

SAFETY MANUAL



JORDAN UNIVERSITY OF SCIENCE AND TECHNOLOGY

Prepared By:

Dr. Atallah Rabi - Dr. Mamdouh Allawzi - Eng. Riad Al-Zoubi

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CONTACT INFORMATION

ALL EMERGENCIES - CHEMICAL, MEDICAL, or FIRE.....22880 & 22929

JUST CIVIL DEFENCE CENTER..... 22880

OPERATION AND MAINTENANCE UNIT....22814

ENVIRONMENTAL, HEALTH & SAFETY SECTION22929

KING ABDULLAH HOSPITAL EMERGENCY.....44444

STUDENT HEALTH CLINIC..... ..22599

RADIATION PROTECTION OFFICER0788158651

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List of Abbreviation

AAS	: Atomic absorption spectrophotometers
ACGIH	: American Conference of Governmental Industrial Hygienists
CCDD	: Campus Civil Defense Office
CDs	: Cytotoxic/antineoplastic drugs
CPE	: Chlorinated polyethylene.
CPR	: Cardio Pulmonary Resuscitation
EHSS	: Environmental Health and safety Section
HEPA	: High Efficiency Particulate Air.
HIV	: Human Immunodeficiency Virus
ICP's	: Inductively coupled argon spectrometers
JUST	: Jordan University of Science and Technology
KAUH	: King Abdullah University Hospital
MSDSs	: Material Safety Data Sheets
MOU	: Maintenance and Operation Unit
NEAR	: NOTIFY, EVALUATE, ASSEMBLE, and REPORT.
NFPA	: National Fire Protection Association.
OSHA	: Occupational Safety and Health Administration
PAU	: Personal Affairs Unit in JUST
PELs	: Permissible exposure limits
PPE	: Personal Protective Equipment
PVC	: Polyvinyl Chloride
SSC	: Social Security Council.
PVC	: Polyvinyl Chloride
TLV	: threshold limit value
UHSCDC	: University Higher Safety and Civil Defense Committee

Chapter 1

Environmental Health and Safety in JUST

SECTION 1.1-Mission Statement

The Jordan University of Science and Technology (JUST) in its role as a national and international teaching and research based University offering undergraduate and postgraduate education, is committed to embracing environmental management goals within University activities. These goals will extend to providing community leadership on environmental health and safety issues through quality research and education programs and to the provision of expert advice on environmental health and safety matters of public interest.

The University recognizes its role in educating future leaders who will be in a position to make decisions enhancing Jordan's environmental health sustainability. As the University plays a part in molding environmental health and safety values, Faculty Deans will be responsible for ensuring that programs are made available to enable students and staff to be aware of and to actively support environmental health and safety education programs and research.

The University has a mission to provide safety and advisory services to the University Higher Safety Community through managing risk, assessing and evaluating the environment, advocating safe work practices, providing quality educational programs and ensuring compliance with University and regulatory standards. We are committed to fostering a safe and healthful environment for students, employees and visitors to this manual describes our range of services and provides access to essential safety information for the University community

SECTION 1.2- Policy

The University recognizes its obligation to take all reasonable precautions to provide and maintain so far as is practicable, an environment that is safe and without risks to health for employees, students and visitors. The University shall establish, maintain and support an Environmental Health and Safety Section (EHSS) to design, implement, and audit management systems for occupational health and safety and environmental due diligence. It is the policy of JUST, as far as is reasonably practicable, to:

1. Provide an environment in which staff, students and visitors can function without risk to their health or safety.
2. Ensure that the University is a safe place, and that the environment, facilities, equipment and substances are subject to safe systems of work to prevent risks to health or safety.
3. Provide and maintain an environment that is suitable with regard to facilities and arrangements to safeguard the occupational health requirements and welfare of employees and students.
4. Provide an environment in which everyone can carry out their tasks without fear of intimidation, harassment, violence, or undue stress.
5. To identify the need for, and to provide, training, instruction, information and supervision to all staff and students.

6. Provide a means of consultation on environmental health and safety matters for all employees, their representatives and the student representatives.
7. Promote personal responsibility and effort on the part of everyone to avoid and prevent health hazards and injuries to themselves and to others who may be affected by their acts or omissions and to co-operate with the University to comply with its duties, requirements and statutory obligations.
8. Ensure that all those with responsibilities for managing equipment or premises, or supervising others, are aware that these responsibilities include health and safety requirements and the need to carry out risk assessments for all potentially hazardous activities.
9. Ensure that the principles of good health and safety management are applied to all activities undertaken by the University, including activities such as events, travel, and field trips.
10. Provide support on matters of occupational safety through the University Environmental Health and Safety Officers who will be responsible for advice to the organization, for regular auditing, and who has the responsibility and authority for enforcement.
11. Monitor the health and safety performance of the University through regular reports to University President, and to publicly report on health and safety performance.
12. Appoint specialist officers to provide advice to the University within the realms of their expertise.
13. Make arrangements to act upon health and safety matters at all levels through Departmental meetings and through the University Health and Safety Committee.
14. Display and publicize this statement and review it at least bi-annually.

SECTION 1.3-Objectives

The absence or minimization of risk also includes occupational health in the prevention of accidental exposure to agents which may cause occupational diseases. Thus ergonomics, industrial hygiene, toxicology, biological safety and radiation safety are all part of the University's safety management programs.

To meet its obligations and to ensure legislative compliance, the University has developed a safety management program, using the principles of quality and risk management which aims to:

1. observe and implement relevant statutory requirements;
2. promote workplace safety by education, information, instruction and training;
3. ensure that adequate instruction is given to employees in safe working procedures and that they are informed of any hazard to their health which is known to be associated with work, including off-campus activities in which they are engaged;
4. ensure that situations or work practices which are unsafe or harmful are reported immediately to the supervisor of the employee or student, so that corrective action can be taken;
5. encourage each person in the University to regard accident prevention as an individual responsibility;

6. require the head of each academic and administrative department to apply relevant Policies and Procedures of the University, as published in the Environment Health and Safety Manual, to the specific needs of the Department, including where students or staff are located at another site in consultation with staff of the Risk Management Office and local staff;
7. establish procedures to check Environment Health and Safety (EHS) standards in any other location or country that staff or students may be working;
8. require that every hazardous incident in the University is reported and, where appropriate investigated, and ensure any action necessary to reduce further risk is implemented;
9. establish procedures to minimize the risk of harmful effects of fire, explosion, radiation, biological hazards and chemical release and ensure these procedures are regularly monitored;
10. maintain (in the workplace) proper control of harmful substances (i.e. chemicals, radiation, fire hazards, biological hazards etc.), air pollution and noise;
11. establish procedures for the evacuation of buildings in the event of fire, explosion or other emergencies and ensure those procedures are appropriately tested;
12. ensure that machines and equipment are maintained in a safe condition and that necessary personal protective devices are available in the workplace;
13. provide adequate occupational health services and monitoring programs;
14. maintain proper control over the storage, use and disposal of hazardous substances and dangerous goods;
15. post clearly visible signs and notices as required;
16. Ensure that adequate professionally trained staff is available to co-ordinate and supervise the University's safety management program.

CHAPTER 2 EMERGENCY RESPONSE

During the course of normal laboratory operations there is always the potential for an emergency situation to arise. These emergencies can be the result of a chemical spill, fire, or the need for medical assistance. In the event of an emergency, an emergency response plan should be implemented. This plan would include evacuation of the facility if such action is deemed appropriate. Internal communication is very important during any emergency situation. It is essential that all employees know how to act and react during the emergency. To accomplish this, it is necessary that a written emergency response plan be developed and that all employees are trained and participate in drills. All accidents, regardless of severity, should be reported and investigated. Key elements of an emergency procedure plan are summarized by the acronym **NEAR** – **NOTIFY**, **EVALUATE**, **ASSEMBLE**, and **REPORT**.

SECTION 2.1 - CHEMICAL SPILLS

All chemical spills shall be reported in writing to EHSS 22929 regardless of size. The report shall include the date, time, location, chemical(s) and their volume, and names of all persons involved, including any visitors who were exposed and personnel involved in the clean up. A copy of this report shall also be kept by EHSS.

A: Emergency Spill

A chemical spill is classified as an Emergency Spill whenever it:

1. Causes personal injury or chemical exposure that requires medical attention;
2. Causes a fire hazard or uncontrollable volatility;
3. Requires a need for breathing apparatus of the supplied air or self-contained type to handle the material involved;
4. Involves or contaminates a public area;
5. Causes airborne contamination that requires local or building evacuation;
6. Causes a spill that cannot be controlled or isolated by laboratory personnel;
7. Causes damage to (EHSS) property that will require repairs;
8. Involves any quantity of metallic mercury;
9. Cannot be properly handled due to lack of local trained personnel and/or equipment to perform a safe, effective cleanup;
10. Requires prolonged or overnight cleanup;
11. Involves an unknown substance; or
12. Enters the land or water.

Although the following tactics are prioritized in terms of usual preferred action sequences, each spill incident is unique and involves persons with varying levels of spill expertise and experience. Thus, for any individual incident, isolation of the spill and/or securing the area might best occur prior to or simultaneously with contacting Campus Civil Defense Office (CCDD) telephone (22880)

1. Contact (22880) for (CCDD) Assistance.
1. Don't panic! Always ask for help first, *if possible*.
2. If the spill presents an immediate danger, leave the spill site and warn others, prevent entry to the spill site, and wait for (CCDD) response.
3. Remove contaminated clothing. Flush skin/eyes with water at least 15 to 30 minutes; use soap for intermediate and final cleaning of skin areas.
4. Protect yourself, and then remove injured person(s) to fresh air, if it is safe to do so.
5. Notify nearby persons and evacuate as necessary.
6. Prevent entry, as necessary, by posting a guard in a safe area and/or shutting doors.
7. If flammable vapors are involved, do not operate electrical switches unless to turn off motorized equipment. Try to turn off or remove heat sources, where safe to do so.
8. If the substance involved is unknown, then emergency spill response procedures are limited to self-protection, notification of (CCDD) at (22880) for response, isolation of the chemical, and evacuating and securing the area involved.
9. Do not touch the spill without the use of appropriate personal protective equipment (PPE).
10. Where the spill does not present immediate personal danger, try to control the spread and the volume of the spill. This could mean shutting a door, moving nearby equipment to prevent further contamination, repositioning an overturned container or one that has a hole in the bottom or side, creating a dike by putting an absorbent around a spill or opening the sashes on the fume hoods to facilitate removal of vapors.
11. Never assume gases or vapors do not exist or are harmless because of lack of smell.
12. Increase ventilation by opening closed fume hood sashes to the 25 cm or full open position. Exterior doors may be opened to ventilate non-toxic vapors.
13. Use absorbents to collect substances.
14. Reduce vapor concentrations by covering the surface of a liquid spill with absorbent.
15. Control enlargement of the spill area by diking with absorbent.

B: Minor Spills

Minor spills are those spills which do not fit the requirements for Emergency Spills. The following general procedures should be used for all minor spills:

1. Attend to any persons who may have been contaminated. If these persons require medical attention this is an Emergency Spill (See above).
2. Notify persons in the immediate area about the spill.
3. Evacuate all nonessential personnel from the spill area.
4. If the spilled material is flammable, turn off ignition and heat sources.
5. Avoid breathing vapors of the spilled material. If respiratory protection is necessary this is an Emergency Spill (See above).

6. Leave on or establish exhaust ventilation if it is safe to do so.
7. Secure supplies to effect cleanup.
8. Use appropriate PPE.
9. Spilled Liquids:
 - a. Confine or contain the spill to a small area. Do not let it spread.
 - b. For small quantities of inorganic acids or bases, use a neutralizing agent or an absorbent mixture (e.g., soda ash or diatomaceous earth). For small quantities of other materials, absorb the spill with a non-reactive material (such as vermiculite, clay, dry sand, or towels).
 - c. For larger amounts of inorganic acids and bases, flush with large amounts of water (providing the water will not cause additional damage). Flooding is not recommended in storerooms where violent spattering may cause additional hazards or in areas where water-reactive chemicals may be present.
 - d. Mop up the spill, wringing out the mop in a sink or a pail equipped with rollers.
 - e. Carefully pick up and clean any cartons or bottles that have been splashed or immersed.
 - f. If needed, vacuum the area with a HEPA filtered vacuum cleaner approved and designed for the material involved.
 - g. If the spilled material is extremely volatile, let it evaporate and be exhausted by the laboratory hood (provided that the hood is authorized for use with the spilled chemical).
10. Spilled Solids:

Generally, sweep spilled solids of low toxicity into a dust pan and places them into a container suitable for that chemical. Additional precautions such as the use of a vacuum cleaner equipped with a(HEPA) filter may be necessary when cleaning up spills of more highly toxic solids.
11. Dispose of residues according to safe disposal procedures. Remembering that personal protective equipment, brooms, dust pans, and other items may require special disposal procedures. (See Section 3.4 - "Chemical Waste").
12. Report the chemical spill in writing as required above.

C: Mercury Handling and Spill Clean Up

1. Health Effects:

The American Council of Government Industrial Hygienists (ACGIH) has established a threshold limit value (TLV) of 0.05 mg mercury/m³ of air (0.05mg/m³) based on an 8-hour day and 40-hour week. The(TLV) for mercury also carries a "skin" notation, which indicates that metallic mercury can be absorbed into the body as well as through inhalation and ingestion into the skin. Mercury vapors are odorless, colorless, and tasteless. A quantity as small as 1 milliliter can evaporate over time, as raise levels in excess of allowable limits. Mercury poisoning from exposure by chronic inhalation can cause emotional disturbances, unsteadiness, inflammation of the mouth and gums, general fatigue, memory loss, and headaches. In most cases of exposure by chronic inhalation, the symptoms of

poisoning gradually disappear when the source of exposure is removed. Improvement, however, may be slow and complete recovery may take years.

2. Storage and Handling:

Because of the health effects of mercury, the extremely difficult and time-consuming procedures required to properly clean spills, every effort should be taken to prevent accidents involving mercury. Always store mercury in unbreakable containers and in a well-ventilated area, if breakage of instruments or apparatus containing mercury is a possibility, the equipment should be placed in an enameled or plastic tray or pan that can be cleaned easily and is large enough to contain the mercury. Transfers of mercury from one container to another should be carried out in a hood, over a tray or pan to confine any spills. If at all possible, the use of mercury thermometers should be avoided. If a mercury thermometer is required, many are now available with a Teflon[®] coating that will prevent shattering. Always wash hands after handling mercury to prevent skin absorption or irritation.

3. Air Monitoring:

Any mercury spill has the potential to generate airborne concentrations in excess of regulated levels. Contact EHSS at (22929) for air monitoring of the spill area before cleanup to determine the airborne concentration. Large spills or spills with elevated vapor levels may dictate cleanup by a qualified contractor.

4. Protective Clothing:

1. For small spills, a laboratory coat, safety glasses, and gloves should be used.
2. Gloves made of the following have been rated as excellent for protection against elemental mercury:
 - Chlorinated polyethylene (CPE),
 - Polyvinyl Chloride (PVC),
 - Polyurethane Nitrile Rubber (also known by Viton),
 - Butyl Rubber Neoprene
 - If mercury has been spilled on the floor, the workers involved in cleanup and decontamination should wear plastic shoe covers.
 - EHSS should be called immediately if a spill is extensive enough to require workers to kneel or sit where mercury has been spilled since Tyvek[®] or similar impermeable clothing will be required.

5. Spill Kits:

Special spill kits are available from a variety of sources. If a spill kit is purchased, follow the manufacturer's directions. Alternatively, a kit can be assembled with the following components:

- a. protective gloves,
- b. mercury suction pump or disposable pipettes to recover small droplets,
- c. elemental zinc powder (or commercial amalgam material),
- d. dilute sulfuric acid (5-10%) in spray bottle,
- e. sponge or tool to work amalgam,

- f. plastic trash bag,
- g. plastic container (for amalgam), and
- h. plastic sealed vial for recovered mercury.

6. Clean Up Procedures:

- a. Wearing protective clothing, pools and droplets of metallic mercury can be pushed together and then collected by a suction pump.
- b. After the gross contamination has been removed, sprinkle the entire area with zinc powder. Spray the zinc with the dilute sulfuric acid.
- c. Using the sponge, work the zinc powder/sulfuric acid into a paste consistency while scrubbing the contaminated surface and cracks or crevices.
- d. To minimize contamination of housekeeping items, stiff paper may be used to assist in cleaning up the amalgam.
- e. After the paste has dried, it can be swept up and placed into the plastic container for disposal.
- f. Rags, shoe covers, sponges, and anything used for the cleanup should be placed in the trash bag to be disposed of as contaminated material.

SECTION 2.2 – RADIATION MATERIAL SPILLS

Emergencies will generally be in the nature of spills, fires, or explosions, as a result of which radioactive materials are spread around the installation. In the event of such DISSEMINATION OF RADIOACTIVE MATERIALS, the following general procedures are given as a guide to be adapted to the specific nature of the emergency. All spills involving radioactive material shall be reported by phone to Radiation Protection Officer (0788158651) and inform EHSS (22929) with a written follow-up submitted within five working days (unless this spill or discharge results in a fatality).

A: Minor Spills Involving No Radiation Hazard to Personnel

- 1. Notify all other persons in the room at once.
- 2. Permit only the minimum number of persons necessary to deal with the spill into the area.
- 3. Confine the spill immediately.

Liquid Spills:

- a. Don protective gloves
- b. Drop absorbent paper on the spill.

Dry Spills:

- a. Don protective gloves.
 - b. Dampen thoroughly, taking care not to spread the contamination.
- 4. Notify the faculty member in charge of the laboratory and the EHSS as soon as possible.
 - 5. Monitor all persons involved in the spill and cleaning.
 - 6. Decontaminate the area according to the directions of the EHSS

7. Permit no person to resume work in the area until a survey is made, and approval of the EHSS is secured.
8. Prepare a complete history of the accident and subsequent activity related thereto for the records of the EHSS.

B: Major Spills Involving Radiation Hazard to Personnel

1. Notify all persons not involved in the spill to vacate the room at once.
2. If the spill is a liquid, and the hands are protected, use the right the container.
3. If the spill is on the skin, flush thoroughly.
4. If the spill is on clothing, discard outer or protective clothing at once.
5. Shut off air conditioning units serving the laboratory.
6. Vacate the room.
7. Notify the faculty member in charge and the EHSS as soon as possible.
8. Take immediate steps to decontaminate personnel involved, as necessary.
9. Decontaminate the area per the recommendations of the EHSS. (Personnel involved in decontamination must be adequately protected.)
10. Monitor all persons involved in the spill and cleaning to determine adequacy of decontamination.
11. Permit no person to resume work in the area until a survey is made and approval of the EHSS is secured.
12. Prepare a complete history of the accident and subsequent activity related thereto for the records of the EHSS.

C: Accidents Involving Radioactive Dusts, Mists, Fumes, Organic Vapors, and Gases

1. Notify all other persons to vacate the room immediately.
2. Hold breath and vacate room.
3. Shut off air conditioning by master switch.
4. Notify the faculty member in charge and the EHSS at once.
5. Ascertain that all doors giving access to the room are closed and post conspicuous warnings or guards to prevent accidental opening of doors.
6. Report at once all known or suspected inhalations of radioactive materials.
7. The EHSS shall evaluate the hazard and the necessary safety devices for safe re-entry.
8. Determine the cause of contamination and rectify the condition.
9. Decontaminate the area.
10. Perform air survey of the area before permitting work to be resumed.
11. Monitor all persons suspected of contamination.
12. Prepare a complete history of the accident and subsequent activity related thereto for the records of the EHSS

D: Injuries to Personnel Involving Radiation Hazard

1. Wash minor wounds immediately, under running water, while spreading the edges of the gash.
2. Report all radiation accidents to personnel (wounds, overexposure, ingestion, and inhalation) to the faculty member in charge and the EHSS as soon as possible.
3. Call a physician. (Student Health Clinic)
4. Permit no person involved in a radiation injury to return to work without the approval of the EHSS and attendant physician.
5. Prepare a complete history of the accident and subsequent activity related thereto for the records of the EHSS.

SECTION 2.3 - BIOHAZARD SPILLS

A: Biological Spills

Biological spills outside biological safety cabinets will generate aerosols that can be dispersed in the air throughout the laboratory. These spills can be very serious if they involve microorganisms that require Biosafety Level 3 containment, since most of these agents have the potential for transmitting disease by infectious aerosols. To reduce the risk of inhalation exposure in such an accident, occupants should leave the laboratory immediately. The laboratory should not be reentered to decontaminate or clean up the spill for at least 30 minutes. During this time the aerosol may be removed from the laboratory via the exhaust ventilation systems, such as biological safety cabinets or chemical fume hoods, if present.

1. Spills on the Body
 - a. Remove contaminated clothing.
 - b. Vigorously wash exposed area with soap and water for one minute.
 - c. Obtain medical attention (if necessary).
 - d. Report the incident to the laboratory supervisor.
2. Biosafety Level 1 Organism Spill
 - a. Wear disposable gloves.
 - b. Soak paper towels in disinfectant and place over spill.
 - c. Place towels in a plastic bag for disposal.
 - d. Clean up spill area with fresh towels soaked in disinfectant.
3. Biosafety Level 2 Organism Spill
 - a. Alert people in immediate area of spill.
 - b. Put on protective equipment. This may include a laboratory coat with long sleeves, back-fastening gown or jumpsuit, disposable gloves, disposable shoe covers, safety goggles, mask or full-face shield.
 - c. Cover spill with paper towels or other absorbent materials.
 - d. Carefully pour a freshly prepared 1 to 10 dilution of household bleach around the edges of the spill and then into the spill. Avoid splashing.
 - e. Allow a 20-minute contact period.

- f. After the spill has been absorbed, clean up the spill area with fresh towels soaked in disinfectant.
 - g. Place towels in a plastic bag and decontaminate in an autoclave.
4. Biosafety Level 3 Organism Spill
- a. Attend to injured or contaminated persons and remove them from exposure.
 - b. Alert people in the laboratory to evacuate.
 - c. Close doors to affected area.
 - d. Call EHSS 22929 for campus emergency response.
 - e. Have a person knowledgeable of the incident and laboratory assist emergency personnel when they arrive.

B: Blood Spills

1. General Information

- a. Universal precautions must be observed. Refer to the Campus Blood Borne Pathogens Plan or Departmental Exposure Control Plan.....? For more information. Cleaning of blood spills should be limited to those persons who are trained for the task.
 - b. If an untrained person encounters a spill, he/she should limit access to the area and immediately call the person(s) assigned to this duty.
 - c. Only disposable towels should be used to avoid the difficulties involved in laundering.
 - d. If a spill involves broken glassware, the glass should never be picked up directly with the hands. It must be cleaned up using mechanical means, such as a brush and dustpan, tongs, or forceps.

2. Personal Protective Equipment

- a. Persons who clean blood spills should wear disposable gloves of sufficient strength so they will not tear during cleaning activities. If the gloves develop holes, tears, or splits, remove them, wash hands immediately, and put on fresh gloves. Disposable gloves must never be washed or reused.
- b. Remove gloves one at a time by grasping the wrist opening and pulling toward the fingers so that the gloves come off as inside out. Double-bag gloves with other contaminated biomedical waste (such as towels).

3. Disinfectants

Read and follow all manufacturers' handling instructions. All spills of blood and blood-contaminated fluids should be properly cleaned using any of these three disinfectants:

- a. Chemical germicides that have a label claim for tuberculocidal activity. These are chemical germicides that are approved for use as hospital disinfectants and are tuberculocidal when used at recommended dilutions.
- b. Products approved by the Ministry of Health as being effective against human immunodeficiency virus (HIV).
- c. A solution of 5.25 percent sodium hypochlorite (household bleach) diluted between 1:10 and 1:100 with water (a 1:100 dilution of common household bleach yields 500 parts per million free available chlorine - approximately ¼ cup of bleach per gallon of tap water).

4. **Cleaning Blood Spills on Hard Surfaces**

To assure the effectiveness of any sterilization or disinfection process, surfaces must first be thoroughly cleaned of all visible blood or soil before a germicidal chemical is applied for disinfection.

 - a. Isolate the area, if possible.
 - b. Wear gloves and other protective apparel as needed.
 - c. Remove visible blood with disposable towels in a manner that will ensure against direct contact with the blood. For example, put towels over the spill to absorb the liquid.
 - d. Place contaminated towels in a plastic waste disposal bag.
 - e. The area should then be decontaminated with an appropriate germicide applied according to manufacturer's directions.
 - f. All contaminated towels and gloves should be double-bagged for disposal and labeled with the biohazard symbol.
5. **Cleaning Blood Spills on Carpeting**

Use only a registered germicide. Read and follow manufacturer's instructions. Do not use chlorine bleach solution on carpet.

 - a. Isolate the area--if possible.
 - b. Wear gloves and other appropriate apparel.
 - c. Procedures for small spills on carpets (smaller than a quarter) are as follows.
 - (1) Soak the spill with enough disinfectant to cover the spot.
 - (2) Let dry at least overnight to ensure that the spot is disinfected.
 - (3) Shampoo carpet, if needed, or use 3% hydrogen peroxide to remove discoloration.
 - d. Procedures for larger spills are as follows.
 - (1) Pour disinfectant on the spot and let stand at least 30 minutes to allow some disinfection to take place. Blot up excess liquid with disposable towels.
 - (2) Soak the area with additional disinfectant. Allow to dry overnight. Shampoo carpet, if needed, or use 3% hydrogen peroxide to remove discoloration.
 - e. All contaminated towels and gloves should be double-bagged and labeled with the biohazard symbol.

C: Cytotoxic/Antineoplastic Spills

1. **General Procedures**
 - a. Spills and breakages of cytotoxic/antineoplastic drugs (CDs) should be cleaned up immediately by a properly trained person using the appropriate procedures.
 - b. Broken glass should be carefully removed.
 - c. A spill should be identified with a warning sign so that other persons in the area will not be contaminated.
2. **Personnel Contamination**

Clear contamination of gloves or gowns, or direct skin or eye contact should be treated as follows:

- a. Immediately remove the gloves or gown.
- b. Wash the affected skin area immediately with soap (not germicidal cleanser) and water. For eye exposure, immediately flood the affected eye with water or isotonic eyewash designated for the purpose for at least five minutes.
- c. Obtain medical attention immediately.

