be provided with regular opportunities to understand their situation, and how they can best protect themselves, their families and the community. They should be made aware of the procedures that have been put in place by the project, and their own responsibilities in implementing them.

- It is important to be aware that in communities close to the site and amongst workers without access to project management, social media is likely to be a major source of information. This raises the importance of regular information and engagement with workers (e.g. through training, town halls, tool boxes) that emphasizes what management is doing to deal with the risks of COVID-19. Allaying fear is an important aspect of work force peace of mind and business continuity. Workers should be given an opportunity to ask questions, express their concerns, and make suggestions.

- Training of workers should be conducted regularly, as discussed in the sections above, providing workers with a clear understanding of how they are expected to behave and carry out their work duties.
- Training should address issues of discrimination or prejudice if a worker becomes ill and provide an understanding of the trajectory of the virus, where workers return to work.
- Training should cover all issues that would normally be required on the work site, including use of safety procedures, use of construction PPE, occupational health and safety issues, and code of conduct, taking into account that work practices may have been adjusted.
- Communications should be clear, based on fact and designed to be easily understood by workers, for example by displaying posters on handwashing and social distancing, and what to do if a worker displays symptoms.

(k) COMMUNICATION AND CONTACT WITH THE COMMUNITY

Relations with the community should be carefully managed, with a focus on measures that are being implemented to safeguard both workers and the community. The community may be concerned about the presence of non-local workers, or the risks posed to the community by local workers presence on the project site. The project should set out risk-based procedures to be followed , which may reflect WHO guidance (for further information see WHO Risk Communication and Community Engagement (RCCE) Action Plan Guidance COVID-19 Preparedness and Response). The following good practice should be considered:

- Communications should be clear, regular, based on fact and designed to be easily understood by community members.
- Communications should utilize available means. In most cases, face-to-face meetings with the community or community representatives will not be possible. Other forms of communication should be used; posters, pamphlets, radio, text message, electronic meetings. The means used should take into account the ability of different members of the community to access them, to make sure that communication reaches these groups.
- The community should be made aware of procedures put in place at site to address issues related to COVID-19. This should include all measures being implemented to limit or prohibit contact between workers and the community. These need to be communicated clearly, as some measures will have financial implications for the community (e.g. if workers are paying for lodging or using local facilities). The community should be made aware of the procedure for entry/exit to the site, the training being given to workers and the procedure that will be followed by the project if a worker becomes sick.
- If project representatives, contractors or workers are interacting with the community, they should practice social distancing and follow other COVID-19 guidance issued by relevant authorities, both national and international (e.g. WHO).

6. EMERGENCY POWERS AND LEGISLATION

Many Borrowers are enacting emergency legislation. The scope of such legislation, and the way it interacts with other legal requirements, will vary from country to country. Such legislation can cover a range of issues, for example:

- Declaring a public health emergency

- Authorizing the use of police or military in certain activities (e.g. enforcing curfews or restrictions on movement)
- Ordering certain categories of employees to work longer hours, not to take holiday or not to leave their job (e.g. health workers)
- Ordering non-essential workers to stay at home, for reduced pay or compulsory holiday

Except in exceptional circumstances (after referral to the World Bank's Operations Environmental and Social Review Committee (OESRC)), projects will need to follow emergency legislation to the extent that these are mandatory or advisable. It is important that the Borrower understands how mandatory requirements of the legislation will impact the project. Teams should require Borrowers (and in turn, Borrowers should request Contractors) to consider how the emergency legislation will impact the obligations of the Borrower set out in the legal agreement and the obligations set out in the construction contracts. Where the legislation requires a material departure from existing contractual obligations, this should be documented, setting out the relevant provisions.