مركز أبوظبي للسلامة والصحة المهنية
ABU DHABI OCCUPATIONAL SAFETY AND HEALTH CENTER

اوشاد
oshad

Abu Dhabi Occupational Safety and Health System Framework

(OSHAD-SF)

Technical Guidelines

Laboratory Safety

Version 3.0

May 2017

www.oshad.ae

ABU DHABI PUBLIC HEALTH CENTRE | مركز أبوظبي للصحة العامة

Important Note:

(Document Republished for Continued Implementation under Abu Dhabi Public Health Center)

(إعادة نشر الوثيقة لاستمرار التطبيق بإشراف مركز أبوظبي للصحة العامة)

Contents

1. Introduction

(a) This technical guideline provides additional information to assist entities to comply with the requirements of *OSHAD-SF – Element 2 – Risk Management* specifically related to Laboratories' activities and operations. The contents of this technical guideline are not mandatory, however adopting the information within this guide will assist with compliance to the requirements of the element.

(b) The guidelines helps to ensure that the hazards associated with laboratory operations and activities are identified, the risks are assessed, and that control measures are implemented to reduce risks to acceptable levels, thus preventing injury, illness and disease to persons who might be exposed to risks arising from those activities / operations.

(c) The guideline also helps in identifying OSHAD-SF Codes of Practices applicable to Laboratories activities and operations.

(d) If guidance provided in this document conflicts with regulatory requirements mandated by a relevant authority, employers should follow the mandatory requirement.

(e) Depending upon the scope, type, activities and operation, laboratories may require to follow requirements and safety aspects established by international organization, accreditation bodies and international standards including Joint Commission International (JCI), United Kingdom Accreditation Services (UKAS), ISO 15189 (*Medical Laboratory— Particular requirements for quality and competence*), ISO 17025 (*General requirements for the competence of testing and calibration laboratories*), etc. This guideline document is however independent and the supplemental information provided in this document, not intended to replace or modify any requirements of the adopted standards.

(f) The guidance given in this document should not be interpreted as all inclusive. It aims to provide guidance on major hazards, associated risks and recommended controls for laboratory activities. However, the proper control of the hazards and risks potentially experienced in any laboratory environment should be established based on the rigorous risk assessment process.

2. Definitions:

(a) BSC – Biological Safety Cabinet

(b) Competent Person: A person who has acquired through training, qualifications or experience, or a combination of these, the knowledge and skills enabling that person to perform a specified task.

(c) dB(A): Decibel Average (refer to *OSHAD-SF – CoP 3.0 – Occupational Noise*)

(d) Glove Box: A glove box is a sealed container that is designed to allow one to manipulate objects where a separate atmosphere is desired. Glove boxes are containers sealed off and isolated from the atmosphere and lab environment to create a controlled, containment system. This equipment is useful for many applications, including chemical and biological research.

(e) Hazardous Material: As defined in the *OSHAD-SF*, it includes solid, liquid or gaseous materials having properties that are harmful to human health or severely affecting the environment, such as materials that are toxic, explosive, flammable or emitting ionizing radiation.

(f) Laboratory Fume Hood (LFH): A laboratory fume hood is a device, integrated into the ventilation system of a laboratory, which serves to isolate airborne contaminants from laboratory employees by means of unidirectional, exhausted airflow. Typically considered the primary engineering control for hazardous materials in the laboratory, LFHs should be properly used and maintained to afford the user proper containment of hazardous airborne contaminants.

(g) Laboratory: As referred in this document, it means a facility or a workplace that provides controlled conditions in which scientific or technological research, experiments, and measurement may be performed. It is a facility where relatively small quantities of hazardous materials are used on a nonproduction basis. Types of laboratories include but not limited to Chemical, Medical, Industrial, Academic and Research.

(h) Laboratory use of hazardous chemicals: Means handling or use of such chemicals in which all of the following conditions are met:

  (i) Chemical manipulations are carried out on a "laboratory scale";

  (ii) Multiple chemical procedures or chemicals are used;

  (iii) The procedures involved are not part of a production process, nor in any way simulate a production process; and

  (iv) "Protective laboratory practices and equipment" are available and in use to minimize the potential for employee exposure to hazardous chemicals.

(i) LSP – Laboratory Safety Plan: A documented system for establishing requirements on policies, practices, procedures and guidelines for the risk management in the laboratory.

(j) OPIM – Other Potentially Infectious Material (body fluids) in addition to human blood.

(k) SDS – Safety Data Sheet (same as Material Safety Data Sheet)

(l) TLV – Threshold Limit Value (refer to *OSHAD-SF – Standards & Guidelines Values*)

3. Training and Competency

(a) *OSHAD-SF – Element 5 – Training, Awareness and Competency* stipulates mandatory requirements on Training, Awareness and Competency. All OSHAD-SF Codes of Practices include a section on training, awareness & competency specific to the subject matter of the Code of Practice.

(b) Employers should provide an appropriate training program to ensure that all persons involved in laboratory activities acquire the understanding, knowledge, and skills necessary for the safe undertaking of all duties.

(c) Contractors engaged in working inside laboratories should be briefed on laboratory hazards and associated risks including hazardous, flammable and corrosive material.

(d) Employers should develop, document, implement and maintain a standard training program in compliance with *OSHAD-SF – Element 5 – Training, Awareness and Competency.*

(e) The training program should also consider the requirements of this guideline and include as a minimum:

(i) the location and contents of the Laboratory Safety Plan;

(ii) hazards (physical, chemical, biological, laser, radiation etc.) in the work area;

(iii) threshold limit value (TLVs) for hazardous materials used in the laboratory;

(iv) the measures that employees can take to protect themselves from these hazards, including protective equipment, appropriate work practices, standard operating procedures and emergency procedures;

(v) use of applicable Personal Protective Equipment;

(vi) signs and symptoms associated with exposure to hazards in the laboratory;

(vii) the use, location and availability of SDS;

(viii) methods used to detect the presence or release of a hazardous material (chemical, biological or radioactive);

(ix) laboratory waste management and disposal procedures;

(x) first aid;

(xi) emergency management program including procedures for responding to laboratory emergencies (material spill(s), fire, severe weather, etc.);

(xii) procedures for obtaining medical care in the event of exposure / injury; and

(xiii) record keeping.

4. Roles & Responsibilities

4.1 Employer

(a) *OSHAD-SF – Element 1 – Roles, Responsibilities and Self-Regulation* stipulates mandatory requirements for employers' roles and responsibilities.

(b) *OSHAD-SF – Element 2 - Risk Management* stipulates mandatory requirements for risk management. Employers should evaluate each site, activity or operation to determine if hazards are present and to identify suitable control measures in line with the requirements of *OSHAD-SF – Element 2 – Risk Management*.

(c) Employers should have the overall responsibility for risk management in the laboratory.

(d) If required by risk assessment, the employer should ensure that an appropriate Laboratory Safety Plan is developed, approved and implemented.

(e) Employers should ensure designating a competent person to develop and implement a Laboratory Safety Plan as described in this document.

(f) Employers should ensure that laboratory employees and contractors know and follow the safety and hygiene rules.

(g) Employers should establish and implement medical surveillance program for employees considering the requirements of section 6.0 of this document;

(h) Employers should ensure that appropriate training has been provided and requirements of refresher training identified.

(i) Employers should provide regular, formal hygiene and housekeeping inspections, including routine inspections of emergency equipment.

(j) Employers should know the latest legal requirements concerning hazardous material / substances.

(k) Employers should ensure that facilities and training for use of any material being ordered are adequate.

(l) Employers should ensure laboratory setup (space, design, arrangements, facilities, etc.) meets the requirements of relevant authorities.

(m) Employers should provide Personal Protective Equipment (PPE) and ensure that employees are trained in its use. Requirements of Section 10 should be considered. *OSHAD-SF – CoP 2.0 – Personal Protective Equipment* stipulates mandatory requirements for PPE.

(n) Employers should provide first aid and medical care facilities and trained first aid personnel for the laboratories appropriate to the worksite hazards and associated risk. *OSHAD-SF – CoP 4.0 – First Aid & Emergency Medical Treatment* stipulates mandatory requirements for First Aid & Medical Care Facilities and trained First Aid Personnel for the worksite, including:

(i) the employer should conduct an assessment of the workplace to determine what first aid services are needed; and

(ii) the employers should provide equipment, supplies, facilities, trained first aiders, and services that are adequate and appropriate for promptly rendering first aid to employees if they suffer an injury at work, and transporting injured employees to a place of medical treatment.