3. Clean-up of Small Spills

Spills of less than 5 ml or 5 gm outside a hood should be cleaned immediately by personnel wearing gowns, double surgical latex gloves, and eye protection.

- a. Liquids should be wiped with absorbent gauze pads, solids should be wiped with wet absorbent gauze. The spill areas then should be cleaned (three times) using a detergent solution followed by clean water.
- b. Any broken glass fragments should be placed in a small cardboard or plastic container and then into a CD disposal bag, along with the used absorbent pads and any non-cleanable contaminated items.
- c. Reusable glassware or other contaminated items should be placed in a plastic bag and washed in a sink with detergent by a trained employee wearing double surgical latex gloves.

4. Clean-up of Large Spills

For spills of amounts larger than 5 ml or 5 gm, the spread should be limited by gently covering with absorbent sheets of spill-control pads or pillows or, if a powder is involved, with damp cloths or towels. Be sure not to generate aerosols. Access to the spill areas should be restricted.

- a. Protective apparel should be used with the addition of a respirator when there is any danger of airborne powder or an aerosol being generated. The dispersal of CD particles into surrounding air and the possibility of inhalation is a serious matter and should be treated as such.
- b. Chemical inactivators, with the exception of sodium thiosulfate, which can be used safely to inactivate nitrogen mustard, may produce hazardous by-products and should not be applied to the spilled drug.
- c. All contaminated surfaces should be thoroughly cleaned with detergent solution and then wiped with clean water. All contaminated absorbents and other materials should be disposed of in the CD disposal bag.

5. Spills in Hoods

If the spill occurred in either a glove box, clean bench or biological safety cabinet, the HEPA filter (contained in the cabinet) is more than likely contaminated. Label the unit "Do Not Use--Contaminated With (name of substance)." The HEPA filter and filter cabinet must be decontaminated and the filter changed and properly disposed of. This procedure may require the services of an outside contractor trained in the use of specialized personal protective equipment.

6. Spill Kits

Spill kits, clearly labeled, should be kept in or near preparation and administrative areas. It is suggested that kits include a respirator, chemical splash goggles, and two pairs of gloves, two sheets (12x12) of absorbent material, 250 ml and one liter

spill control pillows and a small scoop to collect glass fragments. Absorbents should be suitable for incineration. Finally, the kit should contain two large CD waste-disposal bags.

7. Waste Disposal

Disposal of all CD contaminated materials must be arranged through EHSS.

SECTION 2.4 - LEAKING COMPRESSED GAS CYLINDERS

Occasionally, a cylinder or one of its component parts develops a leak. Most such leaks occur at the top of the cylinder in areas such as the valve threads, safety device, valve stem, and valve outlet.

1. If a leak is suspected, do not use a flame for detection; rather, a flammable-gas leak detector or soapy water or other suitable "snoop" solution should be used. If the leak cannot be remedied by tightening a valve gland or a packing nut, emergency action procedures should be affected. Laboratory workers should never attempt to repair a leak at the valve threads or safety device; rather, they should consult with the supplier for instructions.
2. If the substance in the compressed gas cylinder is not inert, or is hazardous, then use the procedures in Section 1.1 - "Chemical Spills".
3. If the substance in the compressed gas cylinder is inert, or non-hazardous, contact the supplier for instructions.

SECTION 2.5 - FIRES

Fires are a common emergency in a chemistry laboratory. In the event of a fire, do the following things:

1. Assist any person in immediate danger to safety, if it can be accomplished without risk to you.
2. Immediately activate the building fire alarm system. This will automatically notify the Campus CDD, EHSS and sound the fire alarm bells or horns to evacuate the building. It is best to have these people respond and not to be needed than to have them arrive too late for potential rescue.
3. If the fire is small enough, use a nearby fire extinguisher to control and extinguish the fire. Don't fight the fire if these conditions exist:
 - a. The fire is too large or out of control.
 - b. If the atmosphere is toxic.
4. If the first attempts to put out the fire do not succeed, evacuate the building immediately.
5. Doors, and if possible, windows, should be closed as the last person leaves a room or area of a lab.
6. Do not use elevators; use building stairwells.
7. When they hear the fire alarm sound, all personnel in the affected areas shall evacuate the building immediately.

8. Upon evacuating the building, personnel shall proceed to the designated meeting area (at least 150 feet(45.7m) from the affected building) where the supervisors are responsible for taking a head count and accounting for all personnel.
9. No personnel will be allowed to re-enter the building without permission of JUST Environmental Health & Safety or the Fire Department.
10. You must report all fires to (EHSS)
11. All fires will be investigated by (EHSS) and/or the (CCDD).

SECTION 2.6 - MEDICAL EMERGENCIES

Personal injury is not uncommon in laboratories. These injuries are usually minor cuts or burns but can be as severe as acute effects of chemical exposure or incidents such as heart attacks or strokes.

1. The initial responsibility for first aid rests with the first person(s) at the scene, who should react quickly but in a calm and reassuring manner.
2. The person assuming responsibility should:
 - a. Immediately summon medical help (be explicit in reporting suspected types of injury or illness, location of victim, and type of assistance required).
 - b. Send people to meet the ambulance crew at likely entrances of the building.
 - c. The injured person should not be moved except where necessary to prevent further injury.
3. The names of persons in your area trained in CPR and First Aid should be posted by your telephone.
4. The number to call for medical emergencies is (44444) shall also be posted by your telephone.
5. All first aid, chemical exposures, and medical emergencies shall be reported as required in Section 1.7 - "Accident Reporting".?
6. Prevention of injuries should be a major emphasis of any laboratory safety program. Proper training will help prevent injuries from glassware, toxic chemicals, burns and electrical shock. In the event of any type of injury beyond that which first aid can treat, call (44444) and (22599) for medical assistance.

A: General

1. First aid is defined as any one-time treatment and any follow up visit for the purpose of observation, treatment of minor scratches, cuts, burns, splinters, and so forth, which do not ordinarily require medical care.
2. First aid equipment should be readily available in each laboratory.
4. It is recommended that each laboratory have at least one person trained in basic first aid and cardiopulmonary resuscitation.
5. Someone knowledgeable about the accident should always accompany the injured person to the medical facility and a copy of any appropriate material safety data sheets (MSDSs) shall accompany the victim.

6. Minor injuries requiring first aid should always be reported to a supervisor and recorded on an Injury/Exposure Report Form which must be submitted to Personnel Services. Reasons for this are as follows.
 - a. A minor injury may indicate a hazardous situation which should be corrected to prevent a serious future injury.
 - b. It is important to document a minor injury as having been "work related" if the injury later leads to serious complications, such as from an infected cut.
7. All accidents should be investigated to identify the direct and the indirect causes and to control them so that such accidents will not reoccur.

B: Personal Protection During First Aid

1. Safety precautions should be observed when employees respond to emergencies which provide potential exposure to blood and other potentially infectious materials. Safety precautions stresses that all patients should be assumed to be infectious for HIV and other blood borne pathogens.
2. Persons responding to a medical emergency should be protected from exposure to blood and other potentially infectious materials. Protection can be achieved through adherence to work practices designed to minimize or eliminate exposure and through the use of personal protective equipment (i.e., gloves, masks, and protective clothing), which provide a barrier between the worker and the exposure source. For most situations in which first aid is given, the following guidelines should be adequate:
 - a. For bleeding control with minimal bleeding and for handling and cleaning instruments with microbial contamination, disposable gloves alone should be sufficient.
 - b. For bleeding control with spurting blood, disposable gloves, a gown, a mask, and protective eye wear are recommended.
 - c. For measuring temperature or measuring blood pressure, no protection is required.
4. After emergency care has been administered, hands and other skin surfaces should be washed immediately and thoroughly with warm water and soap if contaminated with blood, other body fluids to which universal precautions apply, or potentially contaminated articles. Hands should always be washed after gloves are removed, even if the gloves appear to be intact.

SECTION 2.7 - ACCIDENT REPORTING

1. ALL injuries shall be reported to laboratory management and(EHSS) personnel. Report forms shall be forwarded to EHSS Personnel Affairs Unit (PAU)
2. Minor injuries many times are not reported because they are perceived to be embarrassing or that "careless actions" lead to the accident. However, minor injuries can sometimes lead to more serious complications that only become evident at a later time.

3. Liability and insurance matters will be handled more effectively if initial accident documentation exists. In addition, all minor accidents should be investigated by (EHSS) personnel.
4. Taking corrective action as a result of a minor accident may keep a major incident from happening. Without knowledge of all minor accidents, the desirable investigation is circumvented.
5. Employees should understand that the purpose of reporting and documenting accidents is not to affix blame, but instead to determine the cause of the accident so that similar incidents may be prevented in the future.
6. Each (EHSS) department unit, or section and (EHSS) should document both the nature of the incident and also all injuries that resulted from the incident.
7. If the accident involves overexposure to hazardous materials, an Employee Exposure Report shall also be prepared and forwarded to Environmental Health & Safety.

CHAPTER 3 GENERAL SAFETY

Introduction

People who work in scientific laboratories are exposed to many kinds of hazards. This can be said of most workplaces. In some, the hazards are well recognized (those of ordinary fire, for example) and the precautions to be taken are obvious. Laboratories, however, involve a greater variety of possible hazards than do most workplaces, and some of those hazards call for precautions not ordinarily encountered elsewhere. Therefore, this manual has been provided to inform and guide JUST laboratory technicians and students in safe practices that should help to avoid injury. This chapter sets forth those practices that are deemed good safety practices common to all categories of laboratory operations.

SECTION 3.1 GENERAL SAFETY AND OPERATIONAL RULES

A: General Rules of Safety

1. No running, jumping, or horseplay in laboratory areas shall be permitted.
2. No one shall work alone in a laboratory or chemical storage area when performing a task that is considered unusually hazardous by the laboratory supervisor or JUST safety officer.
3. Spills shall be cleaned immediately. Water spills can create a hazard because of the slip potential and flooding of instruments (particularly on the floor) Small spills of liquids and solids on bench tops shall be cleaned immediately to prevent contact with skin or clothing.
4. Ladders shall be in good condition and used in the manner for which they were designed. Wooden ladders shall not be covered with paint or other coating. (Structural defects may be hidden by the coating.)
5. Lifting of heavy items must be performed in the proper fashion, using the legs to lift, and not the back.
6. It is the responsibility of everyone working in the laboratory, especially the lab technician, to make certain that the laboratory is left clean after work is performed.
7. Animals, except for those that are the subject of experimentation (approved by the Animal Experimentation Committee) are to be excluded from all (EHSS) laboratory areas.

B: Personal Hygiene

1. Wash promptly whenever a chemical has contacted the skin.
2. Know what you are working with (read MSDS for each chemical you are working with) and have the necessary cleaning/neutralization material on hand and readily available.
3. Laboratory technicians shall not wear sandals, open toed shoes or clogs.

4. Clothing worn in the laboratory should offer protection from splashes and should be easily removable in case of accident, Lab coats are to be fastened closed while working and removed prior to exit from the laboratory.
5. Laboratory clothing should be kept clean and replaced when necessary. Clothing should be replaced or laundered using appropriate decontamination procedures whenever contamination is suspected.
6. Lab coats are not to be worn outside the laboratory, especially in rest room or break facilities. Any lab coats, respirators, or other protective gear must be left in the lab areas. Technicians must, 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; do not wash with solvents.
7. Inhalation is one of the four modes of entry for chemical exposure. "Sniff-testing" should not be done.
 - a. Never pipette by mouth. Always use a bulb to pipette.
 - b. Do not drink, eat, smoke, or apply cosmetics in the laboratory or chemical storage areas.
 - c. Do not use ice from laboratory ice machines for beverages.
 - d. No food, beverage, tobacco, or cosmetics products are allowed in the laboratory or chemical storage areas at any time. Cross contamination between these items and chemicals or samples is an obvious hazard and should be avoided.

C: Housekeeping

The following listing of good housekeeping practices indicates common sense activities, which should be implemented as a matter of course in the laboratory. These recommendations are designed for accident prevention.

1. The area must be kept as clean as the area allows. Each laboratory technician shall be responsible for maintaining the cleanliness of his/her area.
2. Reagents and equipment items should be returned to their proper place after use. This also applies to samples in progress. Contaminated or dirty glassware should be placed in specific cleaning areas and not allowed to accumulate.
3. Chemicals, especially liquids, should never be stored on the floor, except in closed-door cabinets suitable for the material to be stored. Nor should large bottles (2.5 liter or larger) be stored above the bench top.
4. Reagents, solutions, glassware, or other apparatus shall not be stored in hoods. Besides reducing the available workspace, they may interfere with the proper airflow Pattern and reduce the effectiveness of the hood as a safety device.
5. Counter tops should be kept neat and clean. Bench tops and fume hoods shall not be used for chemical storage. All work done in fume hoods shall be performed in the "Safety Zone",.
6. Stored items, equipment, and glass tubing shall not project beyond the front of shelf or counter limits.

7. Stored items or equipment shall not block access to the fire extinguisher(s), safety equipment, or other emergency items.
8. Stairways, hallways, passageways/aisles and access to emergency equipment and/or exits must be kept dry and not be obstructed in any fashion, including storage, equipment, phone or other wiring.
9. No combustible material such as paper, wooden boxes, pallets, etc., shall be stored under stairwells or in hallways. Hallways shall be kept free of boxes and materials so that exits or normal paths of travel will not be blocked.
 - a. Materials stored near aisles shall be restrained to prevent their falling.
 - b. Mats shall be kept in good condition.
 - c. All working surfaces and floors should be cleaned regularly.
10. All containers must be labeled with at least the identity of the contents and the hazards those chemicals present to users. If the contents of all containers are known, there will no longer have an unknown waste disposal problem.

D: Electrical Safety

The typical laboratory requires a large quantity of electrical power. This increases the likelihood of electrically related problems and hazards. The following recommendations are basic to a sound electrical safety program in the laboratory.

1. All electrical equipment shall be properly grounded.
2. Sufficient room for work must be present in the area of breaker boxes. All the circuit breakers and the fuses shall be labeled to indicate whether they are in the "on" or "off" position, and what appliance or room area is served.. Fuses must be properly rated.
3. Equipment, appliance and extension cords shall be in good condition.
4. Extension cords shall not be used as a substitute for permanent wiring.
5. Electrical cords or other lines shall not be suspended unsupported across rooms or passageways. Cords shall not be routed over metal objects such as emergency showers, overhead pipes or frames, metal racks, etc. Cords shall not be run through holes in walls or ceilings or through doorways or windows. Do not place under carpet, rugs, or heavy objects. Cords shall not be placed on pathways or other areas where repeated abuse can cause deterioration of insulation.
6. Multi-outlet plugs shall not be used unless they have a built-in circuit breaker. This causes overloading on electrical wiring, which will cause damage and possible overheating.
7. Most of the portable multiple outlets are rated at (15) amps. Technicians shall check when all connections are made to determine that the total input average will never exceed (15) amps. (The amperage on electrical equipment is usually stamped on the manufacturer's plate).
8. All building electrical repairs, splices, and wiring shall be performed by Maintenance and operation Unit (MOU).
9. Electrical standards may be obtained by referencing Jordanian ELECTRICAL CODE.

E. Vacuum Operations

In an evacuated system, the higher pressure is on the outside, rather than the inside, so that a break causes an implosion rather than an explosion. The resulting hazards consist of flying glass, spattered chemicals, and possibly fire. A moderate vacuum, such as 10 mm Hg, which can be achieved by a water aspirator, often seems safe compared with a high vacuum, such as (10⁻⁵) mm Hg. These numbers are deceptive, however, because the pressure differences between the outside and inside are comparable. Therefore any evacuated container must be regarded as an implosion hazard.

When working with a vacuum be aware of implosion hazards. Apply vacuum only to glassware specifically designed for this purpose, i.e., heavy wall filter flasks, desiccators, etc.

1. Never evacuate scratched, cracked, or etched glassware. Always check for stars or cracks before use.
2. Vacuum glassware that has been cooled to liquid nitrogen temperature or below should be annealed prior to reuse under vacuum.
3. Rotary evaporator condensers, receiving flasks, and traps should be taped or kept behind safety shields when under a vacuum.
4. All condensers connected to rotary evaporators should at least be cooled with circulating ice water.
5. The use of a vacuum for the distillation of the more volatile solvents, e.g. ether, low boiling petroleum ether and components, methylene chloride, etc., should be avoided whenever possible.
6. Water, solvents, or corrosive gases should not be allowed to be drawn into a building vacuum system.
7. When a compressor or vacuum pump to distill volatile solvents supplies a vacuum, a cold trap should be used to contain solvent vapors. Cold traps should be of sufficient size and low enough temperature to collect all condensable vapors present in a vacuum system. If such a trap is not used, the pump or compression exhaust must be vented to the outside using explosion proof methods.
8. After completion of an operation in which a cold trap has been used, the system should be vented. This venting is important because volatile substances that have been collected in the trap may vaporize when the coolant has evaporated and cause a pressure buildup that could blow the apparatus apart.
9. After vacuum distillations, the pot residue must be cooled to room temperature before air is admitted to the apparatus.
10. All desiccators under vacuum should be completely enclosed in a shield or wrapped with friction tape in a grid pattern that leaves the contents visible and at the same time guards against flying glass should the vessel collapse. Various plastic (e.g., polycarbonate) desiccators now on the market reduce the implosion hazard and may be preferable.

F. Handling Glassware

Glass breakage is a common cause of injuries in laboratories. Only glass in good condition should be used.

1. Discard or send for repair all broken, chipped, starred or badly scratched glassware. Hand protection should be used when picking up broken glass. For disposal of broken glass see Section 2.5 - "Safety Practices for Disposal of Broken Glassware."
2. Clean all glassware before sending for repair.
3. When using glass tubing, all ends should be fire polished. Lubricate tubing with glycerin or water before inserting into rubber stoppers or rubber tubing.
4. Protect hands with leather gloves when inserting glass tubing. Hold elbows close to the body to limit movement when handling tubing.
5. Do not store glassware near the edge of shelves. Store large or heavier glassware on lower shelves.
6. Use glassware of the proper size. Allow at least 20% free space. Grasp a three-neck flask by the middle neck, not a side neck.
7. Do not attempt to catch glassware if it is dropped or knocked over.
8. Conventional laboratory glassware must never be pressurized.

SECTION 3.2 - GENERAL SAFETY EQUIPMENT

Workers in a laboratory environment are surrounded by physical and chemical hazards, and the potential for accident and injury is always present. Adequate safety equipment in good working order shall be provided to prevent accidents and injury.

A: Fire Extinguishers

EHSS is responsible for the procurement, placement, inspection, and maintenance of all fire extinguishers on campus.

1. Laboratory personnel should be adequately trained regarding pertinent fire hazards associated with their work.
2. Fire extinguishers must be clearly labeled to indicate the types of fire they are designed to extinguish. The following codes are:
 - a. Class A-fires in ordinary combustible materials such as wood, cloth, paper, rubber, and many plastics.
 - b. Class B-fires in flammable liquids, oils, greases, tars, oil-base paints, lacquers and flammable gases.
 - c. Class C-fires that involve energized electrical equipment where the electrical conductivity of the extinguishing medium is of importance; when electrical equipment is de-energized, extinguishers for class A or B fires may be safely used.

- d. Class D-Fires of combustible metals such as magnesium, titanium, zirconium, sodium, lithium and potassium.
3. Fire extinguishers of the "Halon" type are specially designed so they leave no residue that could damage instruments or computers. (However, the area should be thoroughly ventilated before being reoccupied.)
4. Fire extinguishers should never be concealed from general view or blocked from access.
5. EHSS will install all fire extinguishers. Once a fire extinguisher has been installed, EHSS personnel will inspect and maintain the device.
6. If a technician notices a fire extinguisher discharged or not fully charged, an extinguisher with the safety pin pulled out, an extinguisher obstructed from view, or one not hanging in its proper location, please notify EHSS at (22929).

B: Safety Showers

If all protective measures fail and a technician receives a chemical splash to his/her body, then safety showers should be provided throughout the laboratory for immediate and thorough washing of the body.

1. Technicians should familiarize themselves with the location of the nearest safety shower.
2. Technicians should be familiar with the operation of the safety showers.
3. Safety showers are designed to flood the entire body in the event of a clothing fire or a major spill of a chemical. In either case, an technician should simply stand under the shower and activate the shower. Flood the affected area for a minimum of 15 to 30 minutes.
4. In the case of a corrosive liquid spill, the technician should remove the affected portion of clothing to reduce potential contact. Removal of clothing should be done while the individual is under the activated shower.
5. The departmental chemical hygiene officer or laboratory supervisor should be notified as soon as possible if the technician required the use of the safety shower.
6. Safety showers should be tested annually by(EHSS).

C: Eyewash Fountains

If all protective measures fail and a technician receives a chemical splash to his/her eyes, then eye wash fountains should be provided throughout the laboratory for immediate and thorough washing of the eyes.

1. Technicians should familiarize themselves with the location and operation of the nearest eyewash fountain.
2. Always flood the eyes for at least 15 to 30 minutes to be sure there is no residue of the corrosive liquid. Flush from the eye outward.
3. After thorough washing, the proper authorities should be notified and subsequent medical care for the technician should be seriously considered. This is because

serious damage may have already occurred before the eye was thoroughly rinsed and/or the damage may not be immediately apparent.

4. Laboratories for proper operation and to prevent formation of bacteria should test eyewash fountains weekly.
5. Eyewash fountains are checked annually by (EHSS), for proper location and operational status.

D: First Aid Kits

First aid kits, which should be located in conspicuous places (with location clearly marked) in the laboratory, are to be used for the immediate response to minor injuries, such as cuts or minor burns. All injury victims have the option of obtaining medical treatment or consultation.

1. Minor injuries requiring first aid shall always be reported to a supervisor.
2. A minor injury may indicate a hazardous situation which should be corrected to prevent a more serious injury.
3. It is important to document a minor injury as having been "work related" for the purpose of obtaining Worker's Compensation from Social Security Council (SSC), should the injury lead to later, more serious, complications or disability.
4. The location and phone number of emergency services (44444 and 22599) should be clearly posted.
5. A designated party should be responsible for monitoring and maintaining the first aid kit(s). There should be a log attached to the kit indicating the last inspection date and by whom the kit was inspected.
6. First aid kit contents should include items such as Band-aids®, sterile gauze pads, bandages, scissors, antiseptic wipes or ointments, and a first aid card. All kits should also contain examination gloves for response to emergencies in which blood is present. Pocket masks for (CPR) procedures are also recommended.
7. The following items are not recommended for use in a first-aid kit:
 - a. Iodine - Tissue damage can be caused by improper use.
 - b. Ice Pack Compress - If there is swelling of soft tissue, or other need for an ice pack, the person should be examined by a physician.
 - c. Ammonia Inhalants - If an individual is unconscious, obtain help -- do not use ammonia.
 - d. Tourniquet - Not required for minor injuries; use the pressure technique until medical assistance is available.
8. Laboratories where *high-voltage* equipment is in use should have available an emergency electrical response board. This will contain an instruction card and a nonconductive stick to turn off the equipment and remove the shock victim from contact with the source
9. Laboratories using material for which the immediate administration of an antidote or neutralizing agent is manifested (such as hydrofluoric acid and calcium gluconate) should be considered.

E: Explosion-Proof Refrigerators

If there is a need to refrigerate a substance that is flammable, it shall be refrigerated in an approved explosion-proof refrigerator. This refrigerator is designed as such that any flammable vapors in the refrigerator do not contact sparks. This refrigerator must not be used for the storage of food.

F: Ventilation Hoods

1. Laboratory Hoods

- a. Work that involves hazards and noxious materials, which are toxic, odoriferous, volatile or harmful, shall be conducted within a laboratory hood. The primary purpose of a laboratory hood is to keep toxic or irritating vapors and fumes out of the general laboratory working area. A secondary purpose is to serve as a shield between the worker and equipment being used when there is the possibility of an explosive reaction. This is done by lowering the sash of the hood.
- b. Hood ventilation systems are best designed to have an airflow of not less than 60 ft/min (linear) and not more than 120 ft/min (linear) across the face of the hood. Flow rates of higher than 125 ft/min can cause turbulence problems and are not recommended. If possible, a mark will have been placed on the hood so the sash can be drawn to a point where 100 ft/min can be achieved.
- c. Avoid creation of strong cross drafts (100 fpm) caused by open doors and windows, air conditioning and/or heating vents, or personnel movement. Drafts will pull contaminants from the hood and into the laboratory. 100 FPM is generally not perceptible (100 fpm is approximately 3 mph, a normal walking pace). Air conditioning and heating vents and personnel traffic all create airflows in excess of 200 FPM, often much higher. Therefore, laboratory activity in the hood area should be minimized while the hood is in use.
- d. **DO NOT ADJUST BAFFLES** unless you have been instructed to do so by EHS Officer. Do not remove baffles. If ventilation problems develop, contact the OMU (22814) immediately.
- e. When not in use, the sash of the hood should be kept closed. While performing work in the hood, the sliding sash should be kept at the height designated to provide the minimum face velocity required (usually 100 f/min). This will ensure maximum velocity of air flow into the hood and out of the laboratory.
- f. Work should be performed as deeply within the fume hood as possible. Equipment, reagents, and glassware should be placed as far back in the hood as is practical without blocking the rear baffle. Solid objects placed at the face of the hood cause turbulence in the air flow. Therefore, each hood should have a clearly marked "safety zone" in which no work should be conducted or equipment placed.
- g. **ONLY ITEMS NECESSARY TO PERFORM THE PRESENT EXPERIMENT SHOULD BE IN THE HOOD.** The more equipment in the hood, the greater the air turbulence and the chance for gaseous escape into the lab.

