Medical Laboratory

NTQF **Level III**

Learning Guide 29

Unit of Competence: Collect and Process Medical Samples

Module Title: Collect and Process Medical Samples

LG Code: HLT MLT3 LO8-LG29

TTLM Code: HLT MLT3 TTLM 0919v1

Learning Instructions:

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described in number 5 to 11.
3. Read the information written in all Information Sheets. Try to understand what are being discussed. Ask you teacher for assistance if you have hard time understanding them.
4. Accomplish all Self-check according to learning session separately
5. Ask from your teacher the key to correction (key answers) or you can request your teacher to correct your work. (You are to get the key answer only after you finished answering the Self-checks).
6. If you earned a satisfactory evaluation proceed to next Information Sheet. However, if your rating is unsatisfactory, see your teacher for further instructions or go back to pervious Learning Activity.
7. Submit your accomplished Self-check. This will form part of your training portfolio.
8. Try to understand what are being discussed. Ask you teacher for assistance if you have hard time understanding them.
9. Accomplish the all Self-checks.
10. After you accomplish self check proceed to operation sheet if available.
11. If you perform operation procedure correctly proceeds to LAP. test if available

LO8. **Maintain safe work environment**

Learning out comes (objectives): At the end of this module the trainee will be able to:-

- Established work practices and PPE are used to ensure personal safety and that of others.
- Understand Environmental impacts of sampling and generation of waste are minimized.
- Cleaning all equipment, containers, work area and vehicles according to enterprise procedures.
- Avoiding hazards due to laboratory equipment before storage.
- Ensured the safe collection of all hazardous for waste disposal
- Cleaning up Splashes and spillages immediately using appropriate techniques and precautions.
- Segregate all laboratory wastes in accordance with safety policy and waste disposal
- Dispose all waste in accordance with enterprise procedures
- Use appropriate protective equipment to ensure personal safety when sampling, processing, transferring or disposing of samples.
- Report all accidents and spillages to supervisor.

Information sheet-1	Establishing safe work practices and using PPE

8.1. Establishing safe work practices and using PPE

8.1.1. safe working practices

- Personal hygiene measures and wearing of safe footwear.
- Regulations concerning the wearing, storing, decontamination and laundering of protective clothing.
- Preventing laboratory acquired infection including regulations to avoid the accidental:
  - ✓ Ingestion of pathogens,
  - ✓ Inhaling of pathogens,
  - ✓ Inoculation of pathogens.
- What to do when there is a spillage of a specimen or liquid culture.
- Safety rules concerning the handling and storage of chemicals and reagents that are flammable, oxidizing, toxic, harmful, irritant, and corrosive, and how to manage chemical spillages.
- What to do when there is a glass breakage.
- How to pipette and dispense safely.
- Safe operation of manual, electrical, and battery operated laboratory equipment.
- Working tidily, use of racks, and rules to prevent the floor and benches from becoming cluttered and exits obstructed.
- Use of protective gloves, goggles, face shield, dust mask, eyewash bottle.
- How to control noise levels and other causes of loss of concentration.

8.1.2. Personal Protective Equipment

Students, teachers and laboratory staff, when working in the laboratory, should wear suitable personal protective equipment (PPE) in all circumstances wherever there is any potential risk of bodily injury. All PPE should be kept clean and properly maintained in a serviceable condition. Defective PPE should be replaced immediately. The Guidance Notes on Personal Protective Equipment (PPE) for Use and Handling of Chemicals (http://www.labour.gov.hk/eng/public/os/C/equipment.pdf) issued by the Labour Department provides a practical guide for selection of suitable PPE for use and handling of chemicals in the science laboratory.

Each laboratory should be equipped with enough safety spectacles

1. Safety eye Goggles
2. Face Shield
3. Protective/Disposable gloves
4. Disposable Nitrile gloves
5. Gown
6. Apron
7. Boat

Information sheet-2	Minimizing Environmental impacts of sampling and waste generation

8.2. Minimizing Environmental impacts of sampling and waste generation

8.2.1. Ways to Minimize Waste from a Laboratory

Just as the world doesn't have an infinite capacity to deal with hazardous wastes, neither does the university have an infinite budget to pay for them. It is critical that a laboratory does everything it can to reduce the amount of hazardous waste it produces. The following steps will help reduce our generation of hazardous waste. Consider them all when planning or revising your work.