(o) A readily accessible first aid kit should be provided in an unlocked and clearly labelled container. The contents of the kit should be appropriate to the applicable mandatory requirements, the needs of the laboratory and maintained in a satisfactory condition.

(p) Employers should establish a test, inspection and maintenance program for laboratory systems and equipment. The test, inspection and maintenance plan should follow the recommendations of manufactures and suppliers. *OSHAD-SF – CoP 36.0 – Plant and Equipment* stipulates mandatory requirements for Test, Inspection, Maintenance, Repair and Modifications of Plant & Equipment. Refer to Section 11 for specific requirements.

(q) OSHAD-*SF – Element 3 – Management of Contractors* stipulates mandatory requirements for contractors' management. Employers should evaluate each site, activity or operation to determine and implement contractors control requirements.

4.2 Employees

(a) *OSHAD-SF – Element 1 – Roles, Responsibilities and Self-Regulation* stipulates mandatory requirements about employees' Roles and Responsibilities.

(b) employees should undertake their specific roles and responsibilities in accordance with the following:

(i) plan and conduct each activity / operation in accordance with the Laboratory Safety Plan, including use of PPE and engineering controls, as appropriate;

(ii) understand and follow appropriate safety and hygiene policies, procedures and practices; and

(iii) report all workplace incidents including exposures immediately to a supervisor or the designated person. *OSHAD-SF - Mechanism 11.0, Incident Notification, Investigation and Reporting* stipulates mandatory requirements for this.

4.3 Laboratory Safety Officer or Equivalent

(a) This is a suggested role for a competent person designated for developing and ensuring implementation of the laboratory safety plan. Employers should ensure compliance with the applicable competency requirements (qualification, experience, skills, etc.) while designating laboratory personnel for developing, implementation and monitoring of Laboratory Safety Plan.

(b) The Laboratory Safety Officer or equivalent should undertake their specific roles and responsibilities considering the following:

(i) develop and ensure implementation of an appropriate Laboratory Safety Plan, policies and practices;

(ii) monitor procurement, safe storage, use, handling and disposal of materials used in the laboratory;

(iii) ensure that appropriate audits are undertaken and records maintained;

(iv) assist concerned staff in developing precautions and adequate facilities;

(v) regulatory requirements mandated by the relevant authorities; and

(vi) seek to continually improve the Laboratory Safety Plan.

5. Risk Management in Laboratories

(a) *OSHAD-SF – Element 2 – Risk Management* stipulates the mandatory requirements for Risk Management.

(b) Detailed guidance on how to undertake a risk assessment is available within *OSHAD-SF - TG – The Process of Risk Management*.

(c) *OSHAD-SF – CoP 1.0 – Hazardous Material* defines mandatory requirements for Management of Hazardous Material with an objective to reduce the associated risk to the safety and health of employees involved in dealing with the hazardous material.

(d) The laboratory workplace can be a hazardous place to work. Laboratory employees are exposed to numerous potential hazards including chemical, biological, physical and other safety hazards, as well as musculoskeletal stresses.

(e) Employers should evaluate their particular workplace to assess and manage risks for protecting their employees that may combine both immediate actions as well as longer term solutions.

(f) Laboratory risk management should consider the following as a minimum:

  (i) identification of all OSH hazards in the workplace;

  (ii) assessment of the risks of these hazards;

  (iii) formulate control measures to reduce the risk to as low as reasonably practicable level (ALARP);

  (iv) review the program on regular basis; and

  (v) incorporate management of change process within the entity.

(g) Identified control measures should follow the hierarchy of controls as stipulated within *OSHAD-SF – Element 2 – Risk Management.* Employers should use a combination of control methods.

  (i) elimination – eliminate the risk by removing the hazard;

  (ii) substitution – substitute less hazardous material, equipment, processes or substances;

  (iii) engineering controls / isolation - make structural changes to the work environment, work systems, tools or equipment. Use mechanical aids or manual handling devices. Enclose or isolate the hazard through the use of guards or remote handling techniques. provide local exhaust ventilation;

  (iv) administrative controls - appropriate administrative procedures such as policies, guidelines, standard operating procedures (SoPs), registers, work permits, safety signage, job rotation, job timing, routine maintenance and housekeeping. Provide training on the hazards and correct work procedures.

  (v) personal protective equipment (PPE) - provide correctly fitted and properly maintained personal protective equipment (PPE), and / or protective clothing and the training in its use.

(h) An appropriate Laboratory Safety Plan (LSP) should be established for managing the risk associated with the activities and operations in the laboratory.

5.1 Laboratory Safety Plan (LSP)

(a) The Laboratory Safety Plan establishes policies, procedures, equipment, PPE, instructions and work practices required for risk management within the laboratory to protect employees from the potential hazards present in the laboratory activities and operations.

(b) The LSP should be approved by top management, regularly reviewed and readily available to employees.

(c) The following information should be included in Laboratory Safety Plan:

(i) legal requirements: applicable mandatory requirements as set by the relevant regulatory authorities;

(ii) roles & responsibility: identify employees assigned to maintain and monitor implementation of LSP. Identify others having specific roles in the implementation of the LSP. Define the competency requirements, including qualification and experience, for each identified role;

(iii) laboratory safety officer: identify the laboratory safety officer, define his / her competency requirements including qualification and experience and outline his or her role and responsibilities; and, where appropriate, establish Laboratory Safety Committee. Requirements for the OSH Committee stipulated in *OSHAD-SF - Element 4 – Communication & Consultation* should be considered while establishing Laboratory Safety Committee;

(iv) hazards & risk: document all hazards present in the laboratory, assess associated risks and identify their controls;

(v) standard operating procedures (SOPs): develop SOPs where required to stipulate the mandatory practices which should be followed when working in a laboratory. These include general and laboratory-specific procedures for work with hazardous materials;

(vi) criteria for exposure control measures: define criteria used by the employer to determine and implement control measures to reduce employees potential exposure to laboratory hazards;

(vii) engineering controls and other protective equipment: provide list of identified controls, including specific measures that should be taken to ensure adequacy, availability, and proper and adequate functioning and performance of engineering controls and other protective equipment, such as fume hoods. This should include the Equipment Test & Maintenance Plan;

(viii) information and training: outline information and training program required to ensure that employees are informed of the workplace hazards, risk management, SOPs and related information;

(ix) preauthorization process: the requirements and circumstances under which certain laboratory procedures or activities require approval from the employer (Senior Management) or employer's designee before work is initiated;

(x) exposure monitoring: requirements to conduct exposure monitoring, through applicable process including air sampling, if there is reason to believe that employees may be exposed to above the TLVs;

(xi) medical consultations and examinations: provisions for medical consultation and examination when exposure to a hazardous material has or may have taken place;

(xii) particularly hazardous substances: outline additional employee protection for work with particularly hazardous substances. These could include carcinogens, reproductive toxins, and substances which have a high degree of acute toxicity;

(xiii) personal protective equipment: identification, provision and training on PPE applicable to Laboratory activities and operations;

(xiv) emergency response plan: a written emergency plan should be established and communicated to all personnel stipulating potential emergencies, exposures and response procedures, including evacuation, medical care, reporting and drills;

(xv) waste management plan: laboratory waste management program should identify types of waste, methods for collection, segregation, storage, transportation, disposal, and include consideration of what materials can be incinerated. Waste management plan should comply with the applicable mandatory requirements set by relevant regulatory authorities; and

(xvi) review & update: the employer should review and evaluate the effectiveness of the Laboratory Safety Plan at least annually and update it as necessary.

5.2 Chemical Hazards

(a) *OSHAD-SF – CoP 1.0 – Hazardous Material* stipulates requirements for entities using, storing, selling, importing or transporting the hazardous material.

(b) Hazardous chemicals present physical and/or health threats to employees in chemical, medical, industrial, and academic laboratories.

(c) Laboratory risk management for chemical hazards should consist of five major elements:

(i) hazard identification and identified control measures;

(ii) laboratory safety plan with specific requirements for chemical safety;

(iii) information and training;

(iv) exposure monitoring; and

(v) medical surveillance.

5.2.1 Hazard Identification:

(a) *OSHAD-SF – Element 2 – Risk Management* stipulates the mandatory requirements for risk management process. Each laboratory should identify which hazardous chemicals will be encountered by its employees and from this identify control measures to reduce any risks that are present.

