



Center for Advanced Studies in Water

Standard Operating Procedures (SOPs)

for

Advanced Water and Wastewater Quality Control & Pilot Scale Water and Wastewater Treatment Labs

**Mehran University of Engineering & Technology
Jamshoro**

SOP Control Information

SOP No.	03
SOP for:	Advanced Water and Wastewater Quality Control & Pilot Scale Water and Wastewater Treatment Labs
Drafted By:	Dr. Tanveer Ahmed (USPCAS-W)
Reviewed By:	Project Management Unit (PMU)
Approved By:	BoG (USPCAS-W)
Date of Approval:	28 th January, 2019

Responsible Owner:

Deputy Director USPCAS-W, MUET Jamshoro

Review Schedule:

To be reviewed and updated on yearly basis

Document History

Version Number	Edited by	Approved by	Effective Date
1	PMU	BoG	1 st March, 2019

Communication Plan

This SOP will be communicated in hard and soft format to all concerned.

1. Scope

This Standard Operating Procedures (SOPs) applies to the Advanced Water and Wastewater Quality Control & Pilot Scale Water and Wastewater Treatment Labs at USPCAS-W, MUET, Jamshoro and it is meant to cover the general guidelines and standard protocol for all the activities associated to this lab.

2. Purpose

This document describes water, wastewater and prototype scale labs policies, protocols and procedures to be followed during these labs usage. The general instructions are briefed for standard procedures and protocols needed to work in the labs related to Labelling, Storage, Transportation and Management of Chemicals and Biological Cultures/Microorganisms, use of Compressed Gas Cylinders, Instruments/Equipments, Fume Hood, Glassware and Plastic Consumables and Personal Protective Equipments, Waste Handling and Disposal of Chemicals and Biological Cultures/Microorganisms, Cleaning of Instruments/Equipment and Glassware/consumables. The framed SOP defines the integrated roles and responsibilities of Students, Technicians, Researchers, Lab Attendants, Faculty Members, Lab Incharge and Assistants and the regulatory role of the concerned HoD and Center's Management.

3. General Instruction and Policies

The following guidelines apply to all students and staff who work in the water quality control laboratory Advance Water & Wastewater Pilot Scale Labs at U.S-Pakistan Centre for Advanced Studies in Water USPCAS-W, MUET, Jamshoro.

- Only those students are allowed in a laboratory that has an excess of RFID/Electronic card.
- Before performing any work on instrument, student first register then book the online time slot of any equipment from the available online equipment list on this address <http://lab.water.mueta.edu.pk/> , before one week ago. The instrument in-charge approves the request before starting your work on any equipment/instrument/machine gets the training from the in-charge that approves the request then start research work in the lab. Before starting the analysis, students must read the simple operating procedures (SOP's) of each instrument.
- Check the gas cylinders pressure properly before operating the equipment.
- Check the UPS and electricity connection before performing job on equipment.
- Before doing any work on the instrument, the student must sign in the log book (In/out), placed near the equipment.

- For renting out any field/ portable equipment (outsider or working in the project) kindly fill the online request form and information to the lab In-charge/lab technician before one week ago for the water/air quality analysis parameters.
- For water quality control analysis or physical, chemical and biological parameters (outsider/working in project/faculty/staff, student), first fill the request form available on the USPCAS-W website with attached rate list of every parameter.
- For faculty that includes any lab practical's in their course activity or arrange any practical or demo on working mechanism of instrument kindly fill the online form and mention the day/time that is available on the website before two weeks ago. HOD of Lab/discipline approves the request.
- Student working in the laboratory after 5.00 pm or on holidays (off) days, must submit the request application with the approval of their supervisor then forwarded to a lab technician before working.
- Those students enrolled in any project they have to pay the rent of field equipment, and instrumental analysis charges (equipment list is available on the USPCAS-W website).
- All chemicals should be stored in chemical inventory by alphabetical order and should be placed in general water quality control lab.
- Read carefully the available **Material Safety Data Sheet (MSDS)** before using any chemicals. MSDS is a document that contains information on potential hazards (health, fire, reactivity and environmental) and how to work safely with the chemical product. Read the material safety data sheet (MSDS) from the website according to the mentioned product name available on every chemical bottle before doing any practical work.
- Personal protective equipment (PPE), i.e. Gloves, Safety Goggles should be selected basis on the potential hazard presented of any particular lab work. Scrutinize each laboratory procedure individually for potential hazards based on the chemicals to be used and the PPEs to be used.
- Before storage of samples in the refrigerators, students have a responsibility to make a list of samples and placed a record in the lab log book.
- Wash your hands with disinfectant soap when you arrive at the lab and again before you leave.
- The laboratory technician will issue the lab coat for every student. Kindly tags the names of every Lab coats that are available in the wardrobe for every student. Every lab user has a responsibility to keep clean their lab coats. After finishing the lab work, the issued lab coat to be returned to the laboratory.
- Follow the lab Safety protocols during working in the lab. Must wear Personal Protective Equipment (PPE) before starting any experiment in the laboratory and also know about the PPEs:
 - Goggles for eyes