- h. When instrumentation is utilized for a process inside a hood, all instruments should be elevated a minimum of two inches from the hood base to facilitate proper air movement.
- i. The purpose and function of a hood is NOT to store chemicals or unused items. The fume hood is not a storage cabinet.
- j. Hoods shall not be used as a means of disposing of toxic or irritating chemicals, 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.
- k. Some hoods are constructed of stainless steel. These are usually "perchloric acid hoods" or "radioisotope hoods." Never use perchloric acid in a hood not designed for that use. Perchloric acid hoods have a wash-down feature which should be used after each use of the hood and at least every two weeks when the hood is not in use. Date of wash-down should be recorded by the laboratory.
- l. Always look to assure fan motor power switch is in the "on" position before initiating experiment. Note: Some hoods do not have individual "on/off" switches and remain "on" continuously.
- m. Do not use infectious material in a chemical fume hood.
- n. Exhaust fans should be spark-proof if exhausting flammable vapors and corrosive resistant if handling corrosive fumes.
- o. Controls for all services (i.e., vacuum, gas, electric, water) should be located at the front of the hood and should be operable when the hood door is closed.
- p. Radioactive materials may not be used in the hoods without prior approval of EHS Officer.
- q. An emergency plan should be prepared in the event of ventilation failure or other unexpected occurrence such as fire or explosion in the hood. ALWAYS ASSURE THE HOOD IS OPERATIONAL BEFORE INITIATING AN EXPERIMENT.

2. Biological Safety Cabinets

Biological Safety cabinets are among the most effective, as well as the most commonly used, primary containment devices in laboratories working with infectious agents. Class I and II biological safety cabinets, when used in conjunction with good microbiological techniques, provide an effective partial containment system for safe manipulation of moderate and some high-risk microorganisms. It is imperative that Class I and II biological safety cabinets are tested and certified in *sites*, any time the cabinet is moved, and at least annually thereafter. Certification at locations other than the final site may attest to the performance capability of the individual cabinet or model but does not supersede the critical certification prior to use in the laboratory. As with any other piece of laboratory equipment, personnel must be trained in the proper use of the biological safety

cabinets. Of particular note are those activities, which may disrupt the inward directional airflow through the work opening of Class I, and II cabinets. Aerosol particles can escape the cabinet in various ways. Among these are repeated insertion and withdrawal of workers' arms in and from the work chamber, opening and closing doors to the laboratory or isolation cubicle, improper placement or operation of materials or equipment within the work chamber, or brisk walking past the cabinet while it is in use. Strict adherence to recommended practices for the use of biological safety cabinets is as important in attaining the maximum containment capability of the equipment as is the mechanical performance of the equipment itself. Always decontaminate the hood using procedures adopted by the laboratory after each use or at the end of the work day. **BIOLOGICAL SAFETY CABINETS ARE NOT CHEMICAL FUME HOODS AND SHALL NOT BE USED AS SUCH.**

3. Specialized Local Ventilation

Some instruments such as atomic absorption spectrophotometers (AAS) or inductively coupled argon spectrometers (ICP's) emit small quantities of hazardous materials during use. To prevent excessive accumulations of these materials, each of these instruments should be provided with an individual ventilation exhaust duct. Gas chromatography equipment using thermal conductivity detection should be kept in a hood or have a vent over the column outlets.

G: Flammable-Liquid Storage Cabinets

Cabinets designed for the storage of flammable liquids should be properly used and maintained. Read and follow the manufacturer's information and also follow these safety practices:

1. Store only compatible materials inside a cabinet.
2. Do not store paper or cardboard or other combustible packaging material in a flammable liquid cabinet.
3. The manufacturer establishes quantity limits for various sizes of flammable-liquid storage cabinets; do not overload a cabinet. (NFPA) Guidelines and (OSHA) Standards on Flammable Liquids are utilized as standards for Worker/Fire Protection at JUST.

H: Safety Shields

Safety shields should be used for protection against possible explosions, implosions or splash hazards. Laboratory equipment should be shielded on all sides so that there is no line-of-sight exposure of personnel. Provided its opening is covered by closed doors, the conventional laboratory exhaust hood is a readily available built-in shield. However, a portable shield should also be used when manipulations are performed, particularly with hoods that have vertical-rising doors rather than horizontal-sliding sashes. Portable shields can be used to protect against hazards of limited severity, e.g., small splashes, heat, and fires. A portable shield, however, provides no protection at the sides or back of the equipment and many such shields are not sufficiently weighted and may topple toward the

worker when there is a blast (permitting exposure to flying objects). A fixed shield that completely surrounds the experimental apparatus can afford protection against minor blast damage.

SECTION 3.3 - PERSONAL PROTECTIVE EQUIPMENT

The standard general requirements for the selection and use of personal protective equipment (PPE) are the following:

1. Employers must conduct a hazard assessment to determine if hazards present necessitate the use of PPE.
2. PPE selection must be made on the basis of hazard assessment and affected workers properly trained.
3. Defective or damaged PPE must not be used.
4. Training of technicians using PPE must be established. This should include requirements for technicians to demonstrate an understanding of the training.
5. For the PPE to perform the desired function, it must be used and managed properly.
6. Laboratory supervisors and/or departmental chemical hygiene officers shall:
 - a. Determine a need for such equipment,
 - b. monitor its effectiveness,
 - c. Train the technicians, and
 - d. Monitor and enforce the proper use of such equipment.

A. Eye Protection

1. Eye protection is mandatory in all areas where there is potential for injury. This applies not only to persons who work continuously in these areas, but also to persons who may be in the area only temporarily, such as maintenance or clerical personnel.
2. The type of eye protection required depends on the hazard. For most situations, safety glasses with side shields are adequate. Where there is a danger of splashing chemicals, goggles are required. More hazardous operations include conducting reactions which have potential for explosion and using or mixing strong caustics or acids. In these situations, a face shield or a combination of face shield and safety goggles or glasses should be used.
3. Plastic safety glasses should be issued to technicians who do not require corrective lenses.
4. For persons requiring corrective lenses, safety glasses ground to their prescription are available in a safety frame. Contact (EHSS) for additional information about availability. Please note that the wearing of safety glasses does not excuse the technician from the requirement of wearing safety goggles.
5. It is recommended that contact lenses not be permitted in the laboratory. The reasons for this prohibition are:
 - a. If a corrosive liquid should splash in the eye, the natural reflex to clamp the eyelids shut makes it very difficult, if not impossible, to remove the contact lens before damage is done.

- b. The plastic used in contact lenses is permeable to some of the vapors found in the laboratory. These vapors can be trapped behind the lenses and can cause extensive irritation.
 - c. The lenses can prevent tears from removing the irritant.
6. If Departmental Chemical Hygiene Officer chooses to allow contact lenses to be worn, they shall be protected by goggles designed specifically for use with contact lenses. (The protective goggles for use with contact lenses fit loosely around the eyes and have no vents for access by vapors.) If chemical vapors contact the eyes while wearing contact lenses, these steps should be followed:
 - a. Immediately remove the lenses.
 - b. Continuously flush the eyes, for at least 15 to 30 minutes.
 - c. Seek medical attention.
7. Although safety glasses are adequate protection for the majority of laboratory operations, they are not sufficient for certain specific operations where there is danger from splashes of corrosive liquids or flying particles. Examples are: washing glassware in chromic acid solution, grinding materials, or laboratory operations using glassware where there is significant hazard of explosion or breakage (i.e., in reduced or excess pressure or temperature). In such cases, goggles or face shields shall be worn if there is need for protection of the entire face and throat.
8. If, despite all precautions, an technician should experience a splash of corrosive liquid in the eye, the technician is to proceed (with the assistance of a co-worker, if possible) to the nearest eyewash fountain and flush the eyes with water for at least 15 to 30 minutes. Flush from the eye outward. During this time, a co-worker should notify the proper authorities.
9. Visitors shall follow the same eye protection policy as technicians. If they do not provide their own eye protection, it is the laboratory's responsibility to provide adequate protection. It should be the responsibility of the technician conducting the tour to enforce his policy. After use safety glasses/goggles used by visitors should be cleaned prior to reuse.

B. Clothing

The following guidelines for laboratory clothing are offered strictly from a safety standpoint.

1. Due to the potential for ignition, absorption, and entanglement in machinery, loose or torn clothing should be avoided unless wearing a lab coat.
2. Dangling jewelry and excessively long hair pose the same type of safety hazard.
3. Finger rings or other tight jewelry which is not easily removed should be avoided because of the danger of corrosive or irritating liquids getting underneath the piece and producing irritation.
4. Lab coats should be provided for protection and convenience. They should be worn at all the lab areas. Due to the possible absorption and accumulation of chemicals in the material, lab coats should not be worn in the lunchroom or elsewhere outside the laboratory.
5. Where infectious materials are present, closed (snapped) lab coats and gloves are essential.

6. Shoes shall be worn at all times in the laboratories. Sandals, open-toed shoes, and shoes with oven uppers, shall not be worn because of the danger of spillage of corrosive or irritating chemicals.
7. Care should be exercised in protective clothing selection; some protective clothing has very limited resistance to selected chemicals or fire.
8. Consult the MSDS for a chemical to find out the recommended clothing or PPE for a particular chemical. (Examples are latex, Nitrile, or PVC gloves, or aprons.)

C. Aprons Rubber or Plastic

Some operations in the laboratory, like washing glassware, require the handling of relatively large quantities of corrosive liquids in open containers. To protect clothing in such operations, plastic or rubber aprons may be supplied. A high-necked, calf- or ankle-length, rubberized laboratory apron or a long-sleeved, calf- or ankle-length, chemical- and fire-resistant laboratory coat should be worn anytime laboratory manipulation or experimentation is being conducted. Always wear long-sleeved and long-legged clothing; do not wear short-sleeved shirts, short trousers, or short skirts.

D. Gloves

When handling chemicals, it is recommended that the correct gloves be used to protect the worker from accidental spills or contamination. If the gloves become contaminated they should be removed and discarded as soon as possible. There is no glove currently available that will protect a worker against all chemicals. Protection of the hands when working with solvents, detergents, or any hazardous material is essential in the defense of the body against contamination. Exposure of the hands to a potentially hazardous chemical could result in burns, chafing of the skin due to extraction of essential oils ("defatting"), or dermatitis. The skin could also become sensitized to the chemical and once sensitized, could react to lesser quantities of chemicals than otherwise would have any effect. It is well documented that primary skin irritations and sensitizations account for significantly greater numbers of lost time incidents on the job than any other single type of industrial injury. Proper selection of the glove material is essential to the performance of the glove as a barrier to chemicals. Several properties of both the glove material and the chemical with which it is to be used should influence the choice of the glove. Some of these properties include: permeability of the glove material, breakthrough time of the chemical, temperature of the chemical, thickness of the glove material, and the amount of the chemical that can be absorbed by the glove material (solubility effect). Glove materials vary widely in respect to these properties; for instance, neoprene is good for protection against most common oils, aliphatic hydrocarbons, and certain other solvents, but is unsatisfactory for use against aromatic hydrocarbons, halogenated hydrocarbons, ketones, and many other solvents. Gloves of various types are available and should be chosen for each specific job for compatibility and breakthrough characteristics. An excellent information is available in Guidelines for the Selection of Chemical Protective Clothing published by the American Conference of Governmental Industrial Hygienists (ACGIH) or in information provided by glove manufacturers.

1. Selection

- For concentrated acids and alkalis, and organic solvents, natural rubber, neoprene or nitrile gloves are recommended.

- For handling hot objects, gloves made of heat-resistant materials (leather or Nomex) should be available and kept near the vicinity of ovens or muffle furnaces. A hot object should never be picked up with rubber or plastic gloves.
 - Special insulated gloves should be worn when handling very cold objects such as liquid N₂ or CO₂. Do not use asbestos containing gloves.
2. Inspection
Before each use, gloves should be inspected for discoloration, punctures, and tears. Rubber and plastic gloves may be checked by inflating with air and submersing them in water to check for air bubbles.
 3. Usage
Gloves should always be rinsed with a compatible solvent, soap and water prior to handling wash bottles or other laboratory fixtures.
 4. Cleaning
Before removal, gloves should be thoroughly washed, either with tap water or soap and water.
 5. Removal
Technicians shall remove gloves before leaving the immediate work site to prevent contamination of door knobs, light switches, telephones, etc. When gloves are removed, pull the cuff over the hand.

E. Respirators

Respirator use should be avoided if at all possible (and is usually not required if adequate precautions are taken). Where possible, engineering controls (fume hoods, etc.) should be utilized to minimize exposure. If respirators are worn because Jordanian permissible exposure limits (PELs) are being exceeded or other reasons, a respirator program must be established. (EHS) Officer should be consulted for additional information and guidance.

SECTION 3.4 COMPRESSED GAS SAFETY

Many laboratory operations require the use of compressed gases for analytical or instrument operations. Compressed gases present a unique hazard. Depending on the particular gas, there is a potential for simultaneous exposure to both mechanical and chemical hazards. Gases may be combustible, explosive, corrosive, poisonous, inert, or a combination of hazards. If the gas is flammable, flash points lower than room temperature compounded by high rates of diffusion (which allow for fast permeation throughout the laboratory) present a danger of fire or explosion. Additional hazards of reactivity and toxicity of the gas, as well as asphyxiation, can be caused by high concentrations of even "harmless" gases such as nitrogen. Since the gases are contained in heavy, highly pressurized metal containers, the large amount of potential energy resulting from compression of the gas makes the cylinder a potential rocket or fragmentation bomb. In summary, careful procedures are necessary for handling the various compressed gases, the cylinders containing the compressed gases, regulators or valves used to control gas flow, and the piping used to confine gases during flow.

A. Identification

1. The contents of any compressed gas cylinder shall be clearly identified for easy, quick, and complete determination by any laboratory worker. Such identification should be stenciled or stamped on the cylinder or a label, provided that it cannot be removed from the cylinder. Commercially available three-part tag systems can be very useful for identification and inventory.
2. No compressed gas cylinder shall be accepted for use that does not legibly identify its contents by name. Color-coding is not a reliable means of identification; cylinder colors vary with the supplier, and labels on caps have little value as caps are interchangeable.
3. If the labeling on a cylinder becomes unclear or an attached tag is defaced to the point the contents cannot be identified, the cylinder should be marked "contents unknown" and returned directly to the manufacturer.
4. All gas lines leading from a compressed gas supply should be clearly labeled to identify the gas, the laboratory served, and the relevant emergency telephone numbers. The labels should be color coded to distinguish hazardous gases (such as flammable, toxic, or corrosive substances) (e.g., a yellow background and black letters).
5. Signs should be conspicuously posted in areas where flammable compressed gases are stored, identifying the substances and appropriate precautions (e.g., HYDROGEN - FLAMMABLE GAS - NO SMOKING - NO OPEN FLAMES).

B. Handling and Use

1. Gas cylinders shall be secured at all times to prevent tipping. Cylinders may be attached to a bench top, individually to the wall, placed in a holding cage, or have a non-tip base attached.
2. When new cylinders are received, they should be inspected. During this inspection, one should insure the proper cap is securely in place and the cylinder is not leaking. Cylinders shall have clear labels indicating the type of gas contained. If the cylinders are acceptable, they shall be stored in a proper location. If a leaking cylinder is discovered, move it to a safe place (if it is safe to do so) and inform EHSS. You should also call the vendor as soon as possible. Under no circumstances should any attempt be made to repair a cylinder or valve.
3. Cylinders containing flammable gases such as hydrogen or acetylene shall not be stored in close proximity to open flames, areas where electrical sparks are generated, or where other sources of ignition may be present. Cylinders containing acetylene shall never be stored on their side. An open flame shall never be used to detect leaks of flammable gases. Hydrogen flame is invisible, so "feel" for heat. All cylinders containing flammable gases should be stored in a well-ventilated area.
4. Oxygen cylinders, full or empty, shall not be stored in the same vicinity as flammable gases. The proper storage for oxygen cylinders requires that a minimum of 50 feet be maintained between flammable gas cylinders and oxygen cylinders or the storage areas be separated, at a minimum, by a fire wall five feet high with a fire rating of 0.5 hours. Greasy and oily materials shall never be stored around oxygen; nor should oil or grease be applied to fittings.

5. Cylinders should be placed with the valve accessible at all times. The main cylinder valve should be closed as soon as it is no longer necessary that it be open (i.e., it should never be left open when the equipment is unattended or not operating). This is necessary not only for safety when the cylinder is under pressure, but also to prevent the corrosion and contamination resulting from diffusion of air and moisture into the cylinder after it has been emptied.
6. Cylinders are equipped with either a hand wheel or stem valve. For cylinders equipped with a stem valve, the valve spindle key should remain on the stem while the cylinder is in service. Only wrenches or tools provided by the cylinder supplier should be used to open or close a valve. At no time should pliers be used to open a cylinder valve. Some valves may require washers; this should be checked before the regulator is fitted. Cylinder valves should be opened slowly.
7. Oxygen cylinder valves should be opened all the way. When opening the valve on a cylinder containing an irritating or toxic gas, the user should position the cylinder with the valve pointing away from them and warn those working nearby.
8. Always make sure that the regulator and valve fittings are compatible. If there is any question as to the suitability of a regulator for a particular gas, check with EHSS or call your vendor for advice. After the regulator is attached, the cylinder valve should be opened just enough to indicate pressure on the regulator gauge (no more than one full turn) and all the connections checked with a soap solution for leaks. Never use oil or grease on the regulator of a cylinder valve.
9. Piping material shall be compatible with the gas being supplied. Copper piping shall not be used for acetylene, or plastic piping for any portion of a high-pressure system. Do not use cast iron pipe for chlorine; do not conceal distribution lines where a high concentration of a leaking hazardous gas can build up and cause an accident. Distribution lines and their outlets should be clearly labeled as to the type of gas contained. Piping systems should be inspected for leaks on a regular basis. Special attention should be given to fittings as well as possible cracks that may have developed.
10. A cylinder should never be emptied to a pressure lower than 172 kPa (25 psi) (the residual contents may become contaminated if the valve is left open). When work involving a compressed gas is completed, the cylinder must be turned off, and if possible, the lines bled. When the cylinder needs to be removed or is empty (see above), all valves shall be closed, the system bled, and the regulator removed. The valve cap shall be replaced, the cylinder clearly marked as "empty," and returned to a storage area for pickup by the supplier. Empty and full cylinders should be stored in separate areas.
11. Where the possibility of flow reversal exists, the cylinder discharge lines should be equipped with approved check valves to prevent inadvertent contamination of cylinders connected to a closed system. "Sucking back" is particularly troublesome where gases are used as reactants in a closed system. A cylinder in such a system should be shut off and removed from the system when the pressure remaining in the cylinder is at least 172 kPa (25 psi). If there is a possibility that the container has been contaminated, it should be so labeled and returned to the supplier.
12. Liquid bulk cylinders may be used in laboratories where a high volume of gas is needed. These cylinders usually have a number of valves on the top of the

cylinder. All valves should be clearly marked as to their function. These cylinders will also vent their contents when a preset internal pressure is reached, therefore, they should be stored or placed in service where there is adequate ventilation. If a liquid fraction is removed from a cylinder, proper hand and eye protection must be worn and the liquid collected in a Dewar flask.

13. Always use safety glasses (preferably a face shield) when handling and using compressed gases, especially when connecting and disconnecting compressed gas regulators and lines.
14. All compressed gas cylinders, including lecture-size cylinders, shall be returned to the supplier when empty or no longer in use.

C. Transportation of Cylinders

The cylinders that contain compressed gases are primarily shipping containers and should not be subjected to rough handling or abuse. Such misuse can seriously weaken the cylinder and render it unfit for further use or transform it into a rocket having sufficient thrust to drive it through masonry walls.

1. To protect the valve during transportation, the cover cap should be screwed on hand tight and remain on until the cylinder is in place and ready for use.
2. Cylinders should never be rolled or dragged.
3. When moving large cylinders, they should be strapped to a properly designed wheeled cart to ensure stability.
4. Only one cylinder should be handled (moved) at a time.

D. Cryogenic Liquids

A number of hazards may be present from the use of cryogenic liquids in the laboratory. Technicians should be properly trained in these hazards prior to use. The transfer of liquefied gases from one container to another should not be attempted for the first time without the direct supervision and instruction of EHSS or someone experienced in the operation.

E. Fire/Explosions

1. Neither liquid nitrogen nor liquid air should be used to cool a flammable mixture in the presence of air because oxygen can condense from the air and lead to a potentially explosive condition.
2. Adequate ventilation must always be used to prevent the build-up of vapors of flammable gases such as hydrogen, methane, and acetylene.
3. Adequate ventilation is also required when using gases such as nitrogen, helium, or hydrogen. In these cases, oxygen can be condensed out of the atmosphere creating a potential for explosive conditions.
4. Pressure Cylinders and other pressure vessels used for the storage and handling of liquefied gases should not be filled to more than 80% of capacity, to prevent the possibility of thermal expansion and the resulting bursting of the vessel by hydrostatic pressure.
5. Appropriate impact-resistant containers must be used that have been designed to withstand the extremely low temperatures.

6. Even very brief contact with a cryogenic liquid is capable of causing tissue damage similar to that of thermal burns. Prolonged contact may result in blood clots that have potentially serious consequences. In addition, surfaces cooled by cryogenic liquids can cause severe damage to the skin. Gloves and eye protection (preferably a face shield) should be worn at all times when handling cryogenic liquids. Gloves should be chosen that are impervious to the fluid being handled and loose enough to be tossed off easily. Appropriate dry gloves should be used when handling dry ice. "Chunks" or cubes should be added slowly to any liquid portion of the cooling bath to avoid foaming over.
7. As the liquid form of gases warm and become airborne, oxygen may be displaced to the point that technicians may experience oxygen deficiency or asphyxiation. Any area where such materials are used should be well ventilated. For this same reason, technicians should avoid lowering their heads into a dry ice chest. (Carbon dioxide is heavier than air, and suffocation can result.)

SECTION 3.5

SAFETY PRACTICES FOR DISPOSAL OF BROKEN GLASSWARE

1. Inspect all glassware before use. Do not use broken, chipped, starred or badly scratched glassware. If it cannot be repaired, discard it in containers specifically designated for broken glass. All broken glass requires special handling and disposal procedures to prevent injury not only to lab personnel, but members of the janitorial staff as well.
2. All broken glass shall be disposed in rigid, puncture proof containers such as a cardboard box with taped seams, or a plastic bucket or metal can with a sealing lid. All broken glass disposal containers shall be clearly marked "DANGER BROKEN GLASS" Limit quantities to no more than approximately 5 to 10 kgms so that lifting of the container will not create a situation that could cause back injury.
3. **Food, beverage, and uncontaminated glassware:** Dispose in a rigid, puncture proof container such as a box with sealed or taped edges or a metal or thick plastic can or bucket with a sealing lid. Label container "DANGER - BROKEN GLASS".
4. **Radioactive glassware:** Contact the EHS Officer for specific instructions.
5. **Glassware with biological contamination:** Glassware that has been in contact with infectious agents may include: used slides, cover slips, test tubes, beakers, pipettes, etc. Contaminated glassware shall be disinfected before disposal. Dispose in a rigid, puncture proof container such as a box with sealed or taped edges or a metal or thick plastic can or bucket with a sealing lid. Label container "DANGER - BROKEN GLASS". Contact the (EHSS) Officer if you require further information.
6. **Glassware with chemical contamination:** Empty the contents of the glassware into a suitable container if safe to do so. Contact (EHSS) Officer, for assistance with decontamination and disposal of the contaminated glassware.

SECTION 3.6 CENTRIFUGE SAFETY

Does your lab have a centrifuge? Have you been instructed in proper use of this valuable tool? Are you aware that 90% of centrifuge failures are the result of user errors? These errors may result in lost samples and damaged equipment as well as a risk to you the lab user and your lab.

This partial checklist is submitted for your convenience and, if appropriate, should be included in your lab's Chemical Hygiene Plan, possibly in the Special Procedures section. Protocol calls for centrifugation.

The following are suggested steps.

1. First review the owner's manual--if manual not available, (obtain a copy before proceeding.)
 - a. Which centrifuge
 - b. Which rotor
 - c. Correct tube size and adapter
 - d. What speed & length of time
2. After the above selections have been made, and the owner's manual and centrifuge log consulted (especially critical on ultra centrifuge), insure the tube fits properly in the rotor. This is important because up to 600,000 g forces may be generated during the centrifugation procedure.
3. Insure you are using the appropriate level of containment. Is the material potentially infectious / radioactive? If so, are you using aerosol containment tubes? Are you loading and unloading the rotor in a biological safety cabinet? Suggested steps to follow BEFORE starting the centrifuge:
 - a. Insure centrifuge bowl and tubes are dry.
 - b. Is the centrifuge spindle clean?
 - c. Avoid overfilling of tubes and bottles
 - d. Insure rotor is properly seated on drive hub.
 - e. Make sure tubes are properly balanced in rotor (½ gram at 1 G is roughly equivalent to 250 Kg @ 500,000 g's).
 - f. Are O-rings properly attached to the rotor? Is the vacuum grease fresh?
 - g. Has the rotor been properly secured to drive?
 - h. Is the centrifuge lid shut properly?
4. After the above steps are taken and the centrifuge has started, make sure the run is proceeding normally before you leave the area. Once the centrifuge run is complete, make sure the rotor has **STOPPED** completely before you open the centrifuge lid; then check for spills. If infectious material was placed in the centrifuge, **WAIT** 10 minutes before opening the centrifuge lid. If leak or damage has occurred, close the lid and plan proper decontamination and cleanup. For biological spills, contact the Biological Safety Officer.
5. Maintenance/Cleaning:
 - a. Keep rotors clean and dry. If spills occur, make sure rotor has been cleaned /decontaminated. If salts or corrosive materials were used, ensure they have been removed from the rotor.