5.2.2 Safety Data Sheets (SDS):

(a) Safety Data Sheets should be maintained for all hazardous chemicals stored or in use within the laboratory and made readily accessible to laboratory employees. Employees should be trained in the requirements of a SDS.

(b) Before a substance is received, information on proper handling, storage and disposal should be known to personnel involved in the use of the substance.

(c) *OSHAD-SF – CoP 1.0 – Hazardous Material* explains SDS requirements for hazardous material.

5.2.3 Laboratory Safety Plan – Chemical Safety Requirements:

(a) Where hazardous chemicals are used in the laboratory and the risk assessment warrants, employers should develop and carry out the provisions of a written Laboratory Safety Plan. Refer to Section 5.1 for requirements on Laboratory Safety Plan.

(b) Laboratory's Safety Plan (LSP) for Chemical Safety should address all aspects of risk management requirements, as listed in Section 5.1. LSP for chemicals should be:

(i) capable of protecting employees from health hazards associated with hazardous chemicals in that laboratory; and

(ii) capable of keeping exposures below the permissible exposure limit as explained in Section 6.

(c) The LSP on chemicals should address every aspect of the procurement, storage, handling, and disposal of chemicals in use within a facility. A list of chemicals in use / stored within the laboratory indicating inventory and SDS should be maintained and regularly updated.

(d) The LSP should include each of the following elements and should indicate specific measures that the employer will take to ensure employee protection:

(i) standard operating procedures relevant to safety and health considerations to be followed when laboratory work involves the use of hazardous chemicals;

(ii) criteria that the employer will use to determine and implement control measures to reduce employee exposure to hazardous chemicals including engineering controls, the use of personal protective equipment and hygiene practices; particular attention should be given to the selection of control measures for chemicals that are known to be extremely hazardous;

(iii) a requirement that engineering controls, including fume hoods and other protective equipment are functioning properly and specific measures that should be taken to ensure proper and adequate performance of such equipment;

(iv) provisions for employee information and training as defined in Section 3. Employers should ensure that employees are trained and prohibited from engaging in the following activities:

1. mouth pipetting/suctioning of chemicals;
2. eating, drinking, smoking, applying cosmetics or lip balm, or handling contact lenses in work areas where there is a reasonable likelihood of occupational exposure to hazardous chemicals; and

3. Storage of food or drink in refrigerators, freezers, cabinets, or on shelves, countertops or bench tops where chemicals are present.

(v) provisions for controlling access to laboratory areas and restricting it to authorized personnel only;

(vi) provisions for medical consultation and medical examinations in accordance with Section 6;

(vii) designation of competent and qualified personnel responsible for implementation of the Laboratory Safety Plan (see Section 4.3);

(viii) provisions for additional employees' protection for work with particularly hazardous substances. These include carcinogens, reproductive toxins and substances which have a high degree of acute toxicity; and

(ix) specific consideration to the following provisions where appropriate:

1. establishment of a designated area for hazardous chemicals as required by SDS ;
2. use of containment devices such as fume hood or glove boxes;
3. replacing a low flashpoint flammable solvent with a high flashpoint one;
4. procedures for safe removal of contaminated waste; and
5. decontamination procedures.

5.2.4 Chemicals Storage & Transport

(a) Storage and transport plans should comply with the applicable local regulations on Hazardous Material Storage & Transport. *OSHAD-SF – CoP 1.0 – Hazardous Material* stipulates certain requirements

(b) All containers for chemicals should be clearly labeled. Labels on chemical containers should not be removed or defaced.

(c) As far as reasonably practicable, the toxic substances should be segregated in well-identified storage areas (i.e., flammable storage cabinets, etc.), with local exhaust ventilation where required.

(d) A designated storage place should be provided for chemicals, together with air conditioning and temperature control as required.

(e) Chemicals stored in stockrooms should be examined periodically (at least annually) for replacement (expiration date), deterioration and container integrity.

(f) Stock rooms should not be used as preparation or repacking areas.

(g) Quantities of chemicals in laboratories should be kept as small as practical without interfering with daily operations.

(h) Flammable liquids should not be stored in laboratory refrigerators unless the unit is approved explosion-proof or laboratory-safety type.

(i) Chemicals should be stored in storage cabinets (storage on bench tops or in hoods should be prohibited). Exposure to heat or direct sunlight should be avoided.

(j) Periodic inventories should be conducted with unneeded items being discarded or returned to the storeroom/stockroom.

(k) Chemical storage should ensure segregating incompatible chemicals to prevent accidental mixing which could cause fire, explosion, toxic gases or other hazardous reactions. Hazardous chemical reactions can occur from improper storage when incompatible materials mix because of:

  (i) accidental breakage;

  (ii) container failure;

  (iii) fires;

  (iv) mixing of gases or vapors from poorly closed containers; and

  (v) mistakenly storing incompatibles together because of improperly labeled containers.

(l) Laboratories that handle explosive material should establish quantity limits and include these limits in the operating directives of the laboratory.

(m) Stairways and hallways should not be used as storage areas even for short periods of time.

(n) Chemicals should be transported in break-resistant secondary containers that are capable of containing all materials in the event of breakage or spill. Secondary containers are defined as commercially available bottle carriers made of rubber or plastic, with carrying handle(s). Or, if the chemicals are too numerous to safely carry with a bottle carrier, an easily maneuverable cart with leak resistant sides of several inches in height on all four sides should be used. Chemicals are to be loaded onto the lowest shelf of the cart to maintain the lowest center of gravity and minimize the height a bottle may drop.

(o) Damaged glassware should not be used.

(p) If small quantities of flammable liquids need to be moved, one should use rugged pressure-resistant, non-venting containers, store during transport in a well-ventilated vehicle, and eliminate potential ignition sources.

(q) Good stock control should be maintained, with emphasis on time-sensitive compounds such as ethers, which once exposed to the air can produce peroxides that are highly explosive. This means a regular review of what is being stored, disposal of surplus or unwanted chemicals, and particular attention to expiry dates. The date when a bottle is first opened should be clearly shown on the label.

(r) Chemicals' storage should be provided with necessary spill management controls considering prevention, containment, clean up, and reporting process. Refer to section 12 on Emergency Management and section 13 on Waste Management.

5.2.5 Chemical Spills

(a) If the incident involves personal injury or chemical contamination, the concerned employees should, as applicable:

(i) ensure wearing the correct PPE providing necessary protection against potential exposure and contamination;

(ii) attend to the injured or contaminated person and move them to safe location if it is safe to do so;

(iii) locate nearest eyewash or safety shower, remove any contaminated clothing, and thoroughly flush all contaminated areas of the body for 15 minutes;

(iv) administer first aid as appropriate (e.g. calcium gluconate for hydrofluoric acid exposures, amyl nitrate ampoules for hydrogen cyanide exposures) and seek medical attention by contacting the designated staff;

(v) print out Safety Data Sheets for chemicals involved in the exposure and ensure the attending fire team/medical personnel receive them;

(vi) evacuate the area and obtain outside help if the situation requires so; and

(vii) as soon as reasonably practicable, report the injury to the designated staff.

(b) Refer to section 12 on Emergency Management and section 13 on Waste Management for guidance on containment and disposal of hazardous spills.

5.3 Biological Hazards

(a) The employer should control laboratory employees' exposure to biological hazards. These hazards are present in various sources throughout the laboratory such as blood and body fluids, culture specimens, body tissue and cadavers, as well as other employees.

(b) Employers should develop a written Laboratory Safety Plan as per Section 5.1, provide training to potentially exposed employees, and comply with other applicable requirements, including use of standard precautions when dealing with blood and other potentially infectious materials (OPIM), if employees roles put them at foreseeable risk of coming into contact with such materials.

(c) Refer to section 6 for requirements on Exposure Determination and Medical Surveillance.

5.3.1 Specific Engineering Control – Biological Safety Cabinets (BSCs)

(a) A biological safety cabinet (BSC) is an enclosed, ventilated workspace for safely working with materials contaminated with (or potentially contaminated with) pathogens requiring a defined biosafety level.

(b) Employers should ensure the use of properly maintained BSCs of the type and class suitable to laboratory work scope, in conjunction with good microbiological techniques, for establishing an effective containment system for safe manipulation of moderate and high-risk infectious agents to protect laboratory employees and the immediate workplace from infectious aerosols generated within the cabinet.