- Micro scale experiments whenever possible.
- Purchase the smallest quantity of chemicals needed (unused chemicals turn into hazardous waste, which is nearly always more expensive that any money saved by buying the "larger size".
- If you need a small amount of chemical or just need some to try out an experiment.
- Substitute less hazardous chemicals for hazardous items
- Minimize the use of heavy metals as they are particularly expensive to dispose of (a good start is to substitute "No-chromix" for chromic acid.)
- Use older items in your inventory before newer items.
- Check your inventory frequently to maintain your materials in good condition. Ethyl ether that has expired is MUCH more expensive to get rid of that ethyl ether that has NOT reached its expiration date.
- Eliminate mercury-containing devices, such as thermometers and manometers, replacing them with non-mercury alternatives.

Hazardous

We try to do our work in the most environmentally sound fashion possible. As a result, we have a number of programs in place to handle materials that are particularly damaging to the environment or that occupy lots of landfill space. Please look at the "recycling" page of the EH&S website and also the Green Practices Committee's website **www.cmu.edu/environment/get-involved/committee/**

When you look at the things your lab produces as waste, consider these four activities in this order:

Reduce Can you reduce the amount of waste produced?

Reuse Can you reuse any of the waste produced (perhaps as a cleaning rinse?)

Recycle Can any of the materials be recycled rather than being landfilled?
Recover Can any of the components of the materials be recovered and used again?

Information sheet-3	Cleaning all equipments, containers, work area and vehicles

8.3. Cleaning all equipments, containers, work area and vehicles

Local environmental decontamination

Decontamination of the laboratory space, its furniture and its equipment requires a combination of liquid and gaseous disinfectants. Surfaces can be decontaminated using a solution of sodium hypochlorite (NaOCl); a solution containing 1 g/l available chlorine may be suitable for general environmental sanitation, but stronger solutions (5 g/l) are recommended when dealing with high-risk situations. For environmental decontamination, formulated solutions containing 3% hydrogen peroxide (H2O2) make suitable substitutes for bleach solutions.

Rooms and equipment can be decontaminated by fumigation with formaldehyde gas generated by heating paraformaldehyde or boiling formalin. This is a highly dangerous process that requires specially trained personnel. All openings in the room (i.e. windows, doors, etc.) should be sealed with masking tape or similar before the gas is generated. Fumigation should be conducted at an ambient temperature of at least 21C^{o} and a relative humidity of 70%. (See also section on Decontamination of biological safety cabinets in this chapter.) After fumigation the area must be ventilated thoroughly before personnel are allowed to enter. Appropriate respirators must be worn by anyone entering the room before it has been ventilated. Gaseous ammonium bicarbonate can be used to neutralize the formaldehyde.

Fumigation of smaller spaces with hydrogen peroxide vapor is also effective but requires specialized equipment to generate the vapor.

Information sheet-4	Avoiding Hazards due to laboratory equipment

8.4. Avoiding Hazards due to laboratory equipment

- Introduction

Definitions of terms Safety: is a prevention and protection of workers and working chemical, physical, ergonomically and psychological hazards known to cause accident and injuries at work. Containment:-control area of safety.

Safe work environment

Laboratory working area can be defined as accomplish laboratory tasks (specimen collection areas, testing areas & storage areas) without contamination.

In general, working areas in clinical laboratory requirements related to the working area.

Information sheet-5	Safe collection of all hazardous wastes

8.5. Safe collection of all hazardous wastes

8.5.1. Waste Management

Laboratory waste management is a critical issue. All potentially harmful and dangerous materials (including liquids and radioactive materials) must be treated in a specific way before disposing. Separate waste containers should be used depending on the nature of the waste, and must be clearly identified by a color code. Specific attention should be given to the management of potentially harmful contaminated waste such as sharps, needles, or broken glassware. Sharps containers must be available on the work benches so they are conveniently accessible to staff. Many labels that give warnings and instructions for safety precautions are internationally recognized and can be found at the following websites:
http://www.ehs.cornell.edu/lrs/lab_dot_labels/lab_dot_labels.cfm
http://ehs.unc.edu/labels/bio.shtml http://www.safetylabel.com/safetylabelstandards/iso-ansi-symbols.php
All materials exposed to blood and body fluids are to be discarded into the Biohazard containers on the bench tops, which will then be closed with a twist tie and disposed properly. The safety officer will inspect the day-to- day cleaning of the laboratory, countertops, glassware, and equipments.
Waste handling Waste is anything that is to be discarded. In laboratories, decontamination of wastes and their ultimate disposal are closely interrelated. In terms of daily use, few if any contaminated materials will require actual removal from the laboratory or destruction. Most glassware, instruments and laboratory clothing will be reused or recycled. The overriding principle is that all infectious materials should be decontaminated, autoclaved or incinerated within the laboratory. The principal questions to be asked before discharge of any objects or materials from laboratories that deal with potentially infectious microorganisms or animal tissues are:

- ✓ Have the objects or materials been effectively decontaminated or disinfected by an approved procedure?
- ✓ If not, have they been packaged in an approved manner for immediate on-site incineration or transfer to another facility with incineration capacity?
- ✓ Does the disposal of the decontaminated objects or materials involve any additional potential hazards, biological or otherwise, to those who carry out the immediate disposal procedures or who might come into contact with discarded items outside the facility?