- b. Avoid mechanical scratches. The smallest, scarcely visible scratch allows etching to enlarge the fracture, which is subject to enormous rupturing forces at high G's--a vicious cycle leading to rotor explosion.
 - c. Avoid bottle brushes with sharp metal ends and harsh detergents when cleaning aluminum rotor heads.
 - d. After proper clean-up, rinse the rotor with de-ionized water.
6. Inspections:
- a. Check the rotor for rough spots, pitting, and discoloration. If discovered, check with the manufacturer before using. Use professional rotor inspection services frequently. These visits can be arranged to accommodate numerous users throughout the (EHSS).
 - b. Consult the centrifuge manufacturer and centrifuge log for the derating schedule for the rotor. Remember-an un logged ultra-speed centrifuge is a ticking time bomb.

SECTION 3.7 TREATED BIOMEDICAL WASTE

"Treated biomedical wastes" means any biomedical waste that has been treated by one of the following methods and rendered harmless and biologically inert:

1. Incineration in an JUST incinerator;
2. Steam sterilization at sufficient temperature and for sufficient time to destroy infectious agents in waste;
3. Chemical disinfection where contact, concentration and quantity of the chemical disinfectant are sufficient to destroy infectious agents in waste;

CHAPTER 4 CHEMICAL SAFETY PLAN

SECTION 4.1 JUST LABORATORY CHEMICAL SAFETY

A. EHSS Responsibilities

1. Keep records of employee exposures to hazardous chemicals:
 - a. Records should include measurements made to monitor exposures, if any, as well as any medical consultations and examinations, including written opinions.
 - b. These records shall be kept by Environmental Health Services' Hazard Communications Section, (EHSS) Personnel Services, and the laboratory or Department in which the exposure occurred. Records should be indexed according to the employee's social security number.
2. Provide (EHSS) employees with:
 - a. Training and information regarding chemical and physical hazards.
 - b. Identification of other hazards.
 - c. Access to medical consultation and examinations.
 - d. Respirators when necessary.
3. Incoming hazardous chemicals:
 - a. Require that the incoming hazardous chemicals have adequate labels. Do not allow the removal or defacement of these labels.
 - b. Require that the MSDSs for incoming hazardous chemicals be on hand prior to receipt of hazardous chemicals whenever possible. Require that (MSDSs) be acquired for all hazardous chemicals on hand whenever possible.
 - c. Keep all material safety data sheets (MSDS) that the (EHSS) receives.
 - d. Make (MSDSs) accessible to employees.
 - e. Maintain an accurate inventory of all chemicals in (EHSS) laboratories.
4. When hazardous chemicals are generated in (EHSS) laboratories:
 - a. If the hazardous properties are known, train (EHSS) employees to handle these chemicals safely
 - b. If the hazardous properties are not known, treat the chemical as though it is hazardous and provide protection.
5. If carcinogens, reproductive toxins, or acute toxins that are very highly toxic are used in the laboratory, identify and post one or more areas as "designated dangerous area(s)".

B. The Content of the Chemical Safety Plan

1. Standard operating procedures relevant to all laboratory operations, to be followed by laboratory employees.
2. Statements of the criteria that will be used to determine and implement control measures to reduce employee exposure to hazardous chemicals. These measures include engineering controls, use of personal protective equipment, and personal hygiene practices. Criteria to reduce exposure to extremely hazardous chemicals used in the laboratory shall be specifically included.

3. A requirement that fume hoods and other protective equipment shall function properly and descriptions of the methods to be taken to make sure that such equipment is functioning properly.
4. Provisions of safety training and information for employees.
5. Circumstances under which a laboratory practice requires prior approval from a supervisor before implementation.
6. Provisions for medical consultation and examination.
7. Designation of personnel responsible for implementation of the chemical safety plan.
8. Provisions for additional protection for employees when working with particularly hazardous substances, including:
 - a. Select carcinogens.
 - b. Reproductive toxins.
 - c. Substances with a high degree of acute toxicity.
9. Specific mention of the following provisions, including when appropriate:
 - a. Establishment of a designated area.
 - b. Use of containment devices such as fume hoods or glove boxes.
 - c. Procedures for safe removal and disposal of contaminated and hazardous waste.
 - d. Decontamination procedures.

SECTION 4.2 CHEMICAL SAFETY

Working with potentially hazardous chemicals is an everyday occurrence in a laboratory setting. Hazardous situations can occur if employees are not educated in general chemical safety, toxicological information, and procedures for handling and storage for the chemicals they are using.

A. Modes of Entry

There are four major modes of entry to chemicals: inhalation, skin absorption, injection, and ingestion. Inhalation and skin absorption are the predominant occupational exposures you may expect to encounter in the laboratory and will be discussed in some detail. Accidental injection of chemicals can be eliminated by good laboratory safety practices. Accidental ingestion of chemicals can be eliminated by a combination of good laboratory and hygienic practices such as washing hands and prohibiting foods, drinks, cosmetics, and tobacco products in the laboratory workplace.

B. Basic Chemical Classifications

1. Volatile Solvents

- a. Organic solvents are perhaps the most ubiquitous chemicals found in the laboratory setting. The potential chronic health effects of some of these materials warrant special attention as one is likely to be exposed to more solvents than any other type of chemical.
- b. For safety purposes, these chemicals are generally subdivided into two categories: chlorinated and non-chlorinated. This is done mainly because the chlorinated solvents are, in general, not flammable while non-chlorinated solvents are often flammable. It should be kept in mind, however, that the chlorinated solvents do

- decompose when burned. This results in high concentrations of toxic vapors, such as phosgene and hydrogen chloride.
- c. The primary route of exposure to these materials is through inhalation. In general, high concentrations of the vapor, when inhaled, produce drowsiness, dizziness and headaches. This can occur quite quickly, since chemical vapors are rapidly absorbed. Most of the solvents will also act as upper respiratory and/or eye irritants. One physical property common to most solvents is odor.
 - d. Unfortunately, the odor of a solvent offers little in the way of determining whether or not the environment is immediately hazardous. Solvent odor thresholds vary widely and acclimation or odor fatigue is often rapid. Odor is also not generally indicative of the degree of hazard that the material presents. Butyl mercaptan has such an extremely disagreeable odor that one cannot tolerate a concentration necessary to be injurious. Chloroform, however, has a sweet odor to many people and tolerance levels can far exceed safe levels.
 - e. Chronic effects of solvent exposure vary widely. Of most concern is the potential for lung, liver, and kidney damage posed by some solvents. This, in general, applies to solvents that are not water soluble. Examples of these solvents would be benzene, toluene, xylene, chloroform, carbon tetrachloride, and trichloroethylene.
 - f. Skin absorption is an additional mode of entry for which an exposure to a solvent may occur. Most commonly, solvents act to de-fat the skin. This will cause drying and cracking of the skin, and may lead to chronic dermatitis with prolonged and repeated exposure. Some solvents can also act as corrosives. Most amines and phenols act in this manner.
 - g. In addition, many of the solvents (dimethyl sulfoxide and dimethyl formamide, for example) will penetrate the skin and be absorbed into the body. In this case, the effects of exposure will be analogous to inhalation exposure. Carbon disulfide, n-butyl alcohol, and phenol are common solvents that can penetrate intact skin. For those solvents, there will be a notation of skin exposure noted on the MSDS. Most skin contact with solvents can be avoided by wearing gloves suitable for that chemical. It is important that the glove be resistant to the material being handled. Using the wrong glove can give a false sense of security and overexposure via the skin may result. If a solvent penetrates the glove, a prolonged contact will result due to slowed evaporation rates. Rubber and neoprene gloves can be classed as good general purpose gloves, but a chemical resistance chart and the MSDS should always be consulted. Direct liquid contact by solvents in the eyes can be very serious. The victim could easily panic. Get them to the eye wash immediately and flush the eyes for at least 15 to 30 minutes. Medical assistance should also be summoned.
 - h. In summary, volatile solvents can pose inhalation, skin, and ingestion hazards. Some of the solvents may also be flammable, which could cause fire and/or explosion hazards. Whenever possible, use volatile solvents in a properly operating fume hood to eliminate inhalation hazards, use correct skin and eye protection and use good laboratory and hygienic technique to eliminate any possible ingestion of volatile solvents.

2. Acid and Bases

- a. Common to all acids and bases is their corrosive action on human tissues. Minor exposures are generally reversible, although often painful for a short period of time. The reversibility of the effects of acid or base exposure will depend on three factors: the duration of exposure, concentration of the material, and the first aid methods used.
- b. Exposure can occur through skin absorption or inhalation. With inhalation exposure, remove the victim from the area (try to keep the victim from breathing too deeply, as this may exacerbate the effects) and summon medical help.
- c. Skin contact is the most common route of exposure. Here the concentration and type of acid are the most important factors. In concentrated forms, all types of corrosives may cause severe penetrating burns. Dilute solutions do not have the same warning properties as concentrated forms, so guard against exposure. One should be particularly careful with hydrofluoric acid.
- d. Neoprene gloves provide the best protection from skin exposure to both acids and bases, but in all cases, follow the recommendations in the (MSDS). When using or dispensing concentrated acids or bases, a lab coat or apron and a full face shield is required. If there is skin or eye contact with acids or bases, make sure to flush the area with water for 15 to 30 minutes and summon medical assistance.

3. Toxic Solids

- a. Many of the chemicals used in the laboratory that are solid and toxic are used in solution, so skin absorption can be of a concern. This is particularly true when a substance is dissolved in a solvent that can penetrate the skin. Also, an oxidizing material dissolved in water can act directly on the skin causing irritation where the solid alone would be relatively less irritating. It is therefore important that proper personal protective equipment be worn.
- b. In the solid form, the greatest risk of exposure is through inhalation. This risk can be lessened by wearing the appropriate respirator and/or working in a fume hood.

C. Incompatible Chemicals

Certain hazardous chemicals cannot be mixed or stored safely with other chemicals due to potentially severe or extremely toxic reactions taking place. For example, keep oxidizing agents separated from reducing agents, initiators separated from monomers, and acids separated from alkalis, etc. The chemical label and Material Safety Data Sheet will contain information on incompatibilities.

D. Chemical Stability

Stability refers to the susceptibility of the chemical to decomposition. Ethers, liquid paraffins, and olefins can form peroxides on exposure to air and light. Since these chemicals are packaged in an air atmosphere, peroxides can form even though the containers have remained sealed. Some inorganic chemicals also are unstable. Unless

inhibitor was added by the manufacturer, closed containers of ethers shall be discarded after one year.

E. Shock-Sensitive Chemicals

Shock-sensitive refers to the sensitivity of the chemical to decompose rapidly or explode when struck, vibrated, or otherwise agitated. The label and Material Safety Data Sheet will indicate if a chemical is shock-sensitive. Shock-sensitive chemicals should be procured as needed to minimize storage problems. Shock-sensitive materials should be considered individually and disposed of as soon as practical. Many chemicals become increasingly shock-sensitive with age. The date received and date opened shall be clearly marked on all containers of shock-sensitive chemicals. Inhibitors are not to be added to shock-sensitive materials unless specific instructions from the manufacturer are provided.

F. Material Safety Data Sheets

The Material Safety Data Sheet (MSDS) is a format for describing what chemical or product you are working with, potential chemical hazards, and ways of minimizing these hazards. These sheets shall be on hand in the laboratory for people who use these chemicals.

G. Procurement of Chemicals

1. The achievement of safe handling, use, and disposal of hazardous substances begins with the persons who requisition such substances and those who approve their purchase orders. These persons must be aware of the potential hazards of the substances being ordered, know whether or not adequate facilities and trained personnel are available to handle such substances, and should ensure that a safe disposal route exists.
2. Before a new substance is received, information concerning its proper handling methods, including proper disposal procedures, should be given to all those who will be working with it. It is the responsibility of the laboratory supervisor to ensure that the facilities are adequate and that those who will handle any material have received proper training and education to do so safely.
3. No container or cylinder should be accepted that does not have an identifying label. For chemicals, it is desirable that this label which requires, at a minimum, the following components:
 - a. Identification of contents of container;
 - b. Signal word and summary description of any hazard(s);
 - c. Precautionary information - what to do to minimize hazard or prevent an accident from happening;
 - d. First aid in case of exposure;
 - e. Spill and cleanup procedures; and
 - f. If appropriate, special instructions to physicians.
 - g. Every effort should be made to ensure that this label remains on the container and legible.

H. Spill Prevention

A hazardous chemical spill means that an uncontrolled release of a hazardous chemical has occurred. The release may involve a gas, liquid, or solid, and usually requires some action be taken to control the point of release or the spread of the chemical. A chemical is hazardous if it possesses a physical or health threat to humans, the environment, or property. More specifically, a substance is considered hazardous when:

- a. It is flammable, explosive, or reactive;
- b. It generates harmful vapor or dust;
- c. It is a carcinogen;
- d. It is a corrosive and attacks skin, clothing, equipment, or facilities;
- e. It is poisonous by ingestion, inhalation or absorption.

Spills involving hazardous materials will require different tactics depending on the magnitude of the spill, the material's toxicity, reactivity, and flammability, routes of entry of the material into the body, and the promptness with which the spill can be safely managed. Many spills can be prevented or controlled by careful planning, use of trays, and absorbent paper. Proper techniques for transporting hazardous chemicals and proper storage techniques may help prevent spills.

I. Handling and Transportation of Chemicals

1. Many laboratory accidents occur through the simple operation of carrying chemicals from one place to another or transferring them from one container to another. The chemicals used in a laboratory are often corrosive, toxic, or flammable and any accident involving these has the potential for personal injury. Therefore, it is good practice to assume that **all** chemicals are potentially hazardous.
2. When large bottles of acids, solvents, or other liquids are transported within the laboratory without a cart, only one bottle should be carried at a time. The bottle should be carried with both hands, one on the neck of the bottle and the other underneath. Avoid the temptation to hook a finger through the glass ring on top of the bottle, allowing it to dangle while being transported. Never carry or attempt to pick up a bottle by the cap.
3. When transporting bottles within the laboratory, a wheeled cart may be used. Carts should be stable under load and have wheels large enough to negotiate uneven surfaces (such as expansion joints and floor drain depressions) without tipping or stopping suddenly. Do not place the bottles near the edge of the cart, nor should they be touching each other or other glassware during transport. Be cautious rolling the cart over door sills or other possible obstructions. Incompatible chemicals should not be transported on the same cart.
4. Special padded or rubber bottle carriers, pails, or carts should be used to prevent breakage by accidental striking against walls or floor, and to contain the material if breakage does occur.
5. Large quantities of concentrated mineral acids, e.g., sulfuric, nitric and hydrochloric acids, shall be kept in storage rooms, in cabinets for corrosive substances, or chemical transfer rooms. Bottles of concentrated acids must be carried from the aforementioned areas in an approved acid bottle carrier.

6. Organic solvents shall also be stored in specialized flammable storage areas. These solvents shall be carried from storage areas in special rubber carriers. Organic solvents can present fire hazards as well as inhalation hazards.

J. Chemical Storage

1. Every chemical in the laboratory should have a definite storage place and should be returned to that location after each use.
2. Solvents, acids, bases, reactives, oxidizers, and toxins will be stored separately. Separation basically refers to physical separation of containers and isolation of potential spills and releases with the goal of preventing chemical reactions. Ideally, separate cabinets or isolated areas within a central storage area should be utilized for segregated storage of incompatibles.
3. Adequate containment for spills and accidental releases shall be provided.
4. Hazardous chemicals should never be stored on the floor. Containers should be kept on low shelves or in cabinets. The shelves should have a lip on the forward edge to prevent bottles from slipping off. Chemicals tend to "creep" toward and over the edge of a shelf. Shelving units should be securely fastened to the wall or floors. Shelves should not be overloaded.
5. Utilize a compatible/suitable container for experiments, stored chemicals and collected wastes. In instances of corrosive wastes or halogenated solvents, the use of metal containers is often unsuitable, even if the solvents were originally shipped in metal containers. In these instances, plastic carboys (high density polyethylene) or lined metal containers may be more suitable.
6. There shall be constant vigilance for any sign of chemical leakage. Containers storing chemical waste must be inspected weekly for any sign of chemical leakage. Containers of all types should be free of rust and deformation.
7. Caps and covers for containers shall be securely in place whenever the container is not in immediate use.
8. Flammable liquids in quantities greater than one liter should be kept in metal safety cans designed for such storage.
9. Metal drums used for storage and dispensing of flammable chemicals shall be properly grounded. Ground cables shall be available and utilized in any lab using metal storage containers for flammable liquid storage.
10. Chemicals should be stored as close as feasible to the point of use in order to maximize efficiency and minimize transport distance. Chemical storage should be limited only to areas in which the particular chemical is used. Storage locations must be identified on an emergency floor plan posted in each work area and should be equipped with a fire extinguisher, spill kit, eye wash, first aid kit, and telephone or other communication system to allow for adequate emergency notification.
11. Small quantities of chemicals can be held at individual work stations if this quantity is to be promptly used in a test and does not compromise acceptable ambient organic vapor levels or procedures for spill control and fire safety. These containers must be properly labeled.
12. Only limited quantities of chemicals and solvents (one semester supply) should be stored in the laboratory. Large drums or multiple bottles of chemicals should be stored in a centralized chemical storage area.

13. Out-of-date (Expired) chemicals shall be disposed of on a periodic basis to reduce overall hazard potential and minimize inventory tracking and updating.

SECTION 4.3 CHEMICAL WASTES HANDLING AND DISPOSAL

A. Basic Procedures

1. Collect substances in original or other suitable primary container.
2. Properly label containers as to contents and hazards.
3. Properly store containers until ready for disposal.
4. When accumulation exceeds the available storage limits within the laboratory area, arrange for the transfer of the substances with your Departmental Chemical Safety Officer who shall coordinate the pickup with (EHSS).
5. Individual containers, except in prearranged situations, shall NOT be boxed together.
6. (EHSS) will pick up surplus substances from the laboratory or collection area upon request only. In certain instances, (EHS) section may request that a department store unwanted chemicals until a chemical pickup by a hazardous waste management firm is arranged.
7. (EHSS) will then determine the status of substances as surplus, for reuse, for recycling, or for waste disposal.

B. Container Condition

1. Where possible, materials should be kept in their original containers.
2. Containers shall be in good condition; leaking or damaged containers are not acceptable. If leaking or damaged, either repackage or call EHS officer to determine the proper packaging for disposal.
3. Containers shall be equipped with a properly fitting cap or other closure means.
4. Containers shall be compatible with substances contained therein.
5. Plastic bags, where acceptable as containers (double bagging is preferred), shall be without punctures or tears and shall be tightly sealed.
6. Containers should be inspected weekly for signs of leaks or deterioration.
7. Compressed gas cylinders shall not be handled or transported until the regulating device is removed and the safety cap installed. Every effort should be made to return compressed gas cylinders to the manufacturer or original supplier.

C. Container Volumes and Sizes

1. Glass containers shall not exceed one gallon (4 liters) in size and shall not be filled into the neck of the fill/pour spout.
2. Where containers have flat tops, the liquid level shall be at least 1 inch from the fill/pour opening.
3. Plastic baggies utilized as primary containers shall be packaged in a secondary container such as glass, hard plastic, metal, or cardboard box.

D. Labeling of Containers

1. Each container shall bear the Hazardous Chemical Surplus Tag that clearly and neatly indicates the chemical or common name of each substance that is at least 1% by volume of the total contents or mixture.
2. Indicate the strength or concentration of the substance where applicable.
3. Do not use chemical formulas, chemical symbols, chemical equations or abbreviations.
4. Indicate the physical and/or health hazards of the substance, if known.
5. Indicate the name of the building, room, and principal investigator or person responsible for generating the waste (or someone with direct knowledge of the process).
6. In the instances of time sensitive substances such as ethers, the date of container opening or initial accumulation shall be included on the form.
7. Remove or obliterate any other labels or wordings not related to the current substance.
8. Do not allow the creation of "UNKNOWN" through lack of secure readable labeling.

E. Disposal of Empty Containers

Containers that are empty and no longer needed must be disposed of properly. A container shall be considered "empty" if all the following conditions exist

1. The container contained none of the chemicals as Tri- Tetra- or Penta-phenol,
2. All chemicals, that can be removed, have been removed using practices commonly employed to remove materials from that type of container e.g. pouring, pumping, aspirating, etc.,
3. There is less than one inch of residue left in the bottom of the container,
4. There is less than 3% by weight of residue left in the container (0.3% for >100 gal. containers),
5. For compressed gas cylinders only, when the pressure in the container approaches atmospheric.
6. Once a container has been declared "empty" by the above criteria, it can be placed in the normal refuse.

G. Storage of Waste Chemicals

1. Waste Chemicals shall be stored in the same manner and using the same procedures as other chemicals. It may be advantageous to further segregate chemical waste. A typical segregation of waste chemicals would be into:
 - a. Acids
 - b. Caustics
 - c. Chlorinated Solvents
 - d. Non-chlorinated Solvents
 - e. Mercury Wastes
 - f. Oxidizing Agents
 - g. PCB Wastes*
 - h. Reactive Chemicals*

- i. Waste Oil
 - j. Wastes with Heavy Metal Contamination
2. These chemicals shall be accumulated in separate containers and need to be isolated from one another to some degree, at least to the extent that spills or leaks would remain isolated from other containers. This is particularly true of acids, bases, and solvents.
 3. Mineral (inorganic) acids, straight-chain fatty acids, and bases should be neutralized by the laboratory generating these wastes.

CHAPTER 5 BIOLOGICAL SAFETY

Section 5.1 Introduction

Microbiological and biohazard laboratories are special, often unique, work environments that may pose special infectious disease risks to persons in or near them. Personnel have contracted infections in the laboratory throughout the history of microbiological and biohazard research. A number of cases have been attributed to carelessness or poor technique in the handling of infectious materials.

Section 5.2. Laboratory Practice and Technique

1. The most important element of containment is strict adherence to standard microbiological practices and techniques.
2. Persons working with infectious agents or infected materials must be aware of potential hazards and must be trained and proficient in the practices and techniques required for safely handling such material.
3. The director or person in charge of the laboratory is responsible for providing or arranging for appropriate training of personnel.
4. Laboratory personnel, safety practices and techniques must be supplemented by appropriate facility design and engineering features, safety equipment and management practices.
5. Engineering controls shall be examined and maintained or replaced on a regular schedule to ensure their effectiveness.
6. Employees shall wash their hands immediately or as soon as possible after removal of gloves or other personal protective equipment and after hand contact with blood or other potentially infectious materials.
7. All personal protective equipment shall be removed immediately upon leaving the work area or as soon as possible if overtly contaminated and placed in an appropriately designated area or container for storage, washing, decontamination or disposal.
8. Used needles and other sharps shall not be sheared, bent, broken, recapped, or reheated by hand. Used needles shall not be removed from disposable syringes.
9. Eating, drinking, smoking, applying cosmetics or lip balm, and handling contact lenses are prohibited in work areas where there is a potential for occupational exposure.
10. Food and drink shall not be stored in refrigerators, freezers, or cabinets where blood or other potentially infectious materials are stored or in other areas of possible contamination.
11. All procedures involving blood or other potentially infectious materials shall be performed in such a manner as to minimize splashing, spraying, and aerosolization of these substances, and shall comply with the Blood-Borne Pathogens Act.

Section 5.3 Safety Procedures for Working with Human Blood or Other Potentially Infectious Material

1. Universal precautions shall be observed at all times. Universal precautions apply to blood, any other body fluid containing visible blood, and other potentially infectious material.
 - a. Under circumstances in which differentiation between body fluid types is difficult or impossible, all body fluids shall be considered potentially infectious materials.
 - b. Universal precautions do not apply to feces, nasal secretions, sputum, saliva, sweat, tears, urine, or vomits unless they contain visible blood.
 - c. Other potentially infectious materials means the following human body fluids:
 - (1) semen,
 - (2) vaginal secretions,
 - (3) pericardial fluid,
 - (4) cerebrospinal fluid,
 - (5) synovial fluid,
 - (6) pleural fluid,
 - (7) peritoneal fluid,
 - (8) amniotic fluid,
 - (9) saliva in dental procedures,
 - (10) any body fluid that is visibly contaminated with blood,
 - (11) all body fluids in situations where it is difficult or impossible to differentiate between body fluids,
 - (12) any unfixed tissue or organ (other than intact skin) from a human, living or dead,
 - (13) human immunodeficiency virus (HIV)-containing cell or tissue cultures, organ cultures, and (HIV) or hepatitis B virus (HBV)-containing culture medium or other solutions, and
 - (14) Blood, organs, or other tissues from experimental animals infected with (HIV),(HBV), or other diseases infectious to humans.
2. Employees must wash their hands immediately or as soon as feasible after removal of gloves or other personal protective equipment, and following contact with blood or other potentially infectious materials.
3. Contaminated needles or other contaminated sharps must not be recapped, sheared, bent, broken or resheathed by hand. Contaminated sharps must be placed in appropriate containers until properly reprocessed or disposed. These containers shall be:
 - a. puncture resistant,
 - b. labeled or color-coded, and
 - c. Leak-proof on the sides and bottom.
4. Specimens of blood or other potentially infectious materials should be placed in a labeled or color-coded container which prevents leakage during collection, storage, transport, or shipping. A secondary container must be used if the primary container is contaminated, punctured or leaking.