5.3.2 Information & Training

(a) Employers should provide awareness and training on applicable regulations and guidelines set by the concerned authorities including Health Authority Abu Dhabi (HAAD) Guidelines on Infection Control;

(b) Employers should ensure that employees are trained and prohibited from engaging in the following activities:

(i) mouth pipetting/suctioning of blood or OPIM;

(ii) eating, drinking, smoking, applying cosmetics or lip balm, or handling contact lenses in work areas where there is a reasonable likelihood of occupational exposure to blood or OPIM; and

(iii) storage of food or drink in refrigerators, freezers, cabinets or on shelves, countertops or bench tops where blood or OPIM are present.

(c) Refer to Section 3 for more details.

5.3.3 Employers Requirements

(a) Employers should ensure that the following are provided:

(i) appropriate PPE for employees if blood or OPIM exposure is anticipated, in types and amounts commensurate with the anticipated exposure:

1. gloves should be worn when hand contact with blood, mucous membranes, OPIM, or non-intact skin is anticipated, or when handling contaminated items or surfaces;
2. surgical caps or hoods and / or shoe covers or boots should be worn in instances when gross contamination can reasonably be anticipated such as during autopsies; and
3. refer to section 10 for information on PPE.

(ii) effective engineering and work practice controls to help remove or isolate exposures to blood and blood-borne pathogens;

(iii) all applicable vaccination(s) (as prescribed by HAAD) under the supervision of a physician or other licensed healthcare professional to all employees who have occupational exposure to blood or OPIM; and

(iv) when any blood or OPIM are present in the workplace, a hazard warning sign, incorporating the universal biohazard symbol, on all access doors.

(b) refer to Section 6 for requirements on Exposure Determination and Medical Surveillance.

5.4 Physical Hazards

(a) Employers should identify the physical hazards in Laboratories and implement the desired controls to manage the risk to ALARP. A Laboratory Safety Plan compliant with the requirements outlined in Section 5.1 should be developed.

(b) Some of the common physical hazards that may be encountered include ergonomic, ionizing radiation, nonionizing radiation and noise hazards.

5.4.1 Ergonomics

(a) *OSHAD-SF – CoP 14.0 – Manual Handling and Ergonomics* stipulates mandatory requirements for managing ergonomics hazards at workplace.

(b) Laboratory employees are at risk for repetitive motion injuries during routine laboratory procedures such as pipetting, working at microscopes, operating microtomes, using cell counters and keyboarding at computer workstations.

(c) Repetitive motion injuries develop over time and occur when muscles and joints are stressed, tendons are inflamed, nerves are pinched and the flow of blood is restricted. Standing and working in awkward positions in front of laboratory fume hoods/biological safety cabinets can also present ergonomic problems.

(d) By implementing necessary controls, including simple workplace adjustments for laboratory ergonomics-related risk factors, employers can reduce the risk of occupational injuries.

(e) Laboratory employees are at risk of musculoskeletal injuries (MSI), which can result in sprains, strains, and inflammation of soft tissues such as muscles, tendons, and ligaments. Employers should identify and assess the factors in the laboratory that may expose employees to this risk. They should then try to eliminate or minimize the risk using engineering or administrative controls.

5.4.1.1 Risk factors

(a) Risk factors to be considered include the following:

(i) physical demands of the work being performed, such as the force needed, the amount of repetitive motion, the duration of such tasks, the postures employed and exposure to local contact stresses;

(ii) layout and conditions of the workplace or workstation, such as how far employees are required to reach, the height of the work surface compared with that of the employee, seating conditions and floor surface conditions;

(iii) characteristics of objects handled, such as size, shape, weight distribution and types of handles and grips;

(iv) workplace environmental conditions, such as illumination and exposure to cold and vibration; and

(v) organization of the work, such as work-recovery cycles, the amount of variability in the tasks and the rate at which employees are required to work.

(b) Control measures may include mechanical aids, work procedures and appropriate use of personal protective equipment. Employees should be educated in the signs and symptoms of musculoskeletal injuries (MSI) and trained in the use of the control measures. The following tips will help reduce the risk of MSI in laboratory employees:

(i) use an ergonomically designed workstation (height-adjustable chair, laboratory stools and workbench, good back, elbow, and foot support, etc.).

(ii) ensure correct lighting for the task being performed and that glare is minimised;

(iii) use appropriate personal protective equipment if necessary (for example, gloves that improve your grip if you have to handle slippery objects);

(iv) keep your head aligned with your spine;

(v) avoid slouching or bending forward or to the side;

(vi) design tasks so that they encourage employees to change positions frequently;

(vii) place materials at a comfortable working level, at or slightly below elbow height;

(viii) organize the work area so that materials and actions are within easy reach;

(ix) use appropriate means including step stools / ladders while accessing materials at height;

(x) use proper lifting techniques and get help when lifting heavy objects;

(xi) avoid handling heavy or unbalanced objects alone, use mechanical aids or ask for team handling as appropriate; ;

(xii) avoid sitting for more than 50 minutes at a time; and

(xiii) use rest periods to relax and move around.

5.4.2 Ionizing Radiation

(a) Radioactive materials and radiation producing devices emit ionizing radiation that may cause harm to humans. Sources of Ionizing Radiation in Laboratories include Radiochemicals, Sealed Sources, X-ray Machines, X-ray Diffraction & Fluoresce, Electron Microscope, etc.

(b) Any laboratory possessing or using radiation sources should be licensed by the relevant authority and comply with its regulations / requirements.

(c) Employers should understand and follow all applicable regulations for the use of isotopes and other radiation sources. Information on radiation sources licensing should be obtained from the relevant authority.

(d) The employer should ensure compliance with regulations as applicable, obtain relevant licenses for official use of radiation sources and designate a competent person e.g. radiation safety officer to oversee and ensure compliance with the concerned authority's requirements.

(e) Employers should ensure only properly trained and authorized personnel handle radiation sources.

(f) All areas in which radiation sources are used or stored should display the symbol for radiation hazards and access should be restricted to authorized personnel.

(g) Ionizing radiation regulations requires precautionary measures and personal monitoring for employees who are likely to be exposed to radiation hazards. Personal monitoring devices (film badges, thermo-luminescent dosimeters (TLD), pocket dosimeters, etc.) should be supplied and used if required to measure an individual's radiation exposure from gamma, neutron, energetic beta, and X-ray sources.

(h) The standard monitoring device is a clip-on badge or ring badge bearing the individual employee name, date of the monitoring period and a unique identification number.

(i) Laboratory employees should read and understand the Radiation Safety Notices and Emergency Contact Information posted in the Laboratory.

(j) Employers should label locations within the laboratory where radionuclides are used or stored or radioactivity is generated (hoods, refrigerators, microwave ovens etc.) to indicate the presence of radiation sources.

(k) Employers should maintain the security of all radiation sources including labeled materials, equipment and waste.

(l) Refer to section 6 for requirements on Exposure Determination and Medical Surveillance.

(m) Refer to section 11 for requirements on Equipment Test, Inspections and Maintenance.

5.4.3 Non-ionizing Radiation

(a) Non-ionizing radiation is found in a wide range of occupational settings and can pose a considerable health risk to potentially exposed employees if not properly controlled.

(b) Non-ionizing radiation is described as a series of electromagnetic waves traveling at the speed of light. Non-ionizing radiation includes visible light, infrared (IR), microwave (MW), radio frequency (RF), extremely low frequency (ELF), and part of the ultraviolet (UV). Lasers commonly operate in the UV, visible, and IR frequencies.

(c) Employers should identify the sources of non-ionization radiation, potential exposures to employees, and implement control measures to avoid safety and health impacts. This should include standard operating procedures on safe use of equipment.

5.4.4 Noise

(a) Exposure to continuous noise may lead to the stress-related symptoms including depression, irritability, decreased concentration in the workplace, reduced efficiency and decreased productivity, Noise-induced hearing loss, Tinnitus (i.e., ringing in the ears); and increased errors in laboratory work.

(b) *OSHAD-SF – CoP 3.0 – Occupational Noise* stipulates mandatory requirements for controlling noise.

(c) Employers should undertake a noise risk assessment and where employees may be exposed to noise at or in excess of 85dB(A), employers should develop and implement a hearing conservation program.