- Lab coat to protect your skin and clothes (must be kept fastened)
- Gloves to protect hands (chemical/heat)
- Tie hair back
- Roll up long sleeves & remove dangling jewelry
- No open-toed shoes/sandals
- Face shield
- Shared spaces facilities and storage units such as stock rooms, walk-in refrigerators, constant temperature rooms, shared refrigerators, freezers, chemical storage cabinets, common/shared or personal glassware, etc. should be managed properly.
- Prepare a clean work environment after each experiment.
- Label all the items involved in lab usage. Chemical labeling guidelines are given in **(Annex-3.1 page 34)**.
- Use Fuming hood while working with volatile, flammable and other fuming chemicals. For detailed guidelines refer the **(Annex-3.2 page 35)**.
- Wash/dry all glassware thoroughly after each experiment.
- All chemical spills must be immediately reported to available lab representative. He/She will respond to evaluate the release and determine the best course-of-action for the containment and cleanup of the spill.
- The compressed gas cylinder should be handled, transported and stored properly. Check and ensure the pressure, leakage and safe storage of the compressed gas cylinders. In case of any safety concern, immediately report to lab Incharge/Technician/Staff for assistance, for detailed guidelines refer the **(Annex-3.3 page 36)**.
- Dispose of broken glassware in broken yellow color bins. Report broken or damaged glassware immediately and Do Not Use It, for detailed guidelines refer the **(Annex-3.4 page 37)**.
- Never pour water upon the acid, always pour acid upon water slowly while diluting any acid. Never store acids in plastic bottles; always use glass bottles for acids.
- Never eat and drink or smoke during working in the laboratory.
- Never smell any chemicals.
- Never pipette out any chemicals by mouth.
- Never return chemical to the reagent bottles (try to bring accurate amount which you needed to avoid contamination).
- Any tools checked out should be returned immediately at the completion of their required task.
- Never leave the lab alone when you are working operating any equipment in the laboratory.

- Broken glass bins are located within certain labs. The contents of these bins are placed into the domestic waste stream, so should not contain any hazardous material.
- The contaminated waste bin contains solid material-glass plastic and paper, which is contaminated with hazardous material.
- Domestic glasses are prohibited in the laboratory such as coffee jars, glass drink bottles, etc.
- Electronic waste, an item with circuitry or electrical components with power or battery supply that has been assessed as waste segregation separating incompatible hazardous chemicals or materials which go into different waste streams. Collecting compatible materials (where practical) can improve the potential for reuse or recycling.
- Label the waste residue container with the appropriate waste label.
- Store waste in a suitable area while awaiting collection like chemicals and solvents should be stored in a ventilated area, and residue container lids must be secure. Ensure the container is not leaking and there is no spillage on the exterior of the container.
- Handle waste only if you are aware of the hazards associated with the waste. Appropriate personal protective equipment should be used.
- Remove cap and dispose of in the normal domestic waste if the glassware contained acid rinse with a water-solvent vent in fume hood before disposal.
- Store acids inside the space available in a storage cabinet, not in a fume hood working area.
- Never open the door with gloves wear hands.
- First Aid Box is available in general and pilot scale laboratory. The lab technicians are responsible for the check and maintenance of First Aid Box.
- Fire extinguishers are mounted on the walls of the potential hazard area, and in case of any incident use fire extinguishers properly or immediately contact on emergency number **16** for assistance.
- Sterilize all glassware before and after completing experiments.
- Wear lab coat and safety goggles. Leave protective clothing in the lab and do not wear it to other non-lab areas.
- Avoid loose-fitting items of clothing. Wear appropriate shoes (sandals are not allowed) in the laboratory.
- Biological waste biological materials glassware's that stored in laboratory refrigerators must dispose of appropriately.
- Keep your workspace free of all unnecessary materials like Backpacks, purses, and coats.
- Replace caps on reagents, solution bottles, and bacterial cultures. Do not open Petri dishes in the lab unless necessary.