5. Equipment which has been in contact with blood or other potentially infected material must be examined and decontaminated by laboratory personnel as necessary prior to servicing or shipping.
6. If the equipment cannot be completely decontaminated, a readily observable label must be attached to the contaminated equipment and all parties who will be in contact with the equipment should be notified.
7. Gloves must be worn when there is potential for contact with blood, or other potentially infectious materials. Disposable (single use) gloves such as surgical or examination gloves must be replaced as soon as possible when visibly soiled, torn, and punctured or when their ability to function as a barrier is compromised.
8. Additional appropriate protective clothing should be selected and worn based upon the task and degree of exposure anticipated.
 - a. Gowns, laboratory coats, aprons or similar clothing should be worn if there is a potential for soiling of clothes with blood or other potentially infectious materials.
 - b. Fluid-resistant clothing should be worn if there is a potential for splashing or spraying of blood or other potentially infectious materials.
 - c. Surgical caps or hoods should be worn if there is a potential for splashing or spraying of blood or other potentially infectious materials.
 - d. Fluid-proof shoe covers should be worn if there is a potential for shoes to become contaminated and/or soaked with blood or other potentially infectious materials.
9. Work surfaces must be decontaminated with an appropriate disinfectant after completion of procedures; when surfaces are overtly contaminated; immediately after the spill of blood or other potentially infectious materials; and at the end of the work shift.
 - a. Appropriate germicides include:
 - (1) EPA-registered "EHSS disinfectant" chemical germicides that have a label claim for tuberculocidal activity, and
 - (2) commercially available hard-surface germicides or solutions containing at least 500 parts per million free available chlorine (a 1:100 dilution of common household bleach - approximately ¼ cup of bleach per gallon of tap water).
 - b. For routine housekeeping or removal of soiling in the **absence** of visible blood contamination, "EHSS disinfectants" (**no** label claim for tuberculocidal activity required) can be used.
 - c. Environmental surfaces such as floors, woodwork, or countertops which have become soiled should be cleaned and disinfected using any cleaner or disinfectant agent that is intended for environmental use.
10. All bins, pails, cans, and similar receptacles intended for reuse that have a potential for becoming contaminated with blood or other potentially infectious materials should be inspected, cleaned, and disinfected on a regularly scheduled basis and cleaned and disinfected immediately or as soon as possible upon visible contamination.

11. Broken glassware which may be contaminated must not be picked up directly with the hands. It shall be cleaned up using mechanical means such as a brush and dust pan, a vacuum cleaner, tongs, cotton swabs or forceps.

Section 5.4. Safety Equipment (Primary Barriers)

1. Safety equipment includes biological safety cabinets and a variety of enclosed containers.
2. The biological safety cabinet is the principal device used to provide containment of infectious aerosols generated by many laboratory procedures.
3. Open fronted Class I and Class II biological safety cabinets are partial containment cabinets which offer significant levels of protection to laboratory personnel and the environment when used with good microbiological techniques.
4. The gas-tight Class III biological safety cabinet provides the highest attainable level of protection to personnel and the environment.
5. Safety equipment also includes items for personal protection such as gloves, coats, gowns, shoe covers, boots, respirators, face shields, and safety glasses. These personal protective devices are often used in combination with biological safety cabinets and other devices which contain the agents, animals, or materials being examined. In some situations in which it is impractical to work in biological safety cabinets, personal protective devices may form the primary barrier between personnel and the infectious materials. Examples of such activities include production activities, and activities relating to maintenance, service or support of the laboratory facility.

Section 5.5. Biological Safety Cabinets

1. Some cabinets are equipped with ultraviolet light. These must be turned off during the day while laboratory personnel are occupying the room.
2. Hands and arms should be washed well with germicidal soap before and after work in the cabinet.
3. Technicians are encouraged to wear long-sleeve gowns with knit cuffs and rubber gloves. This minimizes the shedding of skin flora into the work area and protects the hands and arms from contamination by viable agents.
4. Interior surfaces of the work area should be disinfected by wiping them thoroughly with 70% alcohol.
5. The cabinets should not be overloaded. Everything needed for the complete procedure should be placed in the cabinet before starting so that nothing passes in or out through the air barrier until the procedure is completed.
6. Do not place anything over the front intake or rear exhaust grill in units having a solid work surface. As a general rule, keep equipment at least four inches inside the cabinet window and perform transfer of viable materials as deeply into the cabinet as possible.
7. After all materials have been placed in the cabinet, wait 2-3 minutes before beginning work. This will allow sufficient time for the cabinet air to purge airborne contamination from the work area.
8. Hold the activity in the room to a minimum. Unnecessary activity may create disruptive air currents. The ideal location for a cabinet is in a quiet end of the

- laboratory, removed from doorways, air conditioning and heating vents. Opening and closing laboratory doors can cause disruptive drafts that allow microorganisms to penetrate the air barrier.
9. Schedule uninterrupted work periods. The movement of objects including hands and arms causes turbulent air current, which disrupt the air barrier and allow escape and entrance of airborne contaminants.
 10. Air turbulence caused by rotating laboratory equipment, such as a small clinical centrifuge; disrupt air flow within the cabinet and at the work opening. This is sufficient for contaminated air to escape to the laboratory environment. If a centrifuge must be used in the cabinet, do not perform other research activities in the cabinet while the centrifuge is operating.
 11. Normal laboratory contamination control procedures and aseptic techniques are still necessary while working in the biological safety cabinet.
 12. Equipment in direct contact with the biological agent should not be removed from the cabinet until enclosed or until the surface is decontaminated. Trays of discarded pipettes and glassware must be covered before removal from the cabinets.
 13. If an accident occurs which spills or splatters the biological agent in the work area, all surfaces in the cabinet must be surface decontaminated before being removed.
 14. Do not use a Bunsen. Burner in a biological safety cabinet. The flame causes turbulence in the air stream and the heat generated may damage the (HEPA) filter. If a procedure requires the use of a flame, a burner with a pilot light should be used. It should be placed to the rear of the work space where resulting air turbulence will have a minimal effect.
- 15. Do not mouths pipette?**
16. Following completion of the work, the following steps must be performed:
 - a. Allow the cabinet to run 2-3 minutes with no activity. This will allow sufficient time for cabinet air flow to purge airborne contaminants from the work area;
 - b. Decontamination of the interior surfaces should be repeated after removal of all materials, cultures, apparatus, etc. A careful check of the work area should be made for spilled or splashed nutrients. They may support fungus growth and result in spore liberation that contaminates the protected work environment; and
 - c. Shut down by turning off the fan and lights. Use (UV) lights according to manufacturer's recommendations. Do not use the cabinet to store excess laboratory equipment.

Section 5.6. Personal Protective Equipment

1. When there is a potential for occupational exposure, the (EHSS) shall provide and assure that the employee uses appropriate personal protective equipment such as, but not limited to, gloves, gowns, fluid-proof aprons, laboratory coats, head and foot coverings, face shields or masks, eye protection, mouthpieces, resuscitation bags, pocket masks, or other ventilation devices.
2. The (EHSS) shall assure that appropriate personal protective equipment in the appropriate sizes is readily accessible at the work site or issued to employees.

- Hypoallergenic gloves shall be readily accessible to those employees who are allergic to the gloves normally provided.
3. The EHSS shall provide for the cleaning, laundering or disposal of personal protective equipment.
 4. The EHSS shall repair or replace required personal protective equipment as needed to maintain its effectiveness.
 5. Gloves shall be worn when the employee has the potential for the hands to have the direct skin contact with blood, other potentially infectious materials, mucous membranes, non-intact skin, and when handling items or surfaces soiled with blood or other potentially infectious material.
 - a. Disposable (single-use) gloves such as surgical or examination gloves shall be replaced as soon as possible when visibly soiled, torn, punctured or when their ability to function as a barrier is compromised. They shall not be washed or disinfected for re-use.
 - b. Utility gloves may be disinfected for re-use if the integrity of the glove is not compromised, however, they must be discarded if they are cracked, peeling, discolored, torn, punctured, or exhibit other signs of deterioration.
 6. Masks and eye protection or chin-length face shields shall be worn whenever splashes, spray, spatter, droplets, or aerosols of blood or other potentially infectious materials may be generated and there is a potential for eye, nose, or mouth contamination.
 7. Appropriate protective clothing shall be worn when the employee has potential for occupational exposure. The type and characteristics will depend upon the task and degree of exposure anticipated.
 1. Gowns, lab coats, aprons or similar clothing shall be worn if there is a potential for soiling of clothes with blood or other potentially infectious materials.
 2. Fluid resistant clothing, surgical caps or hoods shall be worn if there is a potential for splashing or spraying of blood or other potentially infectious materials.
 3. Fluid-proof shoe covers shall be worn if there is a potential for shoes to become contaminated and/or soaked with blood or other potentially infectious materials.

Section 5.7 Housekeeping

1. The work site shall be maintained in a clean and sanitary condition. All equipment, environmental enclosures and working surfaces shall be properly cleaned and disinfected after contact with blood or other potentially infectious materials.
2. Work surfaces shall be decontaminated with an appropriate disinfectant after completion of procedures; when surfaces are overtly contaminated; immediately after the spill of blood or other potentially infectious materials; and at the end of the work shift.
3. Protective coverings such as plastic wrap, aluminum foil, or imperviously-backed absorbent paper may be used to cover equipment and environmental surfaces. These coverings shall be removed and replaced at the end of the work shift or when they become overtly contaminated.

4. Equipment which may become contaminated with blood or other potentially infectious materials shall be checked routinely and prior to servicing or shipping and shall be decontaminated as necessary.
5. All bins, pails, cans, and similar receptacles intended for re-use which have a potential for becoming contaminated with blood or other potentially infectious materials shall be inspected, cleaned, and disinfected on a regularly scheduled basis and cleaned and disinfected immediately or as soon as possible upon visible contamination.
6. Broken glassware which may be contaminated shall not be picked up directly with the hands. It shall be cleaned up using mechanical means such as a brush and dust pan, tongs, cotton swabs or forceps.
7. Specimens of blood or other potentially infectious materials shall be placed in a closable, leak-proof container labeled or color-coded bag prior to being stored or transported. If outside contamination of the primary container is likely, then a second leak-proof container that is labeled or color-coded shall be placed over the outside of the first container and closed to prevent leakage during handling, storage, or transport. If puncture of the primary container is likely, it shall be placed in a leak-proof puncture resistant secondary container.
8. Reusable items contaminated with blood or other potentially infectious materials shall be decontaminated prior to washing and/or reprocessing.

SECTION 5.8. Biohazardous waste

A. Biohazard Wastes are discarded materials "that are biological agents or conditions (as an infectious organism or unsecure laboratory condition) that constitutes a hazard to man or his environment." This definition includes "any and all substances which contain materials to which organisms may cause injury or disease to man or his environment, but which are not regulated as controlled industrial waste".

B. Infectious Wastes include the following categories:

- cultures and stocks of infectious agents and associated biologicals;
- human blood and blood products,
- pathological wastes,
- contaminated sharps,
- contaminated animal carcasses, body parts, and bedding,
- wastes from surgery, necropsy and other medical procedures,
- laboratory wastes,
- Isolation wastes, unless determined to be non-infectious by the infection control committee at the (EHSS).
- Any other material and contaminated equipment which, in the determination of the (EHSS) infection control staff, presents a significant danger of infection because it is contaminated with, or may reasonably be expected to be contaminated with, etiologic agents.

C. Chemical Wastes

Subject to the requirements of biohazard waste regulations include wastes from the following categories:

1. pharmaceutical wastes,
2. laboratory reagents contaminated with infectious body fluids,
3. all the disposable materials which have come into contact with cytotoxic/antineoplastic agents during the preparation, handling, and administration of such agents, and
4. Other chemicals that may be contaminated by infectious agents, as designated by experts at the point of generation of the waste.

D. Treated Biohazard

Wastes are all biohazard wastes that have been treated by one of the following methods and rendered harmless and biologically inert:

1. incineration in an approved incinerator,
2. steam sterilization at sufficient time and temperature to destroy infectious agents in waste ("autoclaved"),
3. chemical disinfection where contact time, concentration, and quantity of the chemical
4. disinfectant are sufficient to destroy infectious agents in the waste,

E. Sharps

Sharps are used in animal or human patient care or treatment or in medical research, laboratories, including: hypodermic needles, syringes, (with or without the attached needle), Pasteur pipettes, scalpel blades, suture needles, blood vials, needles with attached tubing, and culture dishes (regardless of presence of infectious agents). Also included are other types of broken or unbroken glassware that were in contact with infectious agents, such as used slides and cover slips.

F. Biohazardous Waste Disposal

1. All infectious waste destined for disposal shall be placed in closable, leak-proof containers or bags that are color-coded or labeled.
2. If outside contamination of the container or bag is likely to occur then a second leak-proof container or bag which is closable and labeled or color-coded shall be placed over the outside of the first and closed to prevent leakage during handling, storage, and transport.
3. Disposal of all infectious waste shall be in accordance with procedures found in (KAUH) Medical Waste Management Plan.
4. Immediately after use, sharps, i.e., broken glass, needles, pipettes, etc., shall be placed in closable, labeled or color-coded leak-proof, puncture resistant, disposable containers. These containers shall be easily accessible to personnel and located in the area of use.
5. If any infectious waste is also a chemical waste, call (EHSS) for assistance with disposal after disinfection. Antineoplastic/cytotoxic agents require special disposal.

6. Biomedical wastes that are also radioactive should be treated according to requirements for both biomedical and radioactive waste.
7. Prior to any treatment, all biomedical wastes, including those to be incinerated, should be enclosed in a puncture-resistant, red biohazard bag that is color-coded or labeled with the biological hazard symbol.
8. All sharps intended for disposal, whether contaminated or not, must be enclosed in a specially designed sharps container. Never clip or recap needles before putting them in the sharps container. The sharps container should be puncture-resistant, leak proof on the sides and bottom, and color-coded or labeled with the biohazard symbol. When selecting sharps containers, look for special safety features such as lids that lock tight for safe disposal.
9. Untreated biomedical waste is not to be disposed of in the municipal waste stream. All biomedical waste, including sharps and syringes, must be treated by incineration, steam sterilization, or chemical disinfection before disposal in the municipal waste stream.
10. After disinfection, but before disposal in the municipal waste stream, all treated biomedical wastes should be enclosed in an unmarked outer bag that is **not** red or labeled with the biohazard symbol. Any biomedical waste that has been treated as described above and packaged such that it is clearly evident that the waste has been effectively treated, is not subject to regulation as biomedical waste and may be collected, transported, and disposed of as municipal waste.

CHAPTER 6 ENGINEERING SAFETY

Supervisors

1. Supervisors must recognize those factors in the workplace with accident potential.
2. The supervisor shall provide frequent inspections of job sites, work methods, and materials/equipment used.
3. Any unsafe equipment/material shall be tagged and rendered inoperative or physically removed from its place of operation.
4. The supervisor shall permit only qualified personnel to operate equipment and machinery according to safe work practices.
5. Ensuring workers exposed or potentially exposed to hazardous chemicals/materials have access to appropriate Material Safety Data Sheets (MSDS).
6. Ensuring that employees remove construction debris and rubbish from the job site upon completion of the job, or daily if extended beyond one day.
7. Ensuring that hazardous materials shall not be left at job sites unless properly stored.
8. Ensuring that work being performed on job sites shall not endanger building occupants (e.g., exits blocked, fire alarm devices disconnected, etc.).
9. Supervisors are responsible for:
 - a. Ensuring safe working conditions
 - b. Providing necessary protective equipment
 - c. Ensuring that workers are properly using provided PPE.
 - d. Ensuring that required guards and protective equipment are provided, used, and properly maintained.
 - e. Ensuring that tools and equipment are properly maintained and used.
 - f. Planning the workload and assigning employees to jobs which they are qualified to perform. Ensuring that the employees understand the work to be done, the hazards that may be encountered, and the proper procedure for doing the work safely.
 - g. Taking immediate action to correct any violation of safety rules observed or reported to them.

SECTION 6.1 General Shop/Work Area Safety

A. Employee Training

Employees shall be thoroughly trained in the use of protective equipment, guards, and safeguards for chemicals and safe operation of equipment, machines, and tools they use or operate. Only employees who have been trained and those undergoing supervised on-the-job training (OJT) shall be allowed to use shop equipment, machines, and tools.

B. Personal Protective Equipment (PPE)

Personal protective equipment (PPE) is not a substitute for engineering controls or feasible work or administrative procedures. While these controls are being implemented, or if it has been determined that control methods are not feasible, personal protective equipment is required whenever there are hazards that can do bodily harm through absorption, inhalation, or physical contact. This equipment

includes respiratory and hearing protective devices, special clothing, and protective devices for the eyes, face, head, and extremities. All (PPE) shall be of a safe design and constructed for the work to be performed and shall be maintained in a sanitary and reliable condition. (The EHSS) shall be contacted for guidance on the type of (PPE) required in each job and work area

1. Eye Protection

Eye protection is required when there is a possibility of injury from chemicals or flying particles. Examples of operation requiring the use of eye protection include, but are not limited to:

- a. Chipping, grinding, and impact drilling.
- b. Breaking concrete, brick, and plaster.
- c. Welding or helping in welding of any type.
- d. Cleaning with compressed air.
- e. Tinning or soldering lugs or large joints.
- f. Riveting, grinding, or burning metals.
- g. Handling chemicals, acids, or caustics.
- h. Examples of Face shields shall be thoroughly washed with soap and water before being worn by another person.

2. Hearing Protection

- a. Appropriate hearing protection shall be used where employees are in designated hazardous noise areas (> 85 dB) with operating noise sources, or using tools or equipment which are labeled as hazardous noise producers.
- b. The (EHSS) shall be contacted for noise level surveys and guidance on the type of hearing protection required.

3. Hand Protection

- a. Rubber protective gloves shall be worn by personnel working in battery shops or where acids, alkalies, organic solvents, and other harmful chemicals are handled.
- b. Electrical worker's gloves are designed and shall be used to insulate electrical workers from shock, burns, and other electrical hazards. These gloves shall NOT be the only protection provided and will never be used with voltages higher than the insulation rating of the gloves.
- c. Multi-use gloves shall be worn to protect the hands from injuries caused by handling sharp or jagged objects, wood, or similar hazard-producing materials. These gloves are usually made of cloth material with chrome leather palms and fingers or synthetic coating. All-leather gloves are also acceptable.

4. Foot Protection

- a. Non-skid shoes shall be worn where floors may be wet or greasy.
- b. Where there is reasonable probability of foot or toe injury from impact and compression forces, safety footwear shall be worn.

5. Respiratory Protection

- a. There are various airborne hazards, e.g., organic vapors, particulates, fumes, etc., that personnel may encounter and respiratory protection may be required.
- b. The EHSS shall be consulted for guidance on the type of protection required.

6. Head Protection

- a. Hard hats shall be worn by all personnel working below other workers and in areas where sharp projections or other head hazards exist.

7. Body Protection

- a. Natural or synthetic rubber or acid-resisting rubberized cloth aprons shall be worn by personnel handling irritating or corrosive substances.
- b. Aprons shall normally be worn with acid sleeves and gloves for greater body protection against skin injuries.

8. Insulated Matting

- a. Insulating matting shall be used by workers for additional resistance to shock where potential shock hazards exist, such as:
 - Areas where floor resistance is lowered due to dampness.
 - Areas where high voltages (above 600 Volts) may be encountered.
 - Areas with electrical repair or test benches.
 - Other

9. General requirements

1. Shop supervisors shall ensure that shop personnel use the protective clothing and equipment that will protect them from hazards of the work they perform. It is the responsibility of workers to keep their PPE in a clean, sanitary state of repair and use the equipment when required.
2. Workers shall keep their hands and face clean, change clothes when they are contaminated with solvents, lubricants, or fuels, and keep their hands and soiled objects out of their mouth.
3. No food or drink shall be brought into or consumed in areas exposed to toxic materials, chemicals, or shop contaminants.
4. Workers shall wash their hands before eating or smoking after exposure to any contaminant.
5. Workers shall not wear rings, bracelets, wristwatches, or necklaces in the vicinity of operating machinery and power tools.
6. Additionally, long full beards, unrestrained long hair, and loose clothing can become caught in tools or machinery and cause serious personal injury.
7. Highly combustible garments or coveralls made of material such as nylon shall not be worn in or around high temperature equipment or operations such as boiler operations, welding, and any other work with open flame devices.

C. Shop Layout

1. Proper layout, spacing, and arrangement of equipment, machinery, passageways, and aisles are essential to orderly operations and to avoid congestion.
2. Equipment and machinery shall be arranged to permit an even flow of materials. Sufficient space should be provided to handle the material with the least possible interference from or to workers or other work being performed. Machines should be placed so it is not necessary for an operator to stand in a passageway or aisle. Additionally, machine positioning should allow for easy maintenance, cleaning, and removal of scrap.
3. Clear zones shall be established and should be of sufficient dimensions to accommodate typical work. Marking of machine clear zones may be yellow or yellow and black hash-marked lines, 2 to 3 inches wide. Machines designed for fixed locations shall be securely anchored.
4. If pieces of stock to be worked exceed workplace/clear zone floor markings, rope/stanchions may be used to temporarily extend the workplace. Machines with shock mounting pads shall be securely anchored and installed according to manufacturer's instructions.
5. Passageways/aisles shall be provided and marked to permit the free movement of employees bringing and removing material from the shop. These passageways are independent of clear zones and storage spaces. They shall be clearly marked.
6. Where powered materials handling equipment (forklift) is used, facility layout shall provide enough clearance in aisles, on loading docks, and through doorways to permit safe turns. Aisles shall be at least 3 feet wider than the widest vehicle used or most common material being transported.

D. Illumination

1. Adequate illumination shall be provided to ensure safe working conditions.
2. Portable lamps shall have UL approved plugs, handles, sockets, guards, and cords for normal working conditions.
3. For work in boilers, condensers, tanks, turbines, or other grounded locations that are wet or may cause excessive perspiration, a low voltage lighting system should be used, either from a battery system or low-voltage lighting unit. In situations where these lighting systems are not available, a vapor-proof 220 volt lighting system shall be used.
4. Flashlights for use near energized electrical equipment and circuitry shall have insulated cases.
5. At least 50 foot-candles of illumination shall be provided at all work stations. However, fine work may require 100 foot-candles or more. This can be obtained with a combination of general lighting plus supplemental lighting.

E. Exits and Exit Markings

1. Every exit shall have "EXIT" in plain legible letters not less than 6 inches high with the strokes of the letters not less than three-quarters of an inch wide.
2. Doors, passageways, or stairways which are neither exits nor ways to an exit (but may be mistaken for an exit) shall be clearly marked "NOT AN EXIT" or by a

- sign indicating their actual use, for example: "STORAGE ROOM" or "BASEMENT."
3. When the direction to the nearest exit may not be apparent to an occupant, an exit sign with an arrow indicating direction shall be used.
 4. Exit access shall be arranged so it is unnecessary to travel toward any area of high hazard potential in order to reach the nearest exit (unless the path of travel is effectively shielded by suitable partitions or other physical barriers).
 5. Exit signs shall be clearly visible from all directions of egress and shall not be obstructed at any time. If occupancy is permitted at night, or if normal lighting levels are reduced at times during working hours, exit signs shall be suitably illuminated by a reliable light source.
 6. A door from a room to an exit or to a way of exit access will be the side-hinged swinging type. It will swing out in the direction of travel if 50 or more persons occupy the room or the exit is from an area of high hazard potential.
 7. Areas around exit doors and passageways shall be free of obstructions. The exit route shall lead to a public way. No lock fastening device shall be used to prevent escape from inside the building.
 8. Where occupants may be endangered by the blocking of any single exit due to fire or smoke, there shall be at least two means of exit remote from each other.
 9. Exits, exterior steps, and ramps shall be adequately lighted to prevent mishaps. Separate lighting will not be required if street or other permanent lighting gives at least one foot-candle of illumination on the exit, steps, or ramp.

F. Housekeeping

Good housekeeping shall be maintained in all shops, yards, buildings, and mobile equipment. Supervisors are responsible for good housekeeping in or around the work they are supervising. As a minimum, the following requirements shall be adhered to:

1. Material shall not be placed where anyone might stumble over it, where it might fall on someone, or on or against any support unless the support can withstand the additional weight.
2. Aisles and passageways shall be kept clear of tripping hazards.
3. Nails shall be removed from loose lumber or the points turned down.
4. Ice shall be removed from all walkways and work areas where it may create a hazard or interfere with work to be done. If ice cannot be removed readily, sand or other approved materials shall be applied.
5. Trash and other waste materials shall be kept in approved receptacles. Trash shall not be allowed to accumulate and shall be removed and disposed of as soon as practicable, at least once per shift (or more often if needed).
6. Disconnect switches, distribution panels, or alarm supply boxes shall not be blocked by any obstruction which may prevent ready access.
7. Machinery and equipment shall be kept clean of excess grease and oil and (operating conditions permitting) free of excessive dust. Pressure gauges and visual displays shall be kept clean, visible, and serviceable at all times. Drip pans and wheeled or stationary containers shall be cleaned and emptied at the end of each shift.

G. Fire Prevention

1. All engineering services personnel shall receive fire prevention training as part of their general training.
2. Supervisors in charge of operations where fuels, solvents, or other flammable liquids are used shall be constantly alert for hazards and unsafe acts. Fuels such as gasoline shall never be used to clean floors or clothing, and open solvent or gasoline containers shall not be kept near electrical equipment. The use of low flashpoint petroleum solvents shall be avoided whenever possible. Open flames, open element heaters, equipment not properly grounded, and non-explosion-proof electrical equipment used in the presence of flammable or combustible liquids shall be avoided.
3. Fire extinguishers of at least 20 BC or greater rating shall be installed in Workshop areas. The **number of extinguishers** depends upon the **size** and **layout** of the facility. **Fire extinguishers shall meet the following requirements:**
 - a. Be kept fully charged and in their designated area.
 - b. Be located along normal paths of travel.
 - c. Not be obstructed or obscured from view.
 - d. Be visually inspected at least monthly to ensure that they:
 - e. Are in their designated places.
 - f. Have not been tampered with or actuated.
 - g. Do not have corrosion or other impairments.
 - h. Are accessible and not obstructed.
 - i. Be examined at least yearly and/or recharged or repaired to ensure operability and safety.
 - j. Be hydrostatically tested.
 - k. Be placed so the maximum travel distance, unless there are extremely hazardous conditions, does not exceed 20 meters for Class A or 15 **meters** for Class B locations.