5.5 Other Safety Hazards

(a) Employers should follow the requirements of *OSHAD-SF – Element 2 – Risk Management* to identify workplace safety hazards, associated risks and controls to manage these risks.

(b) Employers should assess tasks to identify potential worksite hazards and provide and ensure that employees use appropriate personal protective equipment (PPE) as stated in the *OSHAD-SF – CoP 2.0 – Personal Protective Equipment*. Refer to section 10.

5.5.1 Autoclaves and Sterilizers

(a) Employees should be trained to recognize the potential for exposure to burns or cuts from handling or sorting hot sterilized items or sharp instruments when removing them from autoclaves / sterilizers or from steam lines that service the auto- claves.

5.5.2 Centrifuges

(a) Employers should instruct employees when centrifuging materials, they should follow the manufacturer's instructions and wait 10 minutes after the centrifuge rotor has stopped before opening the lid.

(b) Employees should also be trained to use appropriate decontamination and clean up procedures for the materials being centrifuged if a spill occurs and to report all incidents to their supervisor immediately.

5.5.3 Compressed Gases

(a) *OSHAD-SF – CoP 49.0 – Compressed Gases & Air* stipulates mandatory requirements for compressed gases and air.

(b) Laboratories should include compressed gases and air in their inventory of chemicals within their Laboratory Safety Plan.

(c) Employers should store, handle, and use compressed gases and air in accordance with *OSHAD-SF - CoP 49.0 – Compressed Gases and Air*, including:

(i) all cylinders whether empty or full should be stored upright; and

(ii) cylinders of compressed gases should be secured. Cylinders should never be dropped or allowed to strike each other with force;

(d) All cylinders and connection lines should be color coded. Color coding is helpful in identification of gas cylinders and lines by employees provided they are familiarized with such color codes.

(e) It is important for all laboratories to prominently display color code charts in workplace as well as in gas storage area so as to familiarize the employees with potential hazards associated with gases.

(f) It is important to transport compressed gas cylinders with protective caps in place, and not to roll or drag the cylinders.

5.5.4 Cryogens and Dry Ice

(a) Cryogens and substances used to produce very low temperatures [below -153°C (-243°F)], such as liquid nitrogen (LN2) which has a boiling point of -196°C (-321°F), are commonly used in laboratories. Although not a cryogen, solid carbon dioxide or dry ice which converts directly to carbon dioxide gas at -78°C (-109°F) is also often used in laboratories.

(b) Shipments packed with dry ice, samples preserved with liquid nitrogen and in some cases, techniques that use cryogenic liquids, such as cryogenic grinding of samples, present potential hazards in the laboratory.

(c) The safety hazards associated with the use of cryogenic liquids include cold contact burns, asphyxiation and explosion due to pressure or chemical reaction.

(d) Employers, specifically the supervisor in charge of an apparatus, should ensure that the cryogenic safety hazards are minimized. This should include:

(i) a safety analysis and review for all cryogenic facilities;

(ii) cryogenic safety and operational training for relevant employees;

(iii) appropriate maintenance of cryogenic systems in their original working order, i.e., the condition in which the system was approved for use; and

(iv) maintaining inspection schedules and records.

(e) Employers should train employees to use the appropriate personal protective equipment (PPE).

(f) When handling or transferring cryogenic fluids may result in exposure to the cold liquid, boil-off gas or cold surfaces, protective clothing should be worn including face shield or safety goggles, safety gloves, and long-sleeved shirts, lab coats or aprons.

(g) Eye protection is important at all times when working with cryogenic fluids. When pouring a cryogen, working with a wide-mouth Dewar flask or around the exhaust of cold boil-off gas, use of a full face shield is recommended.

(h) Hand protection is important to guard against the hazard of touching cold surfaces. It is recommended that Cryogen Safety Gloves be used by the employee.

5.5.5 Distillations

(a) Employees should inspect glass for cracks before a vacuum distillation.

(b) Employees should use only glassware appropriate for vacuum distillation (no volumetric flasks).

(c) Employees should not heat above the liquid level because the vapors can superheat.

(d) At the end of a distillation, air should not be released into a hot distillation apparatus. The hot organic vapors could ignite upon introduction of oxygen. Allow the apparatus to cool or release to an inert gas such as nitrogen or argon.

(e) Tubing that delivers water for cooling should be clamped down in order to prevent leaks that may potentially flood the fume hood and surrounding area.

5.5.6 Electrical

(a) *OSHAD-SF – CoP 15.0 – Electrical Safety* and *OSHAD-SF – CoP 24.0 – Lockout / Tag out* (Isolation) stipulate requirements to ensure that electrical systems and equipment are free from recognized hazards and safe to use.

(b) Problems involving control of hazardous energy require procedural solutions. Employers should adopt such procedures for controlling hazards to ensure employee safety during maintenance. However, such procedures are effective only if strictly enforced. Employers should therefore, be committed to strict implementation of such procedures.

(c) It is important to implement a regular inspection program for all electrical systems and equipment and ensure that any damaged equipment is taken out of use immediately.

(d) It is important to carefully review hazards and risks, implement necessary controls while using heating mantles, and avoid plugging these in the regular wall outlet.

(e) It is important to consider how a loss of electricity will affect any reaction or equipment that is set-up and take precautionary measures.

5.5.7 Fire

(a) *OSHAD-SF – Element 6 – Emergency Management* establishes the requirements for employers to ensure that the workplace is free from recognized fire hazards, all desired controls are available, and employees are fully aware of emergency response requirements. Refer to Section 12 on Emergency Management.

(b) The following should be considered for fire prevention in laboratories:

(i) minimize the use of open flames - bunsen burners should not be hooked up to a fuel supply such as natural gas by using flexible polymer tubing. Thick rubber tubing should be employed instead. Bunsen burners and propane torches should be employed only in areas that are free of chemicals and flammable clutter;

(ii) be aware of sparking sources in the laboratory such as heat guns, transformers, electric motors and frayed electrical cords; and

(iii) ovens should be elevated from the floor to minimize the risk of setting off a fire in the event of a solvent spill.

(c) Flammable materials burn readily in the presence of an ignition source. Flammable liquids have a flash point of less than or equal to 60ºC (140ºF). Vapor from these liquids can reach remote ignition sources, causing flashback fires.

(d) Employees should consider the following when dealing with flammable material:

(i) minimize the volume of flammable solvent(s) being stored in a particular laboratory space at any given moment. Place smaller solvent orders more frequently;

(ii) isolate ignition sources including hot surfaces, electrical equipment and static electricity from flammable materials;

(iii) store flammables away from oxidizers and strong acids;

(iv) provide proper bunding and grounding when transferring flammable liquids from a container or drum;

(v) implement additional safety precautions when heating flammable liquids, particularly when heating to or above their flash points;

(vi) store flammable liquids in safety cans where quantity exceeds four liters (~ 1 gallon);

(vii) store flammable liquids in a flammables storage cabinet when total quantity in a laboratory exceeds 40 liters (~10 gallons);

(viii) store flammable liquids requiring cool/cold storage in refrigerators/freezers manufactured for that purpose. Modification of general-purpose (domestic) refrigerators or freezers for flammable liquid storage is not permitted; and

(ix) use flammable liquids inside a fume hood when possible to prevent build-up of ignitable vapor / air mixtures.

5.5.8 Vacuum Work

(a) The hazards associated with working with vacuums does not depend on magnitude of a vacuum as almost all vacuum pressure is relatively low with respect to external pressure of 1 atmosphere.

(b) Star cracks and imperfections in glassware may lead to a vacuum implosion (collapse). Debris of flying glass and exposure to the chemical formerly contained in the vessel may result.

(c) Only thick-walled glassware designed for vacuum work should be placed under vacuum. Never place volumetric glassware under vacuum.

5.5.9 Slips, Trips and Falls

(a) *OSHAD-SF – CoP 8.0 – General Workplace Amenities* stipulates mandatory requirements on housekeeping, aisles & passageways and *OSHAD-SF – CoP 22.0 – Barricading of Hazards* defines requirements on securing hazards.

(b) Exposure to wet floors or spills and clutter can lead to slips / trips / falls and other possible injuries.

(c) Employers should implement housekeeping procedures such as keeping floors clean and dry, keeping aisles and passageways clear and in good repair, eliminate uneven floor surfaces, ensuring that spills are reported and cleaned immediately, using caution signs, cleaning only one side of a passageway at a time, and provide good lighting for all halls and stairwells to help reduce incidents, especially during the night hours. Refer to Section 8 on Housekeeping.