- Inoculating loops and needles should be flame sterilized in a Bunsen burner before you lay them down.
- Turn off Bunsen burners when not in use. Long hair must be restrained if Bunsen burners are in use.
- Treat all microorganisms as potential pathogens. Use appropriate care and do not take cultures out of the laboratory.
- Do not pour media or anything down the sink. Before discarding media first autoclave the media in biohazard bag then discard.
- Dispose of all solid waste material in a biohazard bag and autoclave it before discarding in the regular trash.
- Familiarize yourself with the location of safety equipment in the lab (e.g., eye-wash station, shower, sinks, fire extinguisher, biological safety cabinet, first aid box, emergency gas valve).
- Dispose of razor blades, syringe needles, and sharp metal objects in the “sharps” container.
- Before and after use, wipe the surface of the BSC with a suitable disinfectant, e.g., 70% alcohol or a 10% bleach solution
- A biological safety cabinet (BSC) is used as a primary barrier against exposure to infectious biological agents. A BSC has High-Efficiency Particulate Air (HEPA) filters. The airflow in a BSC is laminar, i.e., the air moves with uniform velocity in one direction along parallel flow lines. Depending on the design, a BSC may be vented to the outside, or the air may be exhausted into the room. BSCs are not chemical fume hoods. A percentage of the air is recirculated in most types of BSCs. HEPA filters only trap particulates, allowing any contaminant in non-particulate form to pass through the filter.
- Operate the cabinet for five minutes before and after performing any work in it to purge airborne contaminants.
- Place everything you will need inside the cabinet before beginning work, including a waste container. You should not have to penetrate the air barrier of the cabinet once work has begun.
- Do not place anything on the air intake grills, as this will block the air supply.
- You should prevent unnecessary opening and closing of door because this will disrupt the airflow of the cabinet.
- Always wear a lab coat while using the cabinet and conduct your work at least four inches inside the cabinet.
- Place burners to the rear of the cabinet to reduce air turbulence.
- Do not work in the BSC while the ultraviolet light is on. Ultraviolet light can quickly injure the eye.
- Remove the equipment from the cabinet and decontaminate the work surface.
- Thoroughly wash your hands and arms.

- The proper procedures for cleaning small spills of microorganisms is soaked a paper towel(s) in an appropriate disinfectant (70% ethanol or fresh 10% bleach solution) and place around the spill area.
- After finishing the workplace the paper towels, and gloves into a biohazard bag, and autoclave these materials to sterilize them.
- Dispose of any contaminated clothing properly.
- Burners, induction heaters, ovens, furnaces, and other heat-producing equipment must be located a safe distance from areas where temperature-sensitive and flammable materials and compressed gases are handled.
- Drying ovens should only be used for their intended purpose and not overloaded with combustible materials.
- Electrical panels and switches must never be obstructed and should be clearly labeled to indicate what equipment or power source they control, for detailed guidelines refer the (**Annex-3.5 page 38**).