H. Material Storage

1. All unnecessary accumulation of materials and supplies in the shop area shall be avoided. The presence of unnecessary material in the shop could cause such incidents as tripping, falling, or slipping. This could be especially hazardous around equipment that is in operation. The only material in the shop area shall be that actually in work.
2. The only place that materials should accumulate in quantity is in storerooms and material holding areas.
3. The storage of materials shall not, of itself, create a hazard. Materials stored in tiers shall be stacked, strapped, blocked or interlocked, and limited in height so they are stable and secure against sliding or collapse. Storage racks shall have sufficient capacity to bear the loads imposed on them.
4. Stored materials shall not obstruct fire extinguishers, alarm boxes, sprinkler system controls, electrical switch boxes, machine operations, emergency lighting, first aid or emergency equipment, or exits.
5. Heavy materials and equipment should be stored low and close to the ground or floor to reduce the possibility of injury during handling.

6. All passageways and storerooms shall be maintained clean, unobstructed, dry, and in sanitary condition. Spills will be promptly removed.
7. Where mechanical handling equipment, such as lift trucks are used, safety clearance shall be provided for aisles at loading docks, through doorways, and wherever turns or passages must be made. No obstructions that could create a hazard are permitted in aisles.

I. Use of Tools

1. Hand tools

- a. Incidents at the job site involving hand tools are usually the result of misuse. Hand tools are precision tools capable of performing many jobs when used properly. Prevention of incidents involving hand tools on the job site becomes a matter of good instruction, adequate training, and proper use.
- b. Hand tool safety requires that the tools be of good quality and adequate for the job. All tools shall be kept in good repair and maintained by qualified personnel.
- c. Racks, shelves, or tool boxes shall be provided for storing tools which are not in use.
- d. When personnel use hand tools while they are working on ladders, scaffolds, platforms, or work stands, they shall use carrying bags for tools which are not in use. Workers shall not drop tools.
- e. Supervisors shall frequently inspect all hand tools used in the operation under their supervision. Defective tools shall be immediately removed from service. Some common tool defects are:

1. Handles

- When handles of hammers, axes, picks, or sledges become cracked, split, broken, or splintered, they shall be immediately replaced. Tool handles shall be well-fitted and securely fastened by wedges or other acceptable means.
- Wedges, always used in pairs, shall be driven into the handle when repairing a sledgehammer or maul, to prevent the head from accidentally flying off if the handle shrinks.

2. Tangs

- Files, wood chisels, and other tools with tangs shall be fitted and used with suitable handles covering the end of the tang. Ends of the handles shall not be used for pounding or tapping.

3. Mushroom Heads

- Cold chisels, punches, hammers, drift pins, and other similar tools have a tendency to mushroom from repeated poundings. They shall be dressed down as soon as they begin to crack and curl.
- When dressing tools, a slight bevel of about three-sixteenths of an inch shall be grounded around the head. This will help prevent the heads from mushrooming.
- When tool heads mushroom, the material is highly crystallized and, with each blow of the hammer, fragments are likely to break off.

4. Portable Power Tools

- Portable power tools increase mobility and convenience but are frequently more hazardous to use than their stationary counterparts.
- Personnel who are required to use portable power tools in their work shall be thoroughly trained in safe operating practices. Safe operating procedure shall be set up for each type of tool consistent with the manufacturer's instructions.

J. Use of Compressed Air Sources

1. Compressed air has the appearance of a relatively harmless gas. However, to avoid accidents, compressed air must be used correctly. The improper or inadvertent connection of items not designed for shop air pressure, i.e., equipment, storage vessels, or containers, to a shop air supply may cause serious personal injury and more than likely will damage the item being connected.
2. The maximum air pressure approved for general use in the shops and laboratories is 30 psi (pounds per square inch). This pressure is sufficient for most shop and laboratory operations and is not significantly hazardous. Use discretion and good judgment when using compressed air, even at this low pressure.
3. The following rules and practices are suggested to avoid personal injury, equipment damage, and potential environmental impact:
4. All personnel assigned to shops with air compressors shall be familiar with compressor operating and maintenance instructions.
5. Compressed air is not to be used to blow dirt, chips, or dust from clothing.
6. Air compressors shall be maintained strictly in accordance with the manufacturer's instructions.
7. Do not use compressed air to transfer materials from containers when there is a possibility of exceeding the safe maximum allowable working pressure of the container.
8. The maximum working pressure of compressed air lines shall be identified in psi. Pipeline outlets shall be tagged or marked showing maximum working pressure immediately adjacent to the outlet.
9. Do not use compressed air to transfer materials from standard 55-gallon drums. Use a siphon with a bulk aspirator on a pump

WARNING

1. It is dangerous to pressurize any container not designed for that purpose.
2. Never use compressed air where particles can be accelerated by the air stream.
3. Do not use compressed air to clean machinery or parts unless absolutely necessary. Where possible, use a brush. If necessary, use a minimum pressure and provide barriers or clean the area of personnel. Wear goggles to protect your eyes.
4. Never apply compressed air to any part of a person's body.
5. Do not use a compressed air line that does not have a pressure regulator for reducing the line pressure.
6. Keep the hose length between tool housing and the air source as short as possible.
7. Where possible, attach a short length of light chain between the hose and the housing on air-operated tools. This keeps the hose from whipping should the hose-tool coupling separate.

8. Inspect air supply and tool hoses before using. Discard and label unfit hoses. Repair hoses where applicable.
9. Turn valve off and vent pressure from a line before connecting or disconnecting it. Never work on a pressurized line.
10. Do not connect air supply respirators or supplied-air suits to the compressed air supply system of any building. Such compressed air is unsafe to breathe.
11. Do not attach pneumatic tools, process, or control instruments to breathing air lines. The potential contamination to personnel and systems is hazardous.

K. Working Safely at Elevations

These procedures are designed to prevent the injury of personnel due to falls or slips any time personnel are working on portable stairs, ladders, or scaffolding, or at elevations or more than four (1.2) meter above grade.

1. Ladders

A. Hazards

Falls are the primary hazard associated with the use of ladders. Falls result from a number of unsafe acts and conditions such as:

- 1) Ladders being set on unstable surfaces.
- 2) Personnel reaching too far out to the sides.
- 3) Personnel standing too high to maintain balance.
- 4) Personnel using defective ladders (e.g., broken rails, rungs, missing hardware).

These hazards are minimized if workers adhere to proper ladder safety practices and if supervisors ensure equipment is used, inspected, and maintained in good condition. Tasks which require frequent use of ladders and involve significant climbing effort must be accomplished by workers capable of the physical exertion required under these conditions.

B. Requirements

1. Allowable Lengths

The maximum allowable lengths of portable ladders are:

- Stepladders 2.4 meters (8 feet)
- Platform stepladders(3.6)meters (12 feet)
- Straight ladders 6 meters (20 feet)
- Extension ladders 10.9 meters (36 feet) – with minimum overlap of 3 feet (1meter)

2. Wooden Ladders

- a. Wooden parts used in construction of ladders should be straight-grained; thoroughly seasoned; smoothly dressed; and free of sharp edges, splinters, checks, decay and other defects. Rungs must be parallel, level and uniformly spaced. The spacing shall not be more than 12 inches (0.3meters).
- b. Wooden ladders will be coated with a suitable protective coating such as boiled linseed oil, clear varnish or clear laquer.

- c. Wood ladders shall not be painted with an opaque coating, since possible defects may be covered up.

3. Non-slip Bases

Portable ladders shall be equipped with non-slip bases such as safety feet or spikes, depending upon the type of usage.

4. Electrical

- a. Personnel shall not use portable metal ladders when performing work on or near electrical equipment.
- b. The side rails of metal ladders will be stenciled in 2-inch (or smaller if necessary to fit on the side rails) red letters: "DANGER - DO NOT USE AROUND ELECTRICAL EQUIPMENT."
- c. Wood or reinforced plastic ladders shall be used for work on or near electrical equipment. They will be kept clean.
- d. Remove all surface buildup or dirt, grease, or oils to avoid creating a ready path for electrical current.

5. Care of Ladders

- a. Handle ladders with care. Do not drop, jar or misuse them.
- b. Ladders shall be stored in a manner that will provide easy access for inspection and will permit safe withdrawal for use. They shall not be stored in a manner that presents a tripping hazard not where they can fall on someone. They should be stored in a manner that will prevent sagging.
- c. Lubricate metal bearings of locks, wheels, pulleys, etc., as required to keep them working.
- d. Replace frayed or badly worn rope.
- e. Keep safety feet and other parts in good condition to ensure they work.
- f. Maintain ladders in good usable condition. Inspect ladders prior to use.
- g. Ladders with defects which cannot be immediately repaired, shall be removed from service for repair or destruction, and shall be tagged with a danger tag. Do not attempt to straighten or use a bent ladder made of reinforced plastic.
- h. Rungs or steps on metal ladders that are not corrugated, knurled, or dimpled will have skid-resistant materials applied.

C. Proper Use of Ladders

The correct procedures for using ladders are as follows:

1. Where possible, portable non-self-supporting ladders will be used at such a pitch that the base of the ladder is placed a distance from the vertical wall that is one-fourth of the working length of the ladder. The ladder shall be placed to prevent slipping, or it will be lashed or manually held in position.
2. Ladders shall not be used by more than one person at a time. Ladders specially designed to support greater loads shall be used in combination with ladder jacks and scaffold planks when an operation requires more than one person.

3. Place portable ladders so that the side rails have a secure footing. The top rest for portable rung and cleat ladders will be reasonably rigid and will have adequate strength to support the applied load.
4. Ladders shall not be placed in front of doors opening toward the ladder unless the door is blocked open, locked, or guarded.
5. Do not place ladders on boxes, barrels, or other unstable bases to obtain additional height.
6. To support the top of the ladder at a window opening, attach a board across the back of the ladder, extending across the window to provide firm support against the building walls or window frames.
7. When ascending or descending, users shall face the ladder and use both hands.
8. Ladders with broken or missing steps, rungs, or cleats, broken side rails, or other defects shall not be used. Do not make improvised repairs.
9. Do not splice short ladders together to provide long sections.
10. Do not use ladders made by fastening cleats across a single rail.
11. Do not use ladders as guys, braces, skids, horizontal platforms or scaffolds, or for other than their intended purposes.
12. Do not use a ladder to aid access to a roof unless the top of the ladder extends at least 3 feet above the point of support, at eave, gutter, or roof line.
13. Always raise extension ladders so that the upper section overlaps and rests on the bottom section. The upper section will always overlap on the climbing side of the extension ladder.
14. Nonslip bases are not intended as a substitute for care in safely placing, lashing, or holding a ladder that is being used upon oily, metal, concrete, or slippery surfaces.
15. The bracing on the back legs of step ladders is designed solely for increasing stability and not for climbing.
16. Hooks may be attached at or near the top of portable ladders to provide added stability.
17. When the ladder can be knocked over by others who are working in the area, the ladder will be securely fastened. As an alternative, someone will be assigned to steady the bottom, or the area around the ladder will be roped off.
18. Workers shall not stand higher than the third rung/ step from the ladder top and shall not attempt to reach beyond a normal arm's length.

2. Scaffolding and Elevated Platforms

1. Only tube and coupler or tubular welded frame scaffolding shall be used b. All platforms or scaffolds shall be inspected by the supervisor before use.
2. All elevated platforms shall be surrounded by a standard guardrail, securely fastened to a stationary object, and have a floor capable of withstanding a working load of 75 pounds per square foot.

3. Scaffolds with wheels constructed on the base (bottom) section shall not be used unless all wheels are intact and at least one wheel on each side is locked to prevent movement.
4. The following are general scaffolding rules:
 - a. Know scaffolding safety rules prior to set up, during operations, and for dismantling of scaffolding. Ensure manufacturer's instructions and safety warnings are legible and remain on scaffolding.
 - b. Inspect the equipment before use for damage or deterioration.
 - c. Keep equipment in good repair.
 - d. Inspect erected scaffolds regularly to ensure they are maintained in a safe condition.
 - e. Provide adequate sills and posts and use base plates.
 - f. Anchor wall scaffolds securely between structure and scaffold.
 - g. Use caution when working near power lines. Never be any closer than 10 feet to electrical power lines.
 - h. Use adjusting screws instead of blocking to adjust for uneven grades. Use outriggers where so equipped.
 - i. Equip all planked areas with proper guard rails and toe-boards.
 - j. Do not ride rolling scaffolding.
 - k. Do not leave materials and equipment on the platform when moving scaffolding.
 - l. Do not try to move rolling scaffolding without help.
 - m. Do not extend adjusting screws over 12 inches.
 - n. Do not let working platform height exceed four times the smallest base dimension unless guyed or otherwise stabilized.
 - o. Do not overload scaffold.
 - p. Do not use ladders or makeshift devices on top of scaffolds to increase height.
 - q. Ensure the footing and anchorage for scaffolds are sound, rigid, and capable of carrying the maximum intended load without settling or displacement. Do not use unstable objects such as barrels, boxes, loose bricks or concrete blocks, etc., to support scaffolds or planks.

3. Rooftop Work

1. If the rooftop to be worked on is not provided with an adequate guardrail, the following procedures shall apply:
2. No employee shall come within 10 feet (3meters) of the roof's edge without wearing a **lifebelt (Safety belt) or harness** securely attached to a securely anchored rope or line, with the entire system being capable of supporting a minimum dead weight of 5,400 pounds (2,450Kg).
3. No employee shall work on the rooftop if the wind speed exceeds 20 miles per hour (32km/hr).

L. Shoring and Trenching

The walls and faces of excavations and trenches over 5 feet (1.5meters), where workers may be exposed to danger, shall be guarded by a shoring system, sloping

of the ground, or some other equivalent means. Trenches less than 5 feet(1.5m), deep with hazardous soil conditions also shall be effectively protected.

The following guidelines are provided:

1. Appropriate trench boxes and/or shields may be used in lieu of shoring or sloping.
2. Tools, equipment, an excavated material shall be kept 2 feet(0.6m) or more from the lip of the trench. Where employees are required to be in or work in trenches 4 feet(1.2meters), deep or more, an adequate means of exit such as ladders or steps shall be provided within 25 feet(7.6meters), of travel and used.
3. Daily inspections shall be made of trenches and excavations by the supervisor in charge to ensure adequate slopes, shoring and bracing, and that there is no evidence of possible slides or cave-ins. More frequent inspections may be necessary as work progresses or after inclement weather conditions, such as rain, or where loose compacted or unstable materials are present.
4. Workers shall take extra care when hand excavating in close proximity to utilities to preclude interruption of services an personnel injury and/or equipment damage which can result from breaking electrical, gas, and steam lines.

M. Barricades

1. Whenever a common area is disturbed by maintenance, repair, or construction operations and presents a hazard to personnel working in or near, or traveling through the area, care shall be taken to warn these personnel and other engineering services personnel of the potential hazard.
2. Appropriate barriers shall be erected around excavations, open manholes, open electrical panels, etc., whenever they are to be left unattended

SECTION 6.2 Electrical Installations and Equipment

A. Hazards

1. The extreme hazard of electrical equipment is the potential for personnel electrocution from contacting energized systems. Electrical equipment can also cause catastrophic property damage because of its potential as an ignition source for causing fire or explosion.
2. Fire is frequently caused by short circuits, overheating equipment and failure of current limiters, thermal sensors, and other safety devices. Explosions may occur when flammable liquids, gases, and dusts are exposed to ignition sources generated by electrical equipment.

B. Requirements

1. Electrical installations and utilization equipment will be in accordance with the current edition of the National Electrical Code, National Fire Protection Code. This code will also apply to every replacement, installation, or utilization equipment.

2. Equipment or facilities designed, fabricated for, and intended for use by JUST will be procured to meet the requirements of the National Electric Code.
3. Frames of all electrical equipment, regardless of voltage shall be grounded.
4. Exposed non-current carrying metal parts of electrical equipment that may become energized under abnormal conditions shall be grounded in accordance with the National Electrical Code.
5. Wires shall be covered wherever they are joined, such as: outlets, switches, junction boxes, etc.
6. Parts of electrical equipment which in ordinary operation produce arcs, sparks, etc., shall not be operated or used in explosive atmospheres or in close proximity to combustible materials.
7. Equipment connected by flexible extension cords shall be grounded either by a 3-wire cord or by a separate ground wire (except double insulated equipment).
8. Ground fault circuit interrupters (GFCI) shall be used on all 220-Volt, single-phase, 15- and 20-ampere receptacle outlets at job sites when the receptacles are not a part of the permanent wiring of the building or structure. Receptacles on a two wire, single-phase portable or vehicle-mounted generator rated not more than 5 kilowatt, where the circuit conductors of the generator are insulated from the generator frame and all or the grounded surfaces, need not be protected with GFCI's.

C. Inspections

1. Supervisors will insure that work areas are inspected for possible electrical hazards.
2. Sufficient workspace shall be provided and maintained around electric equipment to permit safe operations and maintenance of such equipment.

D. Control of Hazardous Energy (LockOut/TagOut)

1. The procedures specified in this section comply with the requirements for the isolation or control of hazardous energy sources. The accidental release of energy during maintenance work can and frequently does cause severe injuries, amputations, and death. Energy can be present in the form of electricity, potential energy (due to gravity) stored in elevated masses, chemical corrosivity, chemical toxicity, or pressure.
2. The only exceptions to these requirements are those situations involving "hot tap" operations. For this exception to be valid, the (O&M) personnel involved must demonstrate that the continuity of services is essential, that shutdown of the energy source is impractical, and that documented (written) procedures and special equipment have been implemented that will provide proven effective protection.
3. These procedures apply to all maintenance or installation operations conducted at (O&M) facilities.

E. Tag-out Devices

1. Tags affixed to energy isolating devices are warning devices that do not provide the physical restraint on those devices that a lock would provide.

2. Any tag so attached to an energy isolating device must not be removed without authorization of the person attaching it, and it must never be bypassed, ignored, or otherwise defeated.
3. Tags must be legible and understandable in order to be effective.
4. Tags must be made of materials which will withstand environmental conditions encountered in the workplace.
5. When utilized, tags must be securely attached to energy isolating devices so that they cannot be inadvertently or accidentally detached during use. Tag-out devices must be substantial enough to prevent inadvertent or accidental removal.
6. Tag-out devices must warn against hazardous conditions if the machine or equipment is energized and must include appropriate warnings such as:
 - **DO NOT START**
 - **DO NOT ENERGIZE**
 - **DO NOT OPEN**
 - **DO NOT OPERATE**
 - **DO NOT CLOSE**

SECTION 6.3 Lock-out Devices

A. Types

Lockout devices and practices vary by nature and function. Several effective lockout devices and practices are listed as follows:

1. Padlocks. Key operated padlocks are recommended and should be assigned individually.
2. Multiple lock adapters will enable more than one worker to place their own padlock on the isolating device to guarantee that the machine or equipment will remain deactivated until each and every employee completes their own task, and only then will the last padlock be removed.
3. Chains or other commercially available devices should be used to prevent valves from being opened or, in some cases, closed. The principle of multiple lock adapters still applies even when chains or other devices are used on operations requiring more than one employee.

B. Procedures

1. General

- a. If energy-isolating devices are not capable of being locked out, they must be modified so that they are capable of being locked out whenever major replacement, repair, renovation, or modification of the machine or equipment takes place. Whenever new machines or equipment are installed, energy-isolating devices for such machines or equipment must be designed to accept a lockout device.
- b. If an isolating device cannot be locked out for any reason, then additional steps must be taken to assure full employee protection such as removing fuses, blocking switches, blanking off lines, etc.
- c. If the machine or equipment is not capable of being locked out, a tag-out procedure must be documented and utilized. The tag-out procedure must provide full employee protection equivalent to a lockout system. For full

employee protection, when a tag-out device is used on an energy-isolating device, the device must be attached at the same location that the lockout device would have been attached, and must demonstrate that the tag-out device will provide a level of safety that is equivalent to that of a lockout system.

C. Plug/Cord and Hose-Connected Type Equipment

1. When servicing or installing plug/cord or hose connected electrical, pneumatic, or hydraulically powered equipment, the cord or hose shall be disconnected from the equipment to be worked on, prior to starting the work. A tag warning against reconnecting the plug or hose shall be affixed to the plug or hose end.
2. Any stored energy (e.g., capacitor voltage, hydraulic pressure) shall be safely released prior to the start of maintenance or installation work.

D. Electrically Powered Equipment

1. Electrically powered equipment shall be de-energized and their source of electricity manually disconnected from them prior to the removal of protective covers or the start of other maintenance or installation work. It is important to recognize that locking and tagging on/off switches is often not sufficient to prevent accidental start up or prevent voltage from being present in the equipment. If the equipment is not wired properly (i.e., the polarity is reversed) or the switch is of the single pole type, voltage can be present even if the operating switch is in the off position. For these reasons, manual disconnects must be placed in the off position and/or the equipment's power fuses removed from the motor control center.
2. The lock-out/tag-out procedure is as follows:
 - a. Each person working on the circuit or piece of equipment shall place a padlock and warning tag on the electrical isolation device (e.g., disconnect switch).
 - b. Each person working on the circuit or piece of equipment shall attempt to energize or start the piece of equipment prior to starting work. Each on/off switch capable of energizing the equipment must be "tried."
 - c. If the try step reveals that the equipment is capable of being energized, the proper disconnects must be located and locked out and the try step repeated.
 - d. As each person completes his or her task, they shall remove their padlock and tag from the energy isolating device.
 - e. All protective covers or panels shall be securely re-attached prior to energizing the equipment after work is completed. In the event that protective covers must be removed to make adjustments on energized equipment, appropriate guards must be constructed and attached in such a manner as to prevent employee contact with live circuitry capable of causing human injury. Such guards must be of durable construction, adequate to prevent injurious contact, and remain in place at all times that the equipment is energized.

E. Chemical and/or Pressurized Lines

Prior to working on any pressurized line or a line containing a toxic, flammable, reactive, or corrosive material, the following procedure must be implemented:

1. The line to be serviced must have two block valves upstream of the work area or device to be serviced or installed, placed in the closed position and tagged. The bleed valve (between the two block valves) shall be opened and tagged so that leakage of the valve upstream would be readily obvious. The line shall be depressurized or drained in a safe manner. Lines shall be broken in such a manner as to release pressure away from the employee. All solids or liquids drained shall be safely collected. This procedure is called "double block and bleed."
2. If it is possible for pressure or line material to enter the work area from more than one direction, the line in each direction of travel shall be "double blocked and bled" as described above.
3. In the event that "double block and bleed" procedures are infeasible (i.e., the line is not provided with adequate valving), alternative measures shall be implemented. One alternate measure is to place a solid "blind" in a flange located between the available upstream valve and the work area. If blinds are used they shall be sufficiently corrosion and pressure-resistant to ensure that if the valve leaks, the blind will stop the material or pressure from reaching the work area.

F. Stored Mechanical Energy

1. In situations where equipment to be worked on has stored mechanical energy (e.g., in a flywheel or drop hammer), the stored energy must be released or blocked in a safe manner before starting maintenance or installation work.
2. Effective blocking practices may include the installation of safety blocks or adequate supports. Under no circumstances will "bumper jacks" or "scissor jacks" be considered to be adequate blocks.

SECTION 6.4. Training

1. The purpose in providing training to employees is to ensure that they understand the purpose and function of the lock-out/tag-out program and procedures, and that they have the knowledge and skills required for the safe application, usage, and removal of energy controls.
2. Personnel who work around electrical equipment but who do not perform a primary duty of electrical system installation or maintenance will be briefed by their supervisor on the hazards of electricity and the proper precautions to observe.
3. Each authorized employee who will use a lock-out/tag-out procedure must receive training in the recognition of applicable hazardous energy sources, the type and magnitude of the energy available in the workplace, and the methods and means necessary for isolation and control.
4. Employees must be retrained whenever there is a change in their job assignment; a change in machines, equipment, or processes that present a new hazard; or when there is a change in the lock-out/tag-out procedures.

SECTION 6.5 Machinery

All mechanical motion is potentially hazardous. Motion hazards, such as rotating devices, cutting or shearing blades, in-running nip points, reciprocating parts, linear moving belts and pulleys, meshing gears, and uncontrolled movement of failing parts, are examples of motion and peculiar to any one machine or job operation. Personnel working within areas where they are exposed to machinery or equipment hazards must be aware of the potential for accidents. Machine operators and others are exposed to moving parts and can get clothing or body parts caught in the machinery.

A. General

1. Personnel Training

Personnel should be trained to safely operate each machine they will be required to use; to recognize potential accident producing situations; and to know what to do when hazards are discovered. Only personnel who have been thoroughly trained, or those who are undergoing supervised on-the-job training on the equipment, will be permitted to operate machinery.

2. Personal Protective Equipment

- a. Eye protection or face shields will be worn by all personnel within areas where machines are operated.
- b. Loose fitting clothing, neckties, rings, bracelets, or other apparel that may become entangled in moving machinery will not be worn by machine operators or their helpers.
- c. Hair nets or caps will be worn to keep long hair away from moving machinery.
- d. Gloves will not be worn where there is a chance of them being caught in machinery.
- e. Ear plugs or muffs will be used when required for worker protection.
- f. The EHSS should be contacted to assist supervisors in determining personnel protective equipment needs.

3. Environmental

- a. Machines designed for fixed locations will normally be securely fastened to the floor or other suitable foundation to eliminate all movement or "walking." Machines equipped with rubber feet, non-skid foot pads, or similar vibration dampening materials will be installed according to the manufacturer's recommendations. Machines that have the potential of tipping or falling over will be firmly secured.
- b. Machines that develop fine dust and fumes will be equipped with effective exhaust hoods, connected to an effective exhaust system. An interlocking device should be installed to link the machine's power supply and the exhaust system to prevent the operation of machines without the exhaust system operating.
- c. Machines will never be left unattended with the power on unless the worker is operating more than one machine in a battery of machines. In this latter

instance, the clear zone will be appropriately marked to include all machines in the group.

- d. No attempt will be made to clean any part of a machine until the moving parts have come to a complete stop. Chips will not be removed from machinery by hand. Hand brushes should be used but compressed air may be used when reduced to less than 30 psi and then only with effective chip guarding and personal protective equipment.
- e. Brushes, swabs, lubricating rolls, and automatic or manual pressure guns will be used by operators to lubricate material, punches, or dies. This equipment will be used so that operators are not required to reach into the point of operation or other hazardous area.