(d) Most common laboratory injuries include strained back from lifting, cuts from broken glass and injuries from slipping or tripping.

(e) It is important to keep your laboratory surroundings organized and uncluttered.

(f) It is important to keep all work areas and aisles clean and unobstructed.

(g) It is important to confine long hair and loose clothing to avoid potential entanglement and falls.

5.5.10 Lone Working

(a) Laboratory employees sometimes work alone, either because of shift work or work at an isolated location. *OSHAD-SF – CoP 30.0 – Lone Working and/or Remote Locations* stipulates mandatory requirements for lone working.

(b) If laboratory operations require lone working, the employer should have a written procedure for checking on the employee's well-being. The procedure should:

(i) specify time intervals for regular checks;

(ii) contain instructions on what to do if the employee cannot be contacted; and

(iii) contain provisions for emergency rescue.

(c) A designated person should make contact with the employee at predetermined intervals and record the results of each check.

(d) Both the employee required to work alone and the management should be consulted to determine the appropriate time interval for regular checks.

(e) The preferred method for checking is visual contact or two-way voice contact. Besides regular checks, a check should be done at the end of the work shift.

6. Exposure Determination & Medical Surveillance

6.1 Exposure Determination

(a) *OSHAD-SF – Occupational Standards and Guidelines Values* document addresses the standard and threshold value limits (TLV) for occupational air quality in terms of chemical substances and occupational noise.

(b) *OSHAD-SF – TG – Occupational Air Quality Management* provides guidance for air quality monitoring and collecting air samples for investigating pollution. It identifies international standards / guidelines applicable to the measurement of air quality (workplace and indoor air) and outlines the considerations required for air monitoring.

(c) Employers should ensure the following considering OSHAD-SF Technical Guidelines and the requirements of concerned authorities:

(i) determine the potential of employees' exposure to laboratory hazards including chemicals, biological, and radiations;

(ii) determine the potential health risks to employees associated with exposures;

(iii) consider the hazardous materials' Threshold Limit Value (TLV) while evaluating potential health risks to employees associated with chemical exposures; and

(iv) conduct exposure monitoring, through applicable process including air sampling, if there is reason to believe that employees may be exposed to chemicals above the TLV.

6.2 Medical Surveillance

(a) Employers should ensure to:

(i) determine hazard (leaks, chemicals, spills, radiation) exposure to which requires medical surveillance;

(ii) provide all potentially exposed employees, medical examination by a licensed physician, including any follow-up examinations which the examining physician determines to be necessary;

(iii) provide medical consultation by a licensed physician whenever a spill, leak, explosion or other occurrence results in the likelihood that a laboratory employee experienced a hazardous exposure, in order to determine whether a medical examination is needed;

(iv) provide medical examination by a licensed physician whenever an employee develops signs or symptoms associated with a hazard to which he or she may have been exposed in the laboratory;

(v) establish medical surveillance for an employee as required by the applicable standard when exposure monitoring reveals exposure levels routinely exceeding the TLV;

(vi) provide the examining physician with the identity of the hazardous material(s) to which the individual may have been exposed, and the conditions under which the exposure may have occurred, including quantitative data, where available, and a description of the signs and symptoms of exposure the employee may be experiencing;

(vii) provide all medical examinations and consultations to the employees periodically or as required by the relevant authority;

(viii) have the examining physician complete a written opinion that includes the following information:

1. diagnosis with signs and symptoms;
2. recommendations for further medical follow-up;
3. the results of the medical examination and any associated tests;
4. any medical condition revealed in the course of the examination that may place the individual at increased risk as a result of exposure to a hazardous chemical in the workplace; and
5. a statement that the employee has been informed of the results of the consultation or medical examination and any medical condition that may require further examination or treatment. However, the written opinion should not reveal specific findings of diagnoses unrelated to occupational exposure.

(ix) have a copy of the examining physician's written opinion provided to the exposed employee.

7. Health & Hygiene

(a) *OSHAD-SF – CoP 8.0 – General Workplace Amenities* stipulates mandatory requirements about provision of drinking water, sanitary convenience and washing facilities at the workplace. *OSHAD-SF - CoP 9.0 – Workplace Wellness* stipulates mandatory requirements for workplace health promotion program.

(b) Food, drink, tobacco products, smoking, eating, gum, medications, cosmetics or handling contact lenses should not be allowed in areas where chemical, biological, or radioactive materials are used or stored.

(c) Food intended for research, teaching, or laboratory activities should be labeled “Not for Human Consumption.”

(d) Laboratory refrigerators, ice chests and cold rooms should never be used to store food or drink.

(e) Laboratory glassware, containers, and equipment should not be used to prepare, consume or store food. These activities greatly increase the risk of ingestion of harmful substances.

(f) Mouth suction for pipetting or starting a siphon is prohibited.

(g) Clothing worn in the laboratory should offer protection from splashes and spills, should be easily removable in case of incident, and where required should be at least fire resistant. Non-flammable, nonporous aprons offer the most satisfactory and the least expensive protection. Lab jackets or coats should have snap fasteners rather than buttons so that they can be readily removed. These coats are to be fastened closed while working and removed prior to exit from the laboratory.

(h) Laboratory clothing should be kept clean, washed/laundered separately and replaced when necessary. Clothing should be replaced or laundered using appropriate decontamination procedures whenever contamination is suspected. Appropriate storage facilities should be provided for laboratory clothing.

(i) Lab coats should not to be worn outside the laboratory, especially in rest room or break facilities. Any lab coats, respirators, or other protective equipment should be left in the lab areas. Employees should, as a matter of routine, be responsible for washing, cleaning, and any other decontamination required when passing between the lab and the other areas. Washing should be done with soap and water, not with solvents.

(j) Liquid hand soap, sanitizer / disinfectants and towels (preferably paper towels) should be provided at the laboratory sink.

(k) Hands and other exposed skin should be washed after using chemical, biological and radiological materials and before leaving the laboratory as well as between glove changes.

(l) Employees should wash thoroughly before leaving the laboratory area, before each work break, and before the end of the work shift. Depending on the hazard, employees may need to shower at the end of the work shift.

(m) Organic solvents should not be used for washing; they remove natural protective oils from the skin, which can cause skin irritation and inflammation

(n) Washing with organic solvents may increase the risk of toxic chemicals being absorbed through the skin.

(o) Employees should keep hands and other items away from the mouth and eyes as well as any open skin wounds.

8. Housekeeping

(a) *OSHAD-SF – CoP 8.0 – General Workplace Amenities* stipulates mandatory requirements about housekeeping.

(b) Laboratory bench tops and other work surfaces should provide enough space to safely carry out procedures. Laboratory bench tops should be smooth and crack free for easy cleaning.

(c) Aisles and egress routes should be clear to allow for prompt evacuation in the event of a spill, fire or other emergency.

(d) The following should be maintained in the laboratory at all times:

  (i) flammable materials are kept away from ignition sources;

  (ii) incompatible materials are separated;

  (iii) emergency equipment and supplies (eyewash, shower, spill kit, and fire extinguisher) are readily accessible; and

  (iv) fume hoods are kept uncluttered.

(e) Shelves, cabinets, refrigerators and other storage equipment should be kept orderly.

(f) All containers should be labeled with at least the identity of the contents (including compressed gases) and the hazards those materials present to users. Label information should be visible.

(g) Storage on the floor should be limited and temporary in nature.

(h) Sinks should be typically clear of dirty glassware.

(i) Pneumatic and gas tubing, power, control and data wiring, should be routed so they are protected from physical damage, do not create a tripping hazard, and are adequately secured to appropriate infrastructure.

(j) Surfaces should be promptly cleaned if contaminated with hazardous materials and periodically cleaned as required.

(k) The work area should be cleaned up on completion of an operation or at the end of each day.

(l) Garbage, recyclables, and surplus equipment and materials should be removed regularly. Refer to Section 13.0 on Waste Management.

9. Laboratory Ventilation

(a) *OSHAD-SF – CoP 52.0 – Local Exhaust Ventilation* stipulates mandatory requirements for ventilation system(s).

(b) The laboratory should have a general ventilation system with air intakes and exhaust located so as to avoid intake of contaminated air.