DO's

- Know the potential hazards of the materials used in the laboratory. Review the Safety Data Sheet (SDS) and container label prior to using a chemical.
- Know the location of safety equipment such as telephones, emergency call numbers, emergency showers, eyewashes, fire extinguishers, fire alarms, first aid kits, and spill kits which can be found in the labs.
- Review your laboratory's emergency procedures, in case of any assistance ask to Lab Incharge or Lab Technicians
- Ensure that necessary supplies and equipment are available for responding to laboratory accidents.
- Practice good housekeeping to minimize unsafe work conditions such as obstructed exits and safety equipment, cluttered benches and hoods, and accumulated chemical waste.
- Wear the appropriate personal protective apparel for the chemicals you are working with. This includes eye protection, lab coat, gloves, and appropriate foot protection (no sandals or open-toed shoes). Gloves must be made of a material known to be resistant to permeation by the chemical in use.
- Shoes must cover the entire foot. Open toed shoes and sandals are inappropriate footwear in laboratories. Fabric and athletic shoes offer little or no

protection from chemical spills. Leather shoes with slip-resistant soles are recommended.

- Contact lenses are not recommended but are permitted. Appropriate safety eyewear is still required for those that use contact lenses. Inform the lab supervisor of the use of contact lenses.
- Wash skin promptly if contacted by any chemical, regardless of corrosivity or toxicity.
- Label all new chemical containers with the “date received” and “date opened.”
- Label and store chemicals properly. All chemical containers must be labeled to identify the container contents (no abbreviations or formulas) and should identify hazard information.
- Chemicals must be stored by hazard groups and chemical compatibilities.
- Use break-resistant bottle carriers when transporting chemicals in glass containers that are greater than 500 milliliters. Use lab carts for multiple containers. Do not use unstable carts.
- Restrain and confine long hair and loose clothing. Ponytails and scarves used to control hair must not present a loose tail that could catch fire or get caught in moving parts of the instrument.
- For departing, students, dispose of all samples or identify, label, and transfer ownership and transfer the responsibility for the chemicals to someone remaining in the lab.
- Immediately report any lab-related incident to lab Incharge/Technician for guidance or assistance.

DON'Ts

- Eat, drink, chew gum, or apply cosmetics in rooms or laboratories where chemicals are used or stored.
- Store food in laboratory refrigerators, ice chests, cold rooms, or ovens.
- Drink water from laboratory water sources.
- Use laboratory glassware to prepare or consume food.
- Smell chemicals, taste chemicals, or pipette by mouth.

- Work alone in the laboratory without prior approval from the Lab Incharge. Avoid chemical work or hazardous activities at night or during off-hours
- Leave potentially hazardous experiments or operations unattended without prior approval from the Lab Incharge.
- attempt to clean up spills involving chemicals that are flammable, toxic, corrosive or reactive as indicated on the label or Material Safety Data Sheet (SDS).
- Never touch or taste any chemical

Labeling

- Unattended beakers, flasks, and other laboratory equipment containing chemicals used during an experiment must be labeled with the full chemical name(s).
- All chemicals should be labeled with the “date received” and “date opened.”
- All laboratory chemical waste containers must be labeled with the name of the chemicals contained.
- All full waste containers must be disposed of promptly. Waste containers must NOT be filled to more than 90% of their capacity}.
- Chemical storage areas such as cabinets, shelves, and refrigerators may be labeled to help the laboratory personnel identify the hazardous nature of the chemicals stored within the area (e.g., flammables, corrosives, oxidizers, water reactive, toxins, carcinogens, and reproductive toxins).