4. Housekeeping

- a. Floors will be kept in good repair and free of chips, dust, metal scraps, and other slipping and tripping hazards.
- b. Waste containers will be emptied daily or more often, if necessary, to prevent excessive waste accumulations.
- c. All materials, including usable scrap, will be stored so that they will not present a hazard.
- d. Drip pans will be used whenever equipment must be oiled. Machinery will not be in motion when being lubricated unless lubrication is automatic or a long gravity flow spout is used, enabling the oiler to remain in the clear while performing this task.

5. Material Handling

- a. Trucks used for scrap disposal will not be overloaded, and scrap will not extend beyond the ends or sides of trucks.
- b. When materials are of a weight or size which makes manual lifting hazardous, mechanical handling equipment will be used.

6. Maintenance/Repair

- a. When maintenance or repair is needed, machines will be completely shut down and the control switch(s) locked and tagged in the "OFF" position.
- b. Cutting tools will be kept sharp and forming tools well dressed and free from accumulations of chips, dust, and other foreign matter. Where two or more cutting tools are used in one cutting head, they will be properly adjusted and balanced.
- c. Damaged cutting tools will be removed from service and will not be used until repaired.

7 Usages

- a. Machines will be used only for work within the rated capacity specified by the machine manufacturer.
- b. Machines will be maintained so that while running at full or idle speed, with the largest cutting tool attached, they are free of excessive vibration.

- c. Machines will be completely stopped before attempting to clear jammed work or debris.
- d. No saw blade, cutter head, or tool collar will be placed or mounted on a machine arbor, unless it has been accurately sized and shaped to fit the arbor.

8. Electrical Safeguards

- a. The motor "**START**" button will be protected against accidental/inadvertent operation. "**START**" buttons will not be wedged for continuous operation.
- b. The wiring and grounding of machinery will be in accordance with the National Electric Code.
- c. Each machine will have a positive electrical disconnect or isolation switch which can be locked out.
- d. Electrically driven machines will be equipped with under-voltage protective systems to preclude automatic restart after either a power failure or other under-voltage condition.

9. Controls

- a. Foot pedal mechanisms will be located and guarded so that they cannot be activated by falling objects or other accidental means. A pad with a non-slip contact area will be firmly attached to the pedal.
- b. Controls will be available to the workers at their operating positions so that they do not reach over moving parts of the equipment. Control functions will be identified by printed words and color coding. Controls will not be wedged for continuous operation.
- c. Power controls must have a way of locking out electrical power. Disconnecting or isolating switches will be mounted on a visible side of, or near, the machine and will be used to lock out power to the machine during repairs or adjustments. When the power is locked out, the isolating switch will be tagged.

10. Guards

Many accidents are caused by machinery that is improperly guarded or not guarded at all. Important factor that must be kept in mind relative to machinery guarding is that no mechanical motion that threatens a worker's safety should be left without a safeguard.

The following areas of machinery will be provided with barriers and/or enclosures that will effectively prevent personnel from coming in contact with moving components:

- a. Point of operation exposures such as blades, knives and cutting heads.
- b. Power transmission exposures such as belts, pulleys, shaft, gears, etc.
- c. Top, bottom and backside exposures, such as the underside of table saws and the wheels on band saws.
- d. When a point-of-operation guard cannot be used because of unusual shapes or cuts, jigs or fixtures which will provide equal safety for the operator will be used. Upon completion of an unusual operation, the guard will be immediately replaced.

- e. Whenever a guard is removed for other than an operational requirement, the machine will be shut down and the control switch(es) locked and tagged in the "OFF" position.
- f. Guards will be affixed to the machine. Where possible, they will be of the hinged type to enhance maintenance or adjustments.

SECTION 6.6 Plumbing Maintenance

A. Hazards

Plumbing maintenance normally includes the installation, preventive maintenance, and repair of water supply systems, sewage and water disposal systems, natural liquefied petroleum gas (LPG) or other gas supply systems (to include gas appliances), and oxygen supply systems. These systems and the maintenance of them contribute to the total well-being of JUST facilities. Hazards that may be encountered during plumbing maintenance include, but are not limited to,

- a. Entry into an oxygen deficient atmosphere (confined space),
- b. Fire or explosion by introducing an ignition or flame source into a hazardous environment,
- c. Falls, cave-in of excavated area,
- d. burns from heat producing equipment,
- e. Strains and sprains of the back or other muscle group, and
- f. Cuts and/or bruises.
- g. Working in confined spaces, handling heavy and awkward materials, being subjected to numerous obstructions in limited working space, and health related hazards are conducive to producing accidents.

Plumbing maintenance workers need to be knowledgeable of these potential hazards and conditions and take reasonable actions to prevent incidents before they occur.

B. Personal Protective Equipment

Personal protective equipment worn during plumbing maintenance operations normally consists of eye and/or face protection, work or chemical resistant gloves, and safety-toe shoes. A bump cap or hard hat may be required under conditions that could result in head injuries, e.g., work in manholes and in close spaces with low overhead pipe or other obstructions. Eye or face protection is required while working plumbing connections, with chemicals, or where an eye hazard could exist while using tools or machines, and while working on pressure systems.

C. Hot Operations

1. Torches and Furnaces

Only essential fire prevention items pertaining to the operation of blowtorches and plumber's furnaces are included. Work and storage areas for this equipment shall be well ventilated.

- a. No one shall be permitted to use a torch or furnace until the user is trained on its use and is familiar with the operating instructions.

- b. Where flammable or explosive vapors or dust may be present, torches and furnaces shall not be used until the atmosphere has been vented and the sources of such vapors or dust removed.
- c. Gasoline blowtorches and furnaces shall not be used in small, unventilated spaces since they could cause explosions. Acetylene gas shall never be brought in contact with metal powders such as copper or silver as the combination may produce flashes which can ignite explosive atmospheres.
- d. Combustible materials in locations where torches or furnaces are to be used shall be protected or kept far enough away to prevent their being subjected to sparks or dangerous temperatures. Appropriate fire extinguishers shall be available.

2. Soldering and Brazing

Soldering and brazing is the joining of metal parts by melting a fusible alloy. When solders used have a melting point above 800 degrees F, the procedure is called brazing.

- a. Improper equipment and/or unsafe practices may cause lead poisoning, irritation from fluxes, burns, electric shock, or fires.
- b. The concentration of toxic fumes and irritants at the breathing level of the operation shall be checked.
- c. Where required because of toxic fumes, a respirator or adequate ventilation shall be provided.
- d. Lead-tin, zinc, silver, cadmium, and antimony-tin solders can pose moderate to serious health hazards. Soldering, particularly with lead-tin, in a confined space where ventilation is not adequate to remove toxic fumes may require the use of a self-contained breathing device.
- e. The (EHSS) shall be consulted for evaluation of potential health hazards and recommendations on respiratory protection during welding, soldering, and brazing operations.
- f. Electric soldering irons shall be grounded unless of double insulation construction.
- g. All soldering irons shall be placed in suitable non-combustible receptacles when not in use.
- h. When required, "Open Flame" permits shall be obtained for these operations.
- i. Appropriate safety eyewear shall be worn during all soldering and brazing operations.

3. Open Storm Drains

Plumbing personnel are not likely to come in contact with the hazards associated with sewer systems while working on open storm drains. However, there are certain hazards associated with that type of drainage system. Some of these hazards and their associated incidents are:

a. Manhole covers

Manhole covers are heavy and closely fitted to the manhole opening. Never attempt to lift a cover without using proper tools, special lifting tools, and

additional help where needed. Ensure fingers and toes do not remain under manhole covers when putting them down.

b. Hazards

Insects, animals, and snakes have been known to nest or den in storm drains. Hazards encountered are:

1. Stings from wasps, spiders, and ants that could lead to toxic shock.
2. Bites from animals that could lead to rabies.
3. Bites from poisonous snakes that could be fatal or cause gangrene.

c. Requirements

Prior to working in storm drains, inspect and clear the drains of dangerous insects, animals, or snakes. Seek assistance from an exterminator or the JUST Safety Department when necessary. Wear proper protective clothing, hard hats, boots, and gloves while working in storm drains.

4. Gas Systems

- a. Maintenance of gas systems includes natural gas, LPG, and oxygen.
- b. Shop personnel shall be familiar with the properties of the gases in the systems they maintain.
- c. Until proved otherwise, all escaping gases shall be considered flammable.
- d. Prior to entering an area where a gas leak is suspected, the area shall be properly vented and purged of existing gas.
- e. Personnel entering the area shall be suited with proper protective clothing and self-contained breathing devices.
- f. For oxygen deficient atmospheres, air supply systems with a special emergency escape air supply are required and shall be used. Tools used to repair leaks in or perform maintenance on gas lines shall be spark-free and protective clothing shall be static-free.
- g. When working on oxygen dispensing lines, workers shall not use tools and equipment that are coated with lubricating substances or grease.

5. Tunnels, Pits, and Sumps

- g. Where shop personnel are required to work in utility tunnels, pits, and sumps, the atmospheric conditions shall be checked for explosive atmosphere or oxygen deficiency before allowing them to enter.
- h. Personnel shall be suited with proper protective clothing and respiratory protective devices, when required, while performing maintenance to underground utilities.
- i. All tunnels, pits, or sumps known to be contaminated shall be tagged or identified for the information of work crews.
- j. Workers shall be assigned in pairs for work performed on underground utilities and all known contaminated tunnels, pits, and sumps shall be ventilated while work is in progress.

- k. When a manhole or vault is open, at least one member of the crew shall be stationed at the surface. This person shall not, under normal circumstances, leave for any purpose.
- l. In areas where removal of a victim would be difficult, an approved lifeline, equipped with a wrist harness, shall be worn by the person entering the area to facilitate rapid removal in case of an emergency

NOTE: UNDER NO CIRCUMSTANCES SHALL A PERSON ENTER A SUBSURFACE STRUCTURE FOR ANY REASON WITHOUT A SECOND PERSON TO ACT AS A GUARD AND TO OBTAIN ASSISTANCE IN THE EVENT OF AN EMERGENCY.

6. Compressed Air

Plumbing workers should be trained and authorized to inspect, maintain, or install compressed air systems. Before opening a compressed air line, workers shall ensure the line has been completely drained of existing air to prevent a sudden release of air which will cause the line to whip. The reverse is also true; when personnel have installed a new compressed air system, all parts of the system shall be secured together before air is put into the system. Workers shall wear eye and face protective equipment while working on compressed air systems.

SECTION 6.7 Carpentry and Structural Maintenance

A. Hazards

Personnel performing duties in carpentry and structural maintenance are potentially exposed to a wide variety of hazards in many different environments and locations. Potential hazards include:

1. Exposures to flammable and combustible adhesives, dusts,
2. Hazardous noise,
3. eye hazards,
4. Working at heights above ground level, lifting hazards,
5. Electric and pneumatic power tools, and
6. Working with unfinished material which could expose them to splinters.
7. Many tasks are performed in areas of high pedestrian traffic; therefore, an additional hazard of possible distraction from the job task arises.

Potential physical and health hazards can be effectively controlled by proper work procedures and controls, and by using required personal protective equipment.

B. General Carpentry

1. Workers shall not leave a woodworking machine running unattended nor shall they attempt to clear, clean, or repair the machine while it is operating. When maintenance is necessary, the machine shall be completely shut down, its control switches locked and tagged in the "**OFF**" position.
2. Supervisors shall ensure that periodic inspections are accomplished on all shop equipment. Chips or dust shall never be removed from machinery by hand.

Machine guards shall not be removed or made inoperative except for authorized maintenance.

3. When guards are removed during machine repair, power control switches shall be locked in the "OFF" position and properly tagged. The machine shall remain locked until the guards are replaced.
4. Personal protective equipment worn while operating machinery, equipment, and saws within the shop and on job sites normally consists of eye protection, safety-toe shoes, and hearing protection. Other safety related personal protective equipment is dust masks where workers are exposed to dust at the point of operation. The (EHSS) shall be consulted to determine the need for dust masks. Hard hats are required on job sites where the potential exists from being struck by falling object(s), e.g., roofing and construction.
5. The following specific guidance applies to table saws:
 - a. Keep hands out of the line of cut when feeding table saws. Use a push stick when close to the blade.
 - b. Adjust saw to expose the least amount of saw blade above table and material being cut.
 - c. Always stand out of line of stock being ripped.
 - d. Hold stock being cut against a gauge when cutting with a circular table saw.
 - e. Always use the appropriate saw for the cut (it would be unsafe to rip with a crosscut saw or to crosscut with a rip saw).
 - f. Avoid crosscutting long boards on a table saw.
 - g. Never adjust the saw or fence gauge while the saw is operating
 - h. Designate the line of cut on the table top with a permanent mark when setting the gauge of a table saw without removing the guards.
 - i. Always use a brush or stick to clean or scrape sawdust from a saw.

C. Ventilation Systems

1. Application

Machines that develop fine dust or other airborne contaminants shall be equipped with effective industrial exhaust ventilation. In shops where small numbers of installed machines are not continuously in operation, portable collection systems may be used.

2. Exhaust Ducts and Pipes

- a. These shall be constructed and sized to minimize clogging.
- b. They shall discharge into an enclosed container.

3. Refuse

- a. Refuse shall be removed daily in all operations that are not required to have an exhaust system or where the refuse cannot be handled by an exhaust system.

D. Storage and Handling of Lumber

1. Storage areas for lumber and other building materials can be potentially hazardous. For example, when lumber is stored upright, precautions shall be taken to prevent

- it from falling into aisles or passageways. Lumber stored in tiers shall be stacked, blocked, and interlocked and the stacks shall be limited in height so they are stable and secure against sliding or collapse. Furthermore, storage areas shall be kept free of accumulations of materials that constitute tripping, fire, or explosion hazards.
2. When heavy stock cannot be safely handled by workers, suitable mechanical lifting devices shall be used.
 3. Gloves shall be worn by workers to reduce injury potential to the hands from splinters or from being pinched between the stacks. The accidental movement of the stacked material can cause serious injuries. Caution shall be taken not to disturb other tiers when removing partial stacks for use.
 4. Manual handling is relatively safe if the proper lifting and carrying positions are used. Balanced handling is the key to safe handling.

SECTION 6.8 Welding and Metal Fabrication

A. Hazards

Welding, cutting and brazing operations present a series of hazardous situations with potential exposure to burns, eye damage, electrical shock, crushed toes and fingers, and the inhalation of vapors and fumes. Many welding, cutting and brazing incidents in industry result from:

1. Inadequately trained personnel.
2. Poor housekeeping practices.
3. Poor shop layout.
4. Inadequate lighting and ventilation.
5. Improper storage and movement of compressed gas cylinders.
6. Exposure of oxygen cylinders and fittings to oil or grease creating a fire or explosive hazard.
7. Pointing welding or cutting torches at a concrete surface causing spattering and flying fragments of concrete.
8. Electric shock when motors, generators and other electric welding equipment are not grounded.
9. Inhalation of toxic fumes or vapors from welding metals or alloys.
10. Fires, explosions, and injuries can occur resulting from:
11. The proximity of combustible solids, liquids, or dusts.
12. The presence or development of possible explosive mixtures of flammable gases and air.
13. The presence or nature of an oxygen-enriched atmosphere in locations where hot work is performed.
14. Cutters and welders, and other exposed personnel, are also susceptible to eye injury from infrared light and ultraviolet radiation.

B. Operating Precautions

The following provides minimum guidance on operating precautions and procedures.

1. Provide ventilation in shops or rooms where work is to be performed but avoid strong drafts directed at the welding work.

2. Do not place work to be welded or heated on a concrete floor. Concrete, when heated, may splatter and fly exposing the welder to possible burns and also throwing hot particles a considerable distance.
3. Provide appropriate protection for welders and helpers when working on elevated surfaces. Welding areas shall be kept neat, clean, and free from tripping hazards.
4. Provide approved personal protective equipment for welders who must enter confined spaces, manholes or other space restricted areas. Also, provide a means to ensure their quick removal in case of an emergency.
5. Do not perform cutting and welding operations in sprinklered buildings when the sprinkler system is inoperable; in explosive atmospheres or where explosive atmospheres may develop; or, within 50 feet of storage of large quantities of exposed, readily ignitable materials.
6. Before lighting the torch for the first time each day, allow enough of each gas to flow through its respective hose to purge any flammable gas mixture. Purge hoses in open spaces and away from ignition sources.
7. Light the torch with a friction lighter or stationary pilot flame keeping a safe distance between the torch and the welder's hands. Point the torch away from persons or combustible materials when lighting. Do not attempt to light a torch from hot metal.
8. When working in a confined space, the fuel gas and oxygen supply shall be located outside the confined space. The torch and hose should be removed from confined spaces when not in use.
9. Fuel gas and oxygen torch valves shall be closed and the fuel gas and oxygen supply to the torch shall be shut off during lunch or break periods, when not in use for extended periods, and when unattended.
10. Welding torch hoses must be protected from damage by contact with hot metal, open flames, corrosive agents or sharp edges. Pressure on hoses will be released at the end of each workday.
11. Hoses must be visually inspected for damage at the beginning of each shift. Hose showing leaks cuts, burns, worn spots or other evidence of deterioration must be repaired or replaced prior to use.
12. Replacement hoses or fittings must be approved for use with acetylene equipment.
13. Shielding shall be provided to protect personnel from heat, sparks, slag, light, and radiation.
14. A fire watch will be maintained for at least 30 minutes after completion of cutting or welding operations to detect and extinguish possible smoldering fires.

C. Personal Protective Equipment

Personnel engaged in or exposed to welding, cutting, or brazing activities should be provided and use personal protective equipment to include eye and face protection, head protection when in a hard hat area, foot protection, and body, arm, and hand protection.

1. Eye Protection

- a. Helmets shall be used during all arc welding or arc cutting operations. Goggles should also be worn during arc welding or cutting operations to provide

protection from injurious rays from adjacent work, and from flying objects. The goggles may have either clear or colored glass, depending upon the amount of exposure to adjacent welding operations. Helpers or attendants shall be provided with proper eye protection. Helmets shall be arranged to protect the face, neck, and ears from direct radiant energy from the arc.

- b. Goggles or other suitable eye protection shall be used during all gas welding or oxygen cutting operations. Spectacles with side shields and suitable filter lenses are permitted for use during gas welding operations on light work, for torch brazing or for inspection. Goggles shall be ventilated to prevent fogging of the lenses as much as practicable.
- c. All operators and attendants of resistance welding or resistance brazing equipment shall use transparent face shields or goggles, depending on the particular job, to protect their faces or eyes, as required.
- d. Eye protection in the form of suitable goggles shall be provided where needed for brazing operations.

2. Protective Clothing

- a. All welders should wear flame-resistant gauntlet gloves and shirts with sleeves of sufficient length and construction to protect the arms from heat, UV radiation, and sparks.
- b. All welders should wear fire-resistant aprons, coveralls, and leggings.
- c. Clothing should be kept reasonably free of oil or grease. Front pockets and upturned sleeves or cuffs should be prohibited, and sleeves and collars should be kept buttoned to prevent hot metal slag or sparks from contacting the skin.

3. Respiratory Protection

The EHSS shall be consulted to determine appropriate levels of respiratory protection to be worn by personnel performing welding operations.

D. Fire Prevention and Protection

1. The welding operation environment shall be free of flammable liquids and vapors. Combustible materials within a radius of 35 feet(10.7meters), of the operation will be protected from activity residue (flame, heat, sparks, slag, etc.).
2. Fire watcher procedures shall be implemented whenever welding activities are conducted within 35 feet (10.7meters), of combustible materials, regardless of protection provided. A qualified individual proficient in the operation of available fire extinguishing equipment and knowledgeable of fire reporting procedures shall observe welding or cutting activities. His or her duty is to detect and prevent the spread of fire produced by welding or cutting activities.
3. Whenever there are cracks or other floor openings within 35 feet(10.7meters), of the welding or cutting that cannot be closed or covered, precautions shall be taken to remove or otherwise protect combustible materials on the floor below that may be exposed to sparks. The same precautions shall be observed with regard to cracks or openings in walls, open doorways, and open or broken windows.
4. Fire extinguishing equipment shall be maintained, ready for use, while welding or cutting operations are being performed. Equipment may consist of pails of water, buckets of sand, hose, or portable extinguishers depending upon the nature and quantity of the combustible material exposed.

5. Where sprinkler protection exists, it shall be in full service while welding or cutting work is being performed. If welding or cutting is to be done within three feet of automatic sprinkler heads, noncombustible sheet material or damp cloth guards will be used to temporarily shield the individual heads.

E. Welding and Cutting Tanks, Cylinders, or Containers

The procedures described below apply only to tanks too small to be entered. Compressed gas cylinders are excluded as are pipelines. Cutting and welding on containers that have held flammable liquids or gases shall be under the direct supervision of knowledgeable personnel.

1. Inspection

- a. BEFORE any tank, cylinder, or other container is cut, welded or other hot work is performed, and the item shall be purged or made inert. New containers shall also be made inert as they may contain a flammable preservative which could form explosive vapors when heated.
- b. Welders shall also ensure that there are no substances such as grease, tars, or acids which, when subjected to heat, might produce explosive or toxic vapors.
- c. Any pipe lines or connections to the drums, cylinders, tanks, or other containers shall be disconnected or blanked.

2. Purging and Inerting

a. Purging with Water

Where the liquid or gas previously contained is known to be readily displaced or easily soluble in water, it can be removed by completely filling the container with water and then draining. When hot work is performed on containers filled with water, extreme care shall be used to eliminate any vapor accumulation by proper venting or positioning of the container during the filling operation.

b. Purging with Air

Hazardous vapors may be displaced from inside containers by purging with air. A safe atmosphere shall be maintained by continuous ventilation.

c. Inerting with Gas

Inert gas may be used to displace flammable gas from the container. Adequate ventilation shall be maintained during the operation to ensure gas concentrations remain below hazardous levels. Examples of inert gases are carbon dioxide and nitrogen.

d. Venting

All hollow spaces, cavities, or containers shall be vented to permit the escape of air or gases before and during preheating, cutting, or welding.

F. Arc Welding

1. Before starting operations, all connections to the arc welding machine shall be checked. The work lead shall be firmly attached to the work; contact surfaces of the magnetic work clamps shall be free of metal splatter particles.
2. Coiled welding cable shall be spread out before use to avoid serious overheating and damage to insulation. Work and electrode lead cables shall be inspected for damage and wear before use.

3. Cables with damaged insulation or exposed conductors shall be replaced. Electrode cables shall be joined and insulated in accordance with approved methods.
4. Grounding of the welding machine from shall be checked. Special attention shall be given to the ground connections of portable machines.
5. Electrode holders, when not in use, shall be placed where they cannot make electrical contact with persons, conducting objects, fuel, or compressed gas cylinders.
6. When it is necessary to splice cables to extend their length, only certified electricians shall make the splices. Cables with splices within 10 feet (3 meters), of the electrode holder shall not be used. The welder shall not coil or loop welding electrode cables around parts of their body.
7. Welders shall not place welding cable and other equipment where it will obstruct passageways, ladders, and stairways.
8. Machines which have become wet shall be thoroughly dried and tested before being used.
9. When welders are working close to one another on one structure where they may touch the exposed parts of more than one electrode holder simultaneously, the machines shall be connected to minimize shock hazard as follows:
 - a. All direct current (DC) machines shall be connected with the same polarity.
 - b. All alternating current (AC) machines shall be connected to the same phase of the supply circuit and with the same instantaneous polarity.

G. Resistance Welding

1. Thermal Protection

Every pair of ignition tubes used in resistance welding equipment shall be equipped with a thermal protection switch. When used in a series-connected water line, a single switch shall be adequate if related to the downstream tube.

2. Control Safeguards

Controls, such as push buttons, foot switches, retraction, and dual-schedule switches on portable guns, etc., shall be arranged or guarded to prevent inadvertent activation.

3. Guarding Welding Machines

Multi-gun welding machines shall be effectively guarded at the point of operation. Devices such as an electronic eye, latches, blocks, barriers, or two-hand controls shall be installed. All chains, gears, operating bus linkage, and belts shall be protected by adequate guards.

4. Electrical Hazards

All external weld-initiating control circuits shall operate on low voltage, not over 120 volts for stationary equipment and not over 36 Volts for portable equipment. All electrical equipment shall be suitably interlocked and insulated to prevent access by unauthorized persons to live portions of the equipment. Only non-ferrous welding clamps should be used to prevent magnetic induction during actuation of the equipment.

H. Welding in Confined Spaces

Confined space means a relatively small or restricted space such as a tank, boiler, pressure vessel, mixing vat, sump, or pit.

1. Ventilation is a prerequisite to work in confined spaces.
2. All welding and cutting operations carried on in confined spaces shall be adequately ventilated to prevent the accumulation of toxic materials, possible oxygen deficiency, or explosive atmosphere.
3. This applies not only to the welder but also to helpers and other personnel in the immediate vicinity. All air replacing that which is withdrawn shall be clear and respirable. Oxygen shall never be used as makeup air.
4. In such circumstances where it is impossible to provide such ventilation, respirators or hose masks approved for this purpose by (EHSS) shall be used. In areas immediately hazardous to life, hose masks with blowers or self-contained breathing apparatus shall be used.
5. Where welding operations are carried on in a confined space and where welders and helpers are provided with hose masks, hose masks with blowers, or self-contained breathing apparatus, a worker shall be stationed on the outside of the confined space to ensure the safety of those working within.
6. When welding or cutting is being performed in any confined space, the gas cylinders and welding machines shall be left on the outside.
7. Before operations are started, heavy portable equipment mounted on wheels shall be securely blocked to prevent accidental movement.
8. Where a welder must enter a confined space through a manhole or other small opening, a means shall be provided for quick removal of the worker in case of emergency. When safety belts and lifelines are used for this purpose, they shall be attached to the welder's body in a way that ensures his or her body cannot be jammed in a small exit opening. A wrist harness assembly shall be used. An attendant with a preplanned rescue procedure shall be stationed outside to observe the welder at all times and shall be capable of putting rescue operations into effect.
9. When arc welding is to be stopped for any substantial period of time, such as during lunch or overnight, all electrodes shall be removed from the holders and the holders carefully located so accidental contact cannot occur. The machine shall be disconnected from the power source.
10. When gas welding or cutting, the torch valves shall be closed and the fuel-gas and oxygen supply to the torch positively shut off at some point outside the confined area whenever the torch is not to be used for a substantial period of time, such as during lunch or overnight. Where practicable, the torch and hose shall also be removed from the confined space.
11. All confined spaces shall be monitored for oxygen content, combustible vapors, and toxic material prior to entry and periodically throughout the operation. Periodic testing shall depend on the type of space being entered.
12. The (EHSS) shall be consulted for guidance.