(c) The general ventilation system should be designed to:

(i) provide a source of air for breathing and for input to local ventilation devices;

(ii) ensure that laboratory air is continually replaced, preventing build-up of air concentrations of toxic substances during the working day; and

(iii) direct air flow into the laboratory from non-laboratory areas and out to the exterior of the building.

(d) While using the Lab Fume Hoods, the user should:

(i) set-up work 6 inches behind the plane of a fume hood sash;

(ii) never put own head inside of a fume hood;

(iii) not clutter or use a fume hood for storage;

(iv) maintain face velocity in 80-110 feet per minute (fpm) range, depending on the type of fume hood. Face velocity is the pull of air that moves fumes from the fume hood through the ductwork;

(v) immediately inform the supervisor or a designated employee if a fume hood is not functioning properly;

(vi) work with the fume hood sash in the lowest possible position; and

(vii) keep the sash closed when not working in the fume hood.

(e) A laboratory fume hood with 0.75 m of hood-space for each person should be provided if two or more people spend most of their time with materials / chemicals.

(f) Each laboratory hood should be equipped with a real-time flow monitoring device (e.g., a hood static pressure monitoring device) to allow for confirmation of hood performance before use.

(g) Lab fume hood or other local ventilation device should be used when working with any volatile substance with Threshold Limit Value (TLV) of less than 50 parts per million (ppm).

(h) Lab fume hoods should not be used as a means of disposing of toxic or irritating materials, but only as a means of removing small quantities of vapor which might escape during laboratory operations. If vaporization of large quantities of such materials is a necessary part of the operation, a means of collecting the vapor by distillation or scrubbing should be considered, rather than allowing it to escape through the hood vent. The collected liquid can then be disposed of as a liquid waste.

(i) Other exhaust ventilation systems such as ventilated chemical storage cabinets, canopy hoods, snorkels, etc., should be provided as needed. Each canopy hood and snorkel should have individual exhaust ducts.

(j) Ventilation system requirements for laboratories exposed to biological hazards with potentially high risk of exposure:

(i) an inward flow of fresh air should be maintained by forced extraction of laboratory air to minimize the spread of aerosols in the event of an inadvertent spill;

(ii) recirculated air should be filtered to remove airborne particulates. Where long term build-up of particulate material can be hazardous to personnel, filtration should occur before air leaves the laboratory;

(iii) ventilation system components such as filters and filter plenums can accumulate particulates. Any special precautions that are required for maintenance personnel should be noted at points of access to this equipment; and

(iv) ventilation air should not be directed towards doors or located in positions that can disturb air flow at Biological Safety Cabinets (BSC).

(k) Exhaust air from glove boxes and isolation rooms should be passed through scrubbers or filters prior to release into the regular exhaust duct systems.

(l) Exhaust fans in glove boxes should be flame/explosion proof where required.

(m) Air exhausted from lab fume hoods should not be recirculated.

(n) Toxic substances should not be released in atmospherically controlled rooms that have air-conditioning.

(o) Materials for which the ventilation system is designed should only be used.

(p) Engineering controls including ventilation system should only be used as designed and not be modified unless appropriate testing and certification clearly indicates that protection of personnel will be equal to or greater than the original protection afforded by the control device. Refer to Section 11.0 for Test, Inspection & Maintenance requirements.

10. Personal Protective Equipment

(a) *OSHAD-SF – CoP 2.0 – Personal Protective Equipment* stipulates mandatory requirements for workplace PPE. The following should be considered for Laboratory's Personnel Protective Equipment policy:

(i) appropriate PPE should be provided and replaced at no cost to the employees;

(ii) safety glasses should be worn at all times inside the laboratory;

(iii) chemical goggles should be worn when handling more hazardous chemicals where there is potential for a chemical splash;

(iv) the use / handling of contact lenses in the laboratory should be prohibited;

(v) eye and face protection with filtered lenses designed to protect against light radiation are required when working with lasers, UV lamps, welding, or other sources of light radiation. Should select the appropriate lens shade or filter for the operation performed;

(vi) regular prescription eyeglasses are not acceptable as safety glasses. They provide neither splash protection nor impact resistance. However, safety goggles or OTG ('over the glasses') safety glasses may be worn over prescription glasses in the laboratory;

(vii) prescription safety glasses may be worn if they meet ANSI Z87.1-2003 impact resistance standards and have side shields, because regular prescription safety glasses may not fit tightly against the forehead;

(viii) face shields should be worn as splash protection when handling corrosive materials. Full-face shields provide additional protection to the face and neck and should be worn when conducting particularly hazardous operations. Safety glasses or goggles should be used in conjunction with a full-face shield. Where possible, a safety shield should be placed around potentially dangerous experiments;

(ix) hand protection should be worn to prevent skin absorption of harmful substances, cuts, lacerations, abrasions, chemical burns, punctures, or thermal burns from harmful temperature extremes. Elastomeric gloves used for chemical resistance should be constructed of elastomers resistant to the material used. Selection is based on elastomer thickness, permeation breakthrough time (in minutes), permeation rate and resistance to degradation;

(x) appropriate gloves as specified in the SDS should be worn while handling chemicals (surgical gloves should not be worn as they may not provide protection from chemical exposure);

(xi) gloves should be inspected prior to use, washed before removal and periodically replaced. Disposable gloves should be discarded after each use, in appropriate trash containers;

(xii) body protection should be worn to protect skin from harmful contaminants (i.e., dusts, fogs, fumes, gases, mists, smokes, sprays, splashes, or vapors), limit contamination of personal clothing, and aid the decontamination process. Lab coats should constitute minimum body protection when working in laboratories. Elastomeric equipment (such as acid-resistant aprons) used for chemical resistance should be constructed of elastomers resistant to the material used. Wearing of dress exposing body parts (shorts, short skirts etc.) in laboratories should be prohibited. The required lab coat or non-permeable apron should cover the knees;

(xiii) laboratory coats should be worn when working in the lab to prevent contamination of personal clothing. If contaminated by chemical agents, laboratory coats should be immediately removed and placed in appropriate receptacles. Should refer to SDS for additional protective equipment such as chemical resistant aprons and foot coverings that may be required when working with certain chemicals;

(xiv) employer should ensure providing the appropriate laundry facilities at no cost to the employees for laboratory clothing. Contaminated laundry should be handled with appropriate care;

(xv) hearing protection is recommended when laboratory operations produce noise levels at or above 85db(a);

(xvi) respiratory protection may be required to prevent exposure to airborne contaminants when engineering controls (i.e., biological safety cabinets, fume hoods, etc.) prove inadequate. A medical exam, fit test and specialized training should be given before using a respirator. The ideal scenario is one where engineering controls (e.g. containment, ventilation) make the use of respirators unnecessary;

(xvii) respirators should be worn in the laboratory only in emergency situations or when engineering controls are not feasible to reduce an exposure level to personnel below the threshold limit value (TLV). All lab personnel using respiratory protective equipment should complete the required training and receive a qualitative or quantitative fit test;

(xviii) safety shoes should be worn while working inside the laboratory. Sandals, perforated shoes, canvas athletic shoes, flip-flops, and other open-toed shoes expose the feet to chemicals as well as sharp objects and are not permitted; and

(xix) appropriate storage facilities should be provided for storage and protection of PPE when it is not being used.

11. Equipment Test, Inspection & Maintenance

(a) *OSHAD-SF – CoP 36.0 – Plant and Equipment* stipulates mandatory requirements for test, inspection, maintenance, repair and modifications of plant and equipment.

(b) All equipment used in the laboratory should function properly and safely. To ensure this, laboratories should maintain equipment according to manufacturer's specifications or established guidelines, perform routine inspections for common problems, corrosion, damaged electrical cords, excessive contamination, leaks, worn parts, etc. and ensure that protections including alarms, guards, interlocks or other safety devices have not been disconnected or disabled.

(c) Equipment should be tested, inspected, calibrated (as applicable), labelled and maintained by a competent person or an entity.

(d) The following equipment should be inspected as per the manufacturers' / suppliers' recommended schedule or as prescribed in facility specific test and maintenance program considering applicable mandatory requirements set by concerned authorities. Laboratory personnel should also inspect these items on a monthly basis and report any issues to concerned supervisors.

(i) biological safety cabinets – at least once a year;

(ii) eyewash stations – every six months, and laboratory personnel should inspect and flush monthly;

(iii) fire extinguishers – Inspected monthly;

(iv) fume hoods – serviced annually; and

(v) safety showers – serviced annually.