Decontamination Steam autoclaving is the preferred method for all decontamination processes. Materials for decontamination and disposal should be placed in containers, e.g. autoclavable plastic bags, that are colour-coded according to whether the contents are to be autoclaved and/or incinerated. Alternative methods may be envisaged only if they remove and/or kill microorganisms.

Handling and disposal procedures for contaminated materials and wastes An identification and separation system for infectious materials and their containers should be adopted. National and international regulations must be followed. Categories should include:

- Non-contaminated (non-infectious) waste that can be reused or recycled or disposed of as general, “household” waste
- Contaminated (infectious) “sharps” – hypodermic needles, scalpels, knives and broken glass; these should always be collected in puncture-proof containers fitted with covers and treated as infectious
- Contaminated material for decontamination by autoclaving and thereafter washing and reuse or recycling
- Contaminated material for autoclaving and disposal
- Contaminated material for direct incineration.

- Sharps

After use, hypodermic needles should not be recapped, clipped or removed from disposable syringes. The complete assembly should be placed in a sharps disposal container. Disposable syringes, used alone or with needles, should be placed in sharps disposal containers and incinerated, with prior autoclaving if required. Sharps disposal containers must be puncture-proof/-resistant and must not be filled to capacity. When they are three-quarters full they should be placed in “infectious waste” containers and incinerated, with prior autoclaving if laboratory practice requires it. Sharps disposal containers must not be discarded in landfills.

- Contaminated (potentially infectious) materials for autoclaving and reuse

No precleaning should be attempted of any contaminated (potentially infectious) materials to be autoclaved and reused. Any necessary cleaning or repair must be done only after autoclaving or disinfection.

- Contaminated (potentially infectious) materials for disposal

Apart from sharps, which are dealt with above, all contaminated (potentially infectious) materials should be autoclaved in leak proof containers, e.g. autoclavable, colour-coded plastic bags, before disposal. After autoclaving, the material may be placed in transfer containers for transport to the incinerator.

If possible, materials deriving from healthcare activities should not be discarded in landfills even after decontamination. If an incinerator is available on the laboratory site, autoclaving may be omitted: the contaminated waste should be placed in designated containers (e.g. colour-coded bags) and transported directly to the incinerator. Reusable transfer containers should be leak proof

and have tight-fitting covers. They should be disinfected and cleaned before they are returned to the laboratory for further use.

Discard containers, pans or jars, preferably unbreakable (e.g. plastic), should be placed at every work station. When disinfectants are used, waste materials should remain in intimate contact with the disinfectant (i.e. not protected by air bubbles) for the appropriate time, according to the disinfectant used. The discard containers should be decontaminated and washed before reuse.

Incineration of contaminated waste must meet with the approval of the public health and air pollution authorities, as well as that of the laboratory biosafety officer.

Information sheet-6	Cleaning splashes and spillages immediately by using appropriate techniques

8.6. Cleaning splashes and spillages immediately by using appropriate techniques

When surfaces are contaminated by biological spills, the appropriate actions to take are:

- Define/isolate the contaminated area.
- Alert coworkers.
- Put on appropriate PPE.
- Remove glass/lumps with forceps or scoop.
- Apply absorbent towel(s) to the spill; remove bulk and reapply if needed.
- Apply disinfectant to towel surface.
- Allow adequate contact time (20 minutes).
- Remove towel, mop up, and clean the surface with alcohol or soap and water.
- Properly dispose of materials.
- Notify the supervisor, safety officer, and other appropriate authorities.

Disinfectant:-

For most spills, use a 1:50 solution (1 g/l chlorine) of household bleach (sodium hypochlorite solution containing 50 g/l chlorine).

For spills containing large amounts of organic material, use a 1:10 solution (5 g/l chlorine) of household bleach, or an approved mycobactericidal.

- ✓ Suggested sources of mycobactericidals are registered with the United States of America Environmental Protection Agency (http://www.epa.gov/oppad001/chemregindex. htm). Alcohols are not recommended as surface decontaminating agents because they evaporate quickly, thus decreasing contact time.