Use of Fume Hoods

- Chemicals and equipment (apparatus, instruments, etc.) should be placed at least 6 inches (15 cm) from the front edge of the hood.
- Equipment should be placed in the center of the working surface in the hood.
- Do not place materials at the front of the working surface because it will block the slot under the airfoil sill at the front.
- Do not place materials at the back of the working surface because it will block airflow to the lower slot under the baffle in the back. Separate and elevate equipment by using blocks or lab jacks to ensure that air can flow easily around and under the equipment.
- Chemical fume hoods must be kept clean and free from unnecessary items and debris at all times. Solid material (paper, tissue, aluminum foil, etc.) must be kept from obstructing the rear baffles and from entering the exhaust ducts of the hood.
- Minimize the number of bottles, beakers and equipment used and stored inside the hood because these items interfere with the airflow across the work surface of the hood.
- Chemicals should not be stored in a hood because they will likely become involved if there is an accidental spill, fire or explosion in the hood, thus creating a more serious problem. Fume hoods are not flammable cabinets and do not offer fire protection for materials stored inside.
- Sliding horizontal sash windows must not be removed from the hood sash.
- Laboratory personnel must not extend their head inside the hood when operations are in progress.
- The hood must not be used for waste disposal (evaporation). Hoods must be monitored by the user to ensure that air is moving into the hood. A small piece of thread or tissue paper can be taped for the indication of air vacuum or throw. In case, if the fumigation fails to inform the lab technician or contact with maintenance staff.

Handling and Storage of Compressed Gas Cylinders

- Cylinders must be marked with a label that identifies the contents.
- All cylinders must be checked for damage before use. Do not repair damaged cylinders or valves. Damaged or defective cylinders, valves, etc., must be taken out of use immediately and returned to the manufacturer/distributor for repair.
- All gas cylinders (full or empty) must be rigidly secured above the midline of the cylinder. Only two cylinders per restraint are allowed in the laboratory and only soldered link chains, or belts with buckles are acceptable. Cylinder stands are also acceptable but not preferred.
- Handcarts shall be used when moving gas cylinders. Cylinders must be chained to the carts.
- A pressure-regulating device shall be used at all times to control the flow of gas from the cylinder.
- The main cylinder valve shall be the only means by which gas flow is to be shut off. The correct position for the main valve is all the way on or all the way off.
- Cylinder valves must never be lubricated, modified, forced, or tampered. Regulator fittings must not be sealed with Teflon tape, grease or pipe sealant. Never grease any oxygen fittings (use PTFE Teflon tape only).
- After connecting a cylinder, check for leaks at connections. Periodically check for leaks while the cylinder is in use.
- Regulators and valves must be tightened firmly with the proper size wrench. Do not use adjustable wrenches or pliers because they may damage the nuts.
- Cylinders must not be placed near heat or where they can become part of an electrical circuit.
- Rapid release of compressed gas must be avoided because it will cause an unsecured gas hose to whip dangerously and also may build up enough static charge to ignite a flammable gas.
- Appropriate regulators must be used on each gas cylinder. Threads and the configuration of valve outlets are different for each family of gases to avoid improper use.
- Cylinders must never be bled empty. Leave a slight pressure to keep contaminants out.
- Gases shall not be transferred from one compressed gas cylinder to another.

Glassware and Sharps

Glassware and sharps should be handled and stored carefully to avoid damage.

Reusable syringes that are not biologically contaminated must be capped and put away after use. Cap syringes using the one-handed method of picking up the cap with the needle then carefully securing the cap onto the syringe. Retractable syringes are preferred. A disposable syringe should be used for biological materials and should be placed in a sharps container without recapping.

Chipped, broken, or star-cracked glassware should be discarded or repaired. Damaged glassware should never be used unless it has been repaired.

Because of the potential for catastrophic breakage resulting in sharp projectiles, only thick-walled, pressure-resistant glassware may be utilized under positive pressure or a vacuum.

Use appropriate hand protection when inserting glass tubing into a rubber stopper or when placing rubber tubing on glass hose connections. Use of plastic or metal connectors should be considered.

Use appropriate hand protection when picking up broken glass or other sharp objects. Small pieces should be swept up using a brush and dustpan.

Electric Safety Procedure

- Laboratory personnel should know the location of electrical shut-off switches and circuit breakers in or near the laboratory so that power can be quickly terminated in the event of a fire or accident.
- All electrical equipment should be periodically inspected to ensure that cords and plugs are in good condition and there is no any loose connection or wiring. In case of any incident or report information to the maintenance staff
- Electrical wires must not be used as supports.
- Extension cords should be avoided. If used, they should have three-pronged, grounded connectors, positioned or secured as not to create a tripping hazard, and ONLY for temporary use.