(e) Lab fume hoods and ventilation systems should be inspected when installed or modified and at least annually thereafter. The inspection should include:

(i) visual inspection of the physical condition of the hood, sash and ductwork;

(ii) air flow indication systems;

(iii) face velocity;

(iv) verification of inward air flow over the entire hood face (smoke test); and

(v) changes in chemicals or work practices that may affect hood performance.

12. Emergency Management

(a) *OSHAD-SF – Element 6 – Emergency Management* stipulates mandatory requirements for emergency management. While establishing the Emergency Management Plan for Laboratories, employers should comply with requirements set by concerned Competent Authorities, and should consider the following:

(i) fire Management plan; and

(ii) emergency evacuation plan

(b) Emergency Response Plan specific to the risks within the entity should address scenarios identified through risk assessment and the procedures to mitigate these. It should include procedures for the identified emergency scenarios including ventilation failure, spills, fire, exposures, evacuation, and need for medical care.

(c) Laboratory emergency equipment should include at a minimum:

(i) fire extinguishers;

(ii) fire alarms;

(iii) safety showers;

(iv) eye wash stations;

(v) first aid kits;

(vi) fire blanket;

(vii) chemical response spill kits; and

(viii) emergency shut-off on equipment.

(d) Appropriate Fire Protection should be provided as per the requirements of the latest published version of the *UAE Fire and Life Safety Code*.

(e) An alarm system to alert people in all parts of the facility including isolated areas such as cold rooms should be provided. Personnel should be familiar with the location and operation of the equipment.

(f) Evacuation routes and alternatives should be identified and an outside assembly area or areas should be designated. All personnel should be trained in the correct emergency response procedures.

(g) Brief guidelines for shutting down operations during an emergency or evacuation should be developed and communicated to all personnel.

(h) Safety shower and eyewash stations should be provided and tested / inspected as per the suppliers' / manufacturers' recommendations and workplace requirements. *OSHAD-SF – CoP 36.0 – Plant and Equipment* should be consulted for applicable requirements.

(i) Adequate lighting and emergency lights should be provided as per the standard requirements and in compliance with *OSHAD-SF – CoP 8.0 – General Workplace Amenities*.

(j) Prominent signs and labels addressing laboratories' hazards and risks should be posted in the laboratory. *OSHAD-SF – CoP 17.0 – Safety Signage & Signals* should be consulted for applicable requirements.

(k) Telephone numbers of emergency personnel/facilities to be contacted in the event of fire, accident, severe weather, or hazardous chemical spill should be prominently posted and employees aware of the action to take in the event of an emergency.

(l) Identification labels, showing contents of containers, appropriate hazard warnings as per NFPA 704 and as provided in the SDS should be installed.

(m) Location signs for safety showers, eyewash stations, other safety and first aid equipment, exits and areas where food and beverage consumption and storage are permitted should be posted as per the requirements of *OSHAD-SF – CoP 17.0 – Safety Signs and Signals*

(n) A spill control policy should be developed and should include consideration of prevention, containment, clean up, and reporting. Refer to Section 13 Waste Management.

(o) Accidental releases and spills of chemicals or other harmful substances should be controlled immediately. The following should be considered:

(i) employees who clean up spills of hazardous materials should be adequately instructed in the safe procedures;

(ii) the clean-up operation should be supervised by someone who is knowledgeable in the hazards involved, the precautions required and trained in safe clean-up procedures;

(iii) any personal protective equipment that will be required during emergency clean-up or escape should be stored in a condition and location so that it is immediately available;

(iv) before attempting to clean up a particular spill, employees should consult the SDS for information on specific spill clean-up procedures and personal protective equipment required;

(v) while dealing with spills, care should be taken for the potential contamination hazards and any decontamination requirements after the clean-up; and

(vi) employees should be aware of all hazards associated with the material(s) that require clean-up. For example, when cleaning up flammable solvents, use an absorbent material that controls flammable vapors as well as the flammable liquid.

(p) Emergency routes and exits

(i) access to exits, emergency equipment and utility controls should not be blocked;

(ii) fire doors should be kept closed;

(iii) laboratory access should be controlled at all times (lock doors when lab is unoccupied); and

(iv) each laboratory employee should be familiar with the location, application, and correct ways to operate the following equipment:

1. fire extinguishers;
2. fire alarms;
3. safety showers;
4. eyewash stations;
5. first aid kits;
6. chemical response spill kits;
7. emergency shut-off on equipment; and
8. location of emergency telephone numbers and telephones.

13. Waste Management

(a) *OSHAD-SF – CoP 54.0 – Waste Management* stipulates mandatory requirements for Waste Management and *OSHAD-SF CoP 1.0 – Hazardous Materials* defines requirements about management of Hazardous Material.

(b) When establishing Laboratory Waste Management Programs, employers should also consider the regulations set by relevant competent authorities.

(c) Laboratory waste management program(s) should specify how solid waste is collected, segregated, stored, and transported and include consideration of what materials can be incinerated.

(d) Solid waste should be carefully segregated, placed in appropriately labeled receptacles (impervious for contaminated waste) and removed from laboratories in to a central waste storage area and from the central waste storage area at regular intervals in accordance with the competent authority requirements.

(e) Laboratory waste management program should also address laboratory wastewater storage, treatment and disposal requirements in compliance with the applicable regulations.

(f) Indiscriminate disposal by pouring waste chemicals down the drain or adding them to mixed refuse for landfill burial should not be permitted.

(g) All non-emergency spills should be promptly cleaned, using appropriate personnel protective equipment and disposal equipment.

14. Recordkeeping

(a) *OSHAD-SF – Element 9 – Compliance and Management Review* stipulates mandatory requirements for recordkeeping.

(b) Employers should maintain an accurate record of exposure monitoring activities and exposure measurements as well as medical consultations and examinations, including medical tests and written opinions.

(c) Such records should be maintained, transferred, and made available, to an individual's physician or made available to an employee or his/her designated representative upon request.

(d) Employers should maintain test, inspection and maintenance record(s) for laboratory systems and equipment including, but not limited to, ventilation System(s), lab fume hoods, fire system, laboratory equipment, safety shower and eyewash stations etc.

15. References

- *OSHAD-SF – Element 1 – Roles, Responsibilities and Self-Regulation*
- *OSHAD-SF – Element 2 – Risk Management*
- *OSHAD-SF – Element 3 – Management of Contractors*
- *OSHAD-SF – Element 4 – Communication and Consultation*
- *OSHAD-SF – Element 5 – Training, Awareness and Competency*
- *OSHAD-SF – Element 7 – Monitoring, Investigation and Reporting*
- *OSHAD-SF - Element 8 – Audit and Inspection*
- *OSHAD-SF – Element 9 – Compliance and Management Review*
- *OSHAD-SF – Mechanism 11.0 – Incidents, Notification, Investigation & Reporting*
- *OSHAD-SF - CoP 1.0 – Hazardous Material*
- *OSHAD-SF – CoP 2.0 – Personal Protective Equipment"*
- *OSHAD-SF – CoP 3.0 – Occupational Noise*
- *OSHAD-SF – CoP 4.0 – First Aid & Emergency Medical Treatment*
- *OSHAD-SF – CoP 8.0 – General Workplace Amenities*
- *OSHAD-SF – CoP 9.0 – Workplace Wellness*
- *OSHAD-SF – CoP 14.0 – Manual Handling & Ergonomics*
- *OSHAD-SF – CoP 15.0 – Electrical Safety"*
- *OSHAD-SF – CoP 17.0 – Safety Signage & Signals*
- *OSHAD-SF – CoP 24.0 – Lockout / Tagout (Isolation)*
- *OSHAD-SF – CoP 30.0 – Lone Working and/or in Remote Locations*
- *OSHAD-SF – CoP 36.0 – Plants & Equipment*
- *OSHAD-SF – CoP 49.0 – Compressed Gases & Air*
- *OSHAD-SF – CoP 52.0 – Local Exhaust Ventilation*
- *OSHAD-SF – CoP 54.0 – Waste Management*
- *OSHAD-SF – TG – The Process of Risk Management*
- *OSHAD-SF – TG – Occupational Air Quality Management*

- *OSHAD-SF – Occupational Standards and Guidelines Values*
- *OSHA Laboratory Standard 29 CFR 1910.1450*

16. Document Amendment Record

Version	Revision Date	Description of Amendment	Page/s Affected
3.0	1st May 2017	New Document	N/A