If laboratory personnel become contaminated with biological hazards due to splashes or spills, immediate steps to take include:

- ✓ Clean exposed skin or body surface with soap and water, eyewash (for eye exposures) or saline (for mouth exposures).
- ✓ Apply first aid and treat as an emergency.
- ✓ Notify supervisor, safety officer, or security desk (after hours).
- ✓ Follow appropriate reporting procedures.
- ✓ Report to physician for treatment or counseling.

Information sheet-7	Segregating all laboratory wastes in accordance with safety policy

8.7. Segregating all laboratory wastes in accordance with safety policy

As a waste generator, you must assure that wastes are collected in a manner that segregates chemicals that could potentially react when mixed. In general, you should have separate containers for each compatible waste stream. Collect acids with acids, bases with bases, etc.

Once a hazardous waste is generated, federal and state regulations stipulate that the hazardous waste be managed according to statutory requirements. This includes putting the waste in appropriate containers, labeling the containers with a completed hazardous waste label, and properly storing the hazardous waste containers in designated areas. While you are accumulating waste from your process, the waste container must be maintained in a Satellite Accumulation Area (SAA) or Waste Accumulation Area (WAA**)**. Determining if you need to store your hazardous waste in a SAA or a WAA depends on the type, quantity and generation rate for your hazardous waste.

Information sheet-8	Dispose all waste in accordance with enterprise procedures

8.8. Dispose all waste in accordance with enterprise procedures

Waste Management

Laboratory waste management is a critical issue. All potentially harmful and dangerous materials (including liquids and radioactive materials) must be treated in a specific way before disposing. Separate waste containers should be used depending on the nature of the waste, and must be clearly identified by a color code. Specific attention should be given to the management of potentially harmful contaminated waste such as sharps, needles, or broken glassware. Sharps containers must be available on the work benches so they are conveniently accessible to staff. Many labels that give warnings and instructions for safety precautions are internationally recognized and can be found at the following websites:

- Needles and sharps

Needles, broken glass, and other sharps need to be handled and disposed of appropriately to prevent risks of infection to laboratory and housekeeping (custodial) staff. For proper disposal of sharps the following instructions should be followed.

- ✓ Needle recapping is not advisable or necessary. If recapping is crucial, the correct procedure is for the person doing the recapping to keep one hand behind the back, and using the other hand to scoop the cover onto the needle.
- ✓ Put sharps in a puncture-resistant, leak-proof, sharps container. Label the container with the word, "SHARPS". If the sharps are not biohazardous, deface any BIOHAZARD markings or symbols, and then seal the container tightly.

Laboratory glass and plastic ware are not considered to be sharps for disposal purposes. Laboratory glass (including plastic ware) is any item that could puncture regular waste bags and therefore endanger waste handlers. Laboratory glass must be placed in sturdy cardboard boxes for safety during transport through the building. Any cardboard box may be used, provided it is sturdy and of a size that will not weigh more than 40 pounds when full.

Contaminated laboratory glass must be appropriately decontaminated prior to disposal.

Never use boxes for the disposal of:

- ✓ Sharps;
- ✓ Biohazardous materials that have not been autoclaved;
- ✓ Liquid wastes;
- ✓ Chemically contaminated laboratory glassware / plastic ware;

- ✓ Chemical containers that cannot be disposed of as regular solid waste.

- Chemical hazards

Exposure to toxic chemicals poses a real threat to the health and safety of laboratory staff. To prevent or reduce incidents caused by exposure to toxic chemicals, all chemicals, including solutions and chemicals transferred from their original containers, should be labeled with their common names, concentrations, and hazards. Additional information such as the date received, date opened, and date of expiration should also be recorded.

It is crucial that chemicals be stored properly. Store corrosive, toxic, and highly reactive chemicals in a well-ventilated area, and store chemicals that can ignite at room temperature in a flammables cabinet.

Radiochemical require special precautions, and need dedicated benches with specific bench covers for manipulation of radiolabeled elements. Specific storage areas for radioactive materials are needed. These must provide appropriate protection (plexiglass, lead) and specific waste containers, depending on the chemical nature of waste and radio elements.

Information sheet-9	Use appropriate protective equipment to ensure personal safety when sampling, processing, transferring or disposing of samples.

8.9. Use appropriate protective equipment to ensure personal safety when sampling, processing, transferring or disposing of samples.

Basic information

The major routes in which laboratory staff acquire work-related infections are:

- ✓ Inhalation of aerosols generated by accident or by work practices;
- ✓ Percutaneous inoculation;
- ✓ Contact between mucous membranes and contaminated material;
- ✓ Accidental ingestion.

To reduce the risk of these occurrences, it is imperative that staff have access to personal protective equipment (PPE), be trained in how to properly use it, and habitually use the PPE while working in the laboratory. Approved goggles, face shields, splatter guards, masks, or other eye and face protection should be worn when handling infectious or other hazardous materials outside the biosafety cabinet.

- Hand protection

Gloves should be worn in all instances, and be available to laboratory staff on a routine basis. Effective use of gloves, however, relies on two simple practices.

- ✓ Remove gloves when leaving the working area to prevent contamination of other areas such as the telephone, door handles, and pens.
- ✓ Never re-use gloves. Do not attempt to wash or decontaminate gloves — they will develop microcracks, become more porous, and lose their protective properties. After use, gloves must be disposed of in the contaminated waste.

- Face protection

Goggles—the projection of droplets is a frequent occurrence when opening patient sample containers. Protection of eyes and other mucous membranes is strongly recommended to prevent contact with these droplets; the use of goggles will protect eyes and should be systematic for this step.

Another way to protect eyes and other mucous membranes from projection is to manipulate the specimen tubes behind a screen, glass or plexiglass, or face shield. This equipment should be

compulsory as well, when manipulating dangerous liquids, such as liquid nitrogen or some solvents.
Contact lenses do not offer protection from splashes. Additional eye protection must be worn with contact lenses.
Masks—Masks serve as a barrier when splashes or sprays occur.

- Body protection

Laboratory coats are compulsory in all instances in the regular level 2 laboratory. Be aware of the composition of fabrics, as some might be highly flammable.
A disposable laboratory coat is compulsory in level 3 laboratories or in specific instances such as sample collection when highly dangerous pathogens can be involved, such as suspected cases of H5N1 avian influenza or severe acute respiratory syndrome (SARS).

Information sheet-10	Report all accidents and spillages to supervisor

8.10. Report all accidents and spillages to supervisor.

If laboratory personnel become contaminated with biological hazards due to splashes or spills, immediate steps to take include:

- clean exposed skin or body surface with soap/water, eyewash (for eye exposures), or saline (for mouth exposures);
- apply first aid and treat as an emergency;
- notify supervisor, safety officer, or security desk (after hours);
- follow appropriate reporting procedures;
- report to physician for treatment/counseling

Reporting Injuries

The following guidelines should be used for employee injuries:

- Employee Actions
- ✓ Report the injury/illness to supervisor and the Employee Injury Management Office by calling.
- ✓ Obtain an Employee Injury Statement Form from your supervisor.
- ✓ Complete the form and have your supervisor sign and date it.
- ✓ If first aid medical care is needed, take completed form with you to the Employee Health Clinic or after hours to the Emergency Room. (Note: Employee has the right to be followed up by physician of their choice.)
- ✓ Ask medical care provider to complete bottom portion of form regarding work capabilities.
- ✓ Return completed form to supervisor.
- Supervisor and/ or Chief Tech
- ✓ Assist the employee in obtaining medical care if needed
- ✓ Have employee complete Employee Injury Statement Form
- ✓ Review form for completeness.
- ✓ Sign and date form, which indicates when the employee reported the injury and what occurred.
- ✓ Inform employee to call Employee Injury Management Office.
- ✓ Submit completed form to the Employee Injury Management Office.
- Lab Safety Committee
- ✓ The Laboratory Safety Committee will compile annual injury data to assess effectiveness of safety procedures and devices, and identification of opportunities for improvement

Self-Check 1	Written Test

Answer the Following Questions (2 point each)

1. Which of the following is cause of laboratory acquired accidental infection?
   A. Ingestion of pathogens,
   B. Inhaling of pathogens,
   C. Inoculation of pathogens.
   D. All

2. Which of the following steps will help reduce our generation of hazardous waste
   A. If you need a small amount of chemical or just need some to try out an experiment.
   B. Substitute less hazardous chemicals for hazardous items
   C. Use older items in your inventory before newer items.
   D. All

3. Surfaces can be decontaminated using a solution of:-
   A. Sodium hypochlorite
   B. 70% Alcohol
   C. Giemsa solution
   D. All

4. Which of the following waste should be disposed in puncture-proof containers/safety box?
   A. Sharps hypodermic needles
   B. Scalpels
   C. Knives
   D. Broken glass

5. List at least 5 Laboratory personal protective equipment

Note: **Satisfactory rating - 10 points Unsatisfactory - below 10 points**

You can ask you teacher for the copy of the correct answers

Answer Sheet

Score _____
Rating _____

Name: _____ Date: _____

Short Answer Question

1._____

2._____

3._____

4._____

5._____

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