I. Portable Gas Units

1. Portable gas welding, cutting, and brazing equipment must be of a type approved for the use intended.
2. Cylinders of compressed gas must have pressure reducing regulators installed.
3. Cylinders in use or in a transport must be stored in an upright position and secured to prevent them from falling.
4. Pressure hoses shall be secured to prevent whipping.
5. Oxygen cylinders and fittings shall be kept free of grease and oil at all times.
6. Cylinders shall be kept away from external sources of heat at all times.
7. Cylinders shall not be dropped or handled roughly.
8. Cylinders or welding sets in excess of 20 kg total weight shall be transported to and from work sites by push cart or motorized vehicle.

J. Portable Electric Units

1. Circuits shall be de-energized before testing, checking or transporting.
2. Motor-generator sets and other electrical welding equipment shall be grounded prior to use.
3. Rotary and polarity switches shall not be operated while the equipment is under an electrical load.
4. Arc welding equipment shall be inspected periodically and inspected prior to use following relocation. Power cables and electrode holders shall be inspected prior to every use.

K. Sheet Metal

1. Machines shall be guarded in accordance with manufacturer's requirements.
2. Supervisors shall ensure sharp metal is stored in an area that will not pose a hazard to machine operators or personnel walking through designated aisles.
3. Work gloves shall always be worn when working with metal and metal scraps.
4. Hearing protection shall be worn when working in designated hazardous noise areas with noise sources operating or when using hand tools labeled hazardous noise producers.

SECTION 6.9 Refrigeration and Air Conditioning Maintenance

A. Hazards

Refrigeration and air conditioning maintenance personnel, as with many other Engineering Services activities, perform duties in many different locations and environments. Not only must these workers be aware of the hazards of the tasks they are performing, but also tasks being performed around them.

Potential hazards include:

- a. hazardous noise,
- b. electrical hazards,
- c. exposure to refrigerants,
- d. lifting hazards, and
- e. Compressed gases and cylinders.

Potential physical and health hazards can be effectively controlled by proper work procedures and controls, and by using required personal protective equipment.

B. General Requirements

1. Equipment rooms where air conditioning equipment is installed shall be kept free and clear of all trash and clutter which could present tripping or fire hazards. Refrigerant piping shall be properly insulated, both to improve operating efficiency and to prevent injury to workers who may accidentally come in contact with it. Equipment rooms are not normally designed for, nor intended for, storage of materials.
2. All belts, pulleys, and rotating shafts shall be guarded to prevent accidental contact. Large valve handle stems which can present a bump or trip hazard shall be marked (color coded) for easy recognition.
3. Electrical parts of the equipment and controls shall have all covers and plates in place. Wiring shall be properly secured to the equipment or structure.

C. Storage and Handling

Storage and handling of cylinders of compressed gas refrigerants can be a source of injury to workers.

1. Workers shall ensure that containers are legibly marked with the type of gas contained and stored with minimum intermingling of types of refrigerant. Cylinders shall be stored separately from flammable gases and oxygen.
2. Where caps have been provided for valve protection, they shall be kept in place at all times until the cylinder is actually in use. Valves shall be kept closed at all times except when the cylinder is in use.
3. Cylinders shall not be used as rollers or supports. Their only use is to contain the gas.
4. Cylinders shall not be dragged, slid, dropped, or allowed to strike each other or solid objects violently. Whenever possible, a suitable hand truck or roll platform shall be used.
5. Containers shall never be lifted by the valve. Cylinders shall not be suspended by chains, ropes, or slings unless the manufacturer has provided appropriate attachment points.
6. Storage areas shall be legibly marked with the names of the gases being stored. Full cylinders and empty cylinders shall be segregated and the full ones arranged so the oldest stock can be removed first with a minimum of handling. The storage area shall be kept as dry as possible and away from exposure to salt or other corrosive chemicals or materials. Cylinders shall be secured by a metal securing device or rack specifically designed to prevent damage.
7. The rules above apply to all refrigeration and air conditioning maintenance work centers that use and store compressed gases.

D. Fluorocarbons

The fluorocarbons are relatively inert, in general are non-flammable, and are low in toxicity shipped as liquefied compressed gases under their own vapor pressures, they are colorless as liquids and gases under their own vapor pressures, and they freeze to white

solids. The fluorocarbons are odorless in concentrations of less than 20 percent by volume in air but some have a faint and ethereal odor in higher concentrations. The fluorocarbons are unusually stable for organic compounds. Resistance toward thermal decomposition, in general, is high but varies with each product. When decomposition does occur, toxic products are very irritating and usually give adequate warning of their presence in very low concentrations in air. Hot work should never be performed on charged systems.

1. Large Liquid Leaks

Large liquid leaks in fluorocarbon systems may be detected visually. As the material escapes, moisture in the air surrounding the leak condenses and then freezes around the leak due to the refrigerating effect of the vaporizing fluorocarbons. The frost thus formed is readily apparent. Smaller leaks may be located with the use of:

- a. A solution of liquid detergent in water applied directly to the area being tested. The formation of bubbles indicates a leak.
- b. Electronic leak detectors, capable of sensitivities far greater than the other methods - often in terms of fractions of an ounce of fluorocarbon per year. When the probe of the instrument is placed near a leak, positive identification of the leak is indicated by a flashing light, meter deflection, or by audible means.

NOTE: The vapors of these fluorocarbons are all much heavier than air and in the absence of good ventilation will tend to collect in low areas, thus possibly displacing available air. The vapors will undergo decomposition when drawn through a flame or if in contact with very hot surfaces. The products of decomposition include hydrogen fluoride and hydrogen chloride and, perhaps, small quantities of carbonyl compounds such as phosgene. The halogen acids are both toxic and intensely irritating to the nose and throat. The irritating action of these decomposition products is readily noticeable before hazardous levels are reached. If such a situation develops, the affected areas should be vacated, the heat source and leak eliminated, and the area well ventilated before resuming work.

SECTION 6.10 Heating Systems and Boiler Plant Maintenance

A. Boiler Operations

Written operating procedures and detailed checklists for operator guidance should be posted in all equipment rooms. It is important that all functions be included, whether manual or automatic. The basic objectives of safe boiler operations are:

1. Require the minimum number of manual operations.
2. Standardize routine operation procedures for normal start-up and on-line operation.
3. Ensure the use of interlocks to minimize improper operating sequences and to stop sequences when conditions are not proper for continuation.
4. Establish and rigidly enforce purge procedures with necessary interlocks.

B. Boiler Safety

1. Water Level

Water in boilers shall be checked and kept at proper levels. Water columns shall be monitored to ensure connections are clear and water returns to the proper level in the gauge glass when drain valves are closed. When water is not visible in the gauge glass, all stresses on the boiler shall be gradually reduced. In boilers fired by

fuels burned in suspension (fuel oil, gas, or pulverized coal), stop the fire immediately, shut off all air flow, close steam outlet valve, and shut off feed water supply. Proceed as in a normal shutdown. Inspect the boiler thoroughly, including a hydrostatic test, before returning it to service.

2. Lighting Gas and Oil Fired Furnaces

Before lighting gas and oil fired furnaces, boilers and breeching shall be ventilated to remove explosive vapors. Burners shall not be lighted if there is oil on the floors or combustion chamber, around the burners, or in front of the boilers. If the flame of a gas or oil-fired burner goes out, the fuel shall be immediately cut off and the furnace passages ventilated before it is re-lit.

3. Cleaning and Maintenance Procedures

- a. Whenever a boiler is taken out of service for a prolonged period, it should be cleaned promptly and inspected for defects by an authorized boiler inspector.
- b. for boilers in continuous service, planned and scheduled boiler shut downs for preventive maintenance is far safer than risking an extensive shutdown caused by boiler failure. At least once a year, the boiler, the flame safeguard supervisory system, and other safety controls shall be inspected during a scheduled shutdown by an authorized boiler inspector who is accompanied by the area supervisor. Defective parts shall be repaired or replaced. For inspection, boilers shall be cool; hand holes and manholes open, and the boiler shall have been ventilated. Adequate lighting and protective equipment for work in the boiler should be provided.
- c. Proper and convenient drain connections shall be provided for draining boilers. Unobstructed floor drains, properly located in the boiler room, facilitate proper cleaning. Infrequently used drains should have water poured into the traps, as required based on local conditions, to prevent the entrance of sewer gases and odors into the boiler room. If there is a possibility of freezing, an antifreeze mixture should be used in the drain traps.
- d. When cleaning a boiler, employees shall wear protective clothing, hats, goggles, heavy leather-palm gloves, safety shoes, and approved respirator and hearing protectors if conditions warrant.

4. Steam Piping and Valve Maintenance

- a. All 4-inch and larger steam valves or main steam valves to any building shall be operated only by qualified heat systems personnel.
- b. High pressure steam valves located in confined areas shall not be turned off until the valve controlling the steam is turned off at the main steam plant. After the valve in the confined area has been closed, the valve in the steam plant may be reopened to distribute steam to other areas.
- c. When a valve in any confined area is to be opened, the operator shall close the main valve at the steam plant before opening the steam valve in the confined area. the operator shall ensure that all pressure has been bled off prior to opening the steam valve in the confined area. The operator shall open the steam valve in the confined area and move away from the confined area before the main valve at the steam plant may be reopened.
- d. Routine operations, maintenance, and repair in steam pits and other confined areas may be accomplished on electric circuits, controls, motors, pumps,

receivers, condensate lines, and vent fans while steam pressure is in the steam line, providing conditions and temperatures are acceptable. However, no operational changes, repair, or maintenance shall be accomplished on steam lines while there is steam pressure on the lines.

- e. Operating personnel shall open drain valves and remove water from the steam line prior to opening a high pressure steam valve. Operating personnel shall familiarize themselves with the location of these drain valves to ensure that the water accumulations are drained from the distribution lines.
- f. When bypass lines and valves are installed around a high pressure steam valve, the bypass valve shall be opened first. When the steam line becomes heated or the steam pressure equalized on both sides of main steam valve, the main steam valve may then be opened.
- g. All high pressure steam valves shall be opened very slowly and everyone shall remain at a safe distance while valve positions are being changed.
- h. When dismantling a valve for maintenance, the worker shall ensure pressure has been relieved through all possible means. The valve body shall be checked for a removable plug to relieve pressure. Bolts shall be carefully removed. Personnel shall never position their body over the valve or in line with the direction of travel, in case the bonnet blows.

5. Vaults, Manholes, and Tanks

- a. All enclosed areas shall be considered hazardous until tested. They will be tested with oxygen deficiency and combustible gas indicators prior to entry.
- b. Atmospheres containing 19.5 percent or less of oxygen by volume should not be entered without the use of an air supplied respirator.
- c. Only manhole cover hooks or other methods approved for this purpose shall be used when removing or replacing manhole covers. When replaced, the covers shall be properly seated. The bearing surfaces shall be free from dirt or ice which might prevent proper seating of the cover.
- d. Personnel shall enter and leave manholes or vaults only by means of a ladder; they will not step on cables, cable hangers, or pipes.
- e. Personnel shall not throw tools or materials into or out of manholes or vaults. They will use canvas buckets, hand lines, or other approved methods for lowering and removing tools and equipment.
- f. Working on energized equipment is especially hazardous in subsurface structures and will be performed by an electrician.
- g. When a manhole or vault is open, at least one member of the crew shall be stationed at the surface to act as a safety observer and take appropriate actions in case of emergency.
- h. Cool vests or other heat reducing equipment should be made available to workers who enter vaults or manholes under high heat conditions (e.g., steam leak repair).

6. Central Heating Plants

A. Boiler Safety

- 1. As a minimum, each boiler shall be equipped with steam and water gauges, gauge cocks, safety and blow-off valves, and low water cutoff devices. Safety valve inspections shall be as outlined in the National Board Inspection Code

published by the National Board of Boiler and Pressure Vessel Inspectors. Boiler feedlines shall be equipped with check and cutoff valves placed as close as possible to each boiler. Water gauge glasses, less than 15 feet from the floor or water tender's platform, will be carefully guarded to prevent accidents resulting from breakage or blowouts. High-pressure gauge glasses will be drawn down on each shift. Low-pressure gauge glasses will be checked at least weekly. Pressure gauges shall be inspected and tested every 12 months by heating plant personnel.

2. No boiler shall be operated unless equipped with a safety valve, calibrated to the boiler manufacturer's recommendations unless normal boiler operating pressures are changed. In the latter case, the maximum operating pressure then becomes the controlling factor on safety valve selection. NO other valves, shall be placed between the safety valve and the boiler or between the safety valve and the end of its discharge pipe. Safety valves shall be manually tested on steam or hot water systems at least monthly for proper operation. If it is not practical to test safety valves every month for high temperature hot water boilers, the valves should be removed from the boiler, tested, and reset (if required) at a properly equipped safety relief valved testing facility by the valve manufacturer or by a certified (ASME) shop. Valves should be tested and reset at least once a year for high temperature hot water boilers.
3. When applicable, spark arresters shall be installed on boiler stacks to prevent flying sparks.
4. No boiler shall be operated at pressures higher than determined safe by the most recent boiler inspection. Boilers shall not be operated at greater pressures than those specified on the manufacturer's stamped instructions. The lowest of these two pressures will govern boiler operation. The instruction stamped by manufacturers on boilers shall not be covered or obliterated.
5. If safety valves do not pop when pressures rise above valve settings, or the valves cannot be opened by hand when tested, the boiler shall be taken out of service until the valves have been repaired or replaced.
6. When fires are banked, boiler tenders shall make certain that draft is sufficient to prevent accumulations of flammable gases.
7. When a boiler is returned to full operation, all external drains between the boiler and main header shall be left open until the boiler is on the line. The stop valve shall be kept closed until boiler pressure is equal to that in the steam main. The stop valve shall then be gradually opened; if no jars or disturbances occur in the line, the valve may be opened completely. If jarring or rumbling occurs during cutting-in, the stop valve shall be closed immediately.
8. Steam shall be introduced into cold pipes very slowly until they have warmed enough to preclude damage.
9. Boiler tenders shall stand to one side when opening fire doors to protect themselves against flarebacks.
10. When not in use, all boiler room tools shall be stored in suitable racks. Tool racks shall be constructed and located so personnel cannot accidentally touch hot surfaces or knock tools from racks while passing by.

11. Adjustments shall not be made to valves or valves removed to increase discharge pressure.
12. Hoistways, driving machinery, conveyors, worm gears, and reciprocating pumps shall be properly guarded.

C. Boiler Water Treatment Tanks

Some of the chemicals used to treat boiler water are hazardous and shall be handled properly. The following safety precautions shall be observed:

1. Acids

Tests for chemical residuals involve small quantities of acid. The risk is small if spillage is avoided and bottles containing acid are not broken. Greater risks are involved in the handling of sulfuric acid in the hydrogen-zeolite, demineralizing, and direct-acid treatment processes. Observe the following precautions when handling sulfuric acid:

- a. Do not permit diluted or strong sulfuric acid to come in contact with the eyes, skin, or clothing.
- b. Always wear full face shields, chemical safety goggles, neoprene gloves, and a neoprene apron.
- c. Never add water or caustic solutions to concentrated acid since a violent reaction will result.
- d. Ensure supervisor observes all cleaning and repairing of tanks. Observe instructions about entering and cleaning tanks, including
- e. Wash down spills with plenty of water. Never use combustibles such as cloths, sawdust, or other organic materials to mop up spilled sulfuric acid. Neutralize spills with soda ash before washing down.
- f. In the event of accidental contact, remove all contaminated clothing immediately and wash affected areas with water for at least 15 minutes. Have medical personnel examine affected areas to determine if further treatment is necessary.

2. Caustic Soda

Never add water to caustic soda (the proper method is to add caustic soda to water) because sufficient heat may be generated to cause the solution to boil and spatter. Personnel may be injured if they come in contact with the spattering, since caustic soda has a marked corrosive action on body tissue. Injury to the upper respiratory tract and lung tissue can result if the dust or concentrated mist from caustic soda is inhaled.

- a. Never store food or eat near caustic soda or in the work area where it is handled.
- b. Do not depend upon creams or ointments for protection from caustic soda.
- c. Ensure that all personnel exposed to caustic soda wear full face shield, close-fitting chemical safety glasses, neoprene gloves, apron, and coveralls which fit snugly at neck and wrist.

3. Application of Chemicals

- a. Always drain the feeder before introducing chemicals into it. Before opening the drain valve, close all pressure connections to the feeder to prevent injury to the operator from hot water or chemicals.

- b. Never place dry chemicals in a chemical feeder or pump. This practice plugs the chemical feed lines in a short time.
- c. Wherever possible, mix chemicals at floor level to minimize the possibility of injury to eyes and face.
- d. Check specifications, temperature, pressure, and materials of construction of piping, valves, and pumps, to determine whether they can be used safely with the chemicals.

4. Safety Equipment

- a. Inspect all safety equipment regularly, including safety eyewash and shower, to ensure that they are in working condition at all times.
- b. Post operating instructions at the emergency eyewash fountain and the safety shower
- c. Periodically instruct personnel in the use of these facilities.

5. Chemical Storage/Handling

- a. Store all large quantities of chemicals used for boiler or condensate water treatment in locations where accidental spills will be contained and where drainage will not be hazardous to personnel or the environment.
- b. Conspicuously post warning and handling instructions where uses of toxic chemicals are necessary.
- c. Train personnel who handle chemicals in safe chemical handling practices.
- d. Practice neutralization and containment techniques and disposal instructions. Consult with the EHS as needed.

6. Chemical Laboratories

- a. Ensure that chemical testing laboratories associated with water treatment have operable mechanical ventilation, when required.
- b. Maintain chemical test kits and test instructions in a current and usable state.
- c. Conspicuously post appropriate warning instructions.
- d. Train personnel who conduct chemical tests in use of the chemicals and hazards involved.

SECTION 6.11 Painting Operations

A. Hazards

Painting and paint removal present hazards requiring effective controls. Hazards include

- Exposure to toxic materials and flammable or explosive mists, particulates, and vapors.
- Inhalation of mists and vapors from nearly all paints, solvents, thinners, cleaning chemicals, strippers, and epoxies can be injurious depending upon the agent's toxic characteristics and the amount and method of exposure.
- Further, many can physically injure the skin and eyes, or be absorbed through the skin.

Potential physical and health hazards can be effectively controlled by appropriate work procedures, controls, facility design, protective clothing, and equipment.

B. Safety

1. Pressure Equipment

Pressure equipment used in painting operations is hazardous because of the compressed air component; therefore, the supervisor shall assure that spray painting equipment is in serviceable condition. On all air-type spraying equipment a pressure regulator valve shall be installed in the air line between the compressor and painting equipment. A pressure relief valve and a pressure gauge shall be installed between the pressure regulator and pressurized paint containers and/or spray guns. Pressure relief valves shall be set to open at pressures not more than 10 pounds (4.5kg) above the required working pressure.

2. Other Equipment

Painter's ladders, scaffolds, and other equipment shall be inspected prior to use to be certain they are in safe condition.

3. Paint Mixing

- a. Paint mixing shall be done in designated, adequately ventilated rooms constructed of fire-resistant materials.
- b. All sources of ignition shall be prohibited in mixing areas.
- c. All electrical fixtures or equipment in or within 20feet(6meters), of designated paint preparation areas shall meet the requirements of the Jordanian Electrical Code

4. Housekeeping

- a. Good housekeeping is essential to safe operations in paint shops.
- b. Paint rooms, booths, etc., shall be kept clean with equipment stored in a proper and orderly manner.
- c. All solvent or paint soiled rags shall be placed in approved self-closing metal containers plainly marked to indicate the contents.
- d. At the end of each day, these containers shall be emptied or removed to an approved location for pickup and disposal.

C. Health

1. Personnel Exposures

There is a wide application of organic solvents in painting. All organic solvents have some effect on the central nervous system and the skin. The principal modes of personnel exposure are inhalation of vapors and skin contact and absorption. Personnel engaged in painting operations should review Material Safety Data Sheets (MSDS) in order to acquaint themselves with the properties and hazards of the solvents that are used. Skin contact with solvents may cause dermatitis, ranging in severity from a simple irritation to actual damage to the skin.

2. Protective Equipment

- a. Personnel engaged in painting and paint removal shall wear protective clothing, respiratory devices if required and appropriate face, eye, and hand protection.
- b. Eye or face protection is required during scraping or paint preparation (abrasive techniques).
- c. Clothing shall be changed, as needed, to minimize body contamination.

3. Respiratory Protection

The EHSS should be consulted for specific advice on respiratory protection required for specific painting activities.

4. Personal Hygiene

- a. The hands and face shall be kept clean, clothes shall be changed when contaminated and hands and soiled objects shall be kept out of the mouth.
- b. No food or drink shall be brought into, or consumed, in paint shops.
- c. Personnel shall wash their hands prior to smoking or consuming food.

D. Air and Water Pollution

1. Pollution Prevention

- a. Painting and paint removal operations can cause air and water pollution problems which can impact the (EHSS) environment.
- b. Liquid, solid, and gaseous waste products from painting and paint removal operations shall be disposed of in accordance with federal and state air, water, and solid waste pollution control laws and as specified and approved by the(EHSS).

2. Spills

- a. All spills of flammable or combustible liquids shall be cleaned up promptly.
- b. With major spills, remove ignition sources, evacuate, and ventilate the area, and provide appropriate protective equipment to cleanup personnel.
- c. These liquids shall not be allowed to enter a confined space, such as a sewer, because of the possibility of an explosion.

E. Fire Prevention and Protection

1. Fire Prevention

Painting operations of particular concern are those having a fire potential; i.e., paint removal, solvent wipe and paint application by means of spray apparatus. Certain paints, lacquers, varnishes, shellacs, solvents, and thinners are very flammable. Others, under certain conditions, will burn violently. These, for the purpose of control, are classified as being flammable. Solvent materials selected to do the residual clean up, after the initial removal, shall have a flash point of 140oF or above.

2. Spray Painting

Spray painting presents varying degrees of fire hazards, depending on the materials used. Any material having a flash point below 140F (60 °C) should be handled very carefully, and precautions are in order even for those having a flash point higher than this.

3. Sprinklers

Fire suppression sprinklers installed in spray finishing areas shall conform to (NFPA) 13, provisions for extra hazardous occupancy. Dry chemical, carbon dioxide, or halogenated extinguisher systems may be installed where automatic sprinkler protection is not available.

4. Extinguishers

Portable fire extinguishers shall be installed near all paint spraying areas. The EHSS shall determine the type of extinguisher that is appropriate.

F. Ventilation Systems

1. Ventilation

Ventilation and exhaust systems shall be in accordance with the standard for Blower and Exhaust Systems for Vapor Removal, (NFPA) 91. Mechanical ventilation shall be in operation while spraying operations are being conducted and for a sufficient time thereafter to assure vapors are completely exhausted. Adequate conditioned make-up air must be provided.

2. Fan Unit

The fan-rotating element and its casing shall be non-sparking. Ample clearances shall be provided to prevent friction-caused fire hazards. Fan blades shall be mounted on a shaft rigid enough to maintain alignment when the fan is operating under full load.

3. Exhaust Ducts

Exhaust ducts shall be protected against mechanical damage, properly supported, and will normally have a separation of at least 18 inches (0.45meters), from combustible materials. Ducts shall be periodically inspected for accumulation of paint deposits and shall be cleaned as needed.

4. Exhaust

Air exhaust from spray operations shall be directed so that it will not contaminate make-up air being introduced into the spraying area or other ventilation intakes. Unless the spray booth exhaust duct terminal is from a water-wash spray booth, the terminal discharge point shall be at least 6 feet (1.8meters) from any combustible exterior wall or roof.

5. Motors

Electric motors driving exhaust fans shall not be placed inside booths or ducts. Drive belts shall not enter the duct or booth unless the belt and pulley within the duct or booth are enclosed or guarded.

G. Storage and Handling

1. Storage

- a. The quantity of paints, lacquers, thinners, solvents and other flammable and combustible liquids kept near spraying operations shall be the minimum required for operations but shall not exceed 1 day's supply.
- b. Bulk storage of these liquids shall be in a separate building detached from other buildings or in rooms specifically designed and constructed to meet flammable storage room requirements.
- c. No storage of open containers of solvents is permitted. Open containers may only be used for cleaning of painting materials after which the solvent shall be transferred back to a closed container for retention or disposal.
- d. Supplies of flammable and combustible liquids shall be stored in approved fire-resistant safety containers equipped with flash screens and self-closing lids.

- e. Operations involving water base latex paints are exempt from the above requirements.

2. Containers

Original closed containers, approved portable tanks, and approved safety cans shall be used for bringing flammable or combustible liquids into spray finishing rooms. Open or glass containers shall not be used.

3. Liquid Transfer

The withdrawal of liquids from containers and the filling of containers, including portable mixing tanks, shall be done only in a mixing room or in a spraying area when the ventilating system is in operation. Precautions shall be taken to protect against liquid spillage.

4. Grounding

Whenever flammable or combustible liquids are transferred from one container to another, both containers shall be effectively bonded and grounded. This practice prevents electrical discharge from the accumulation of static charge because of the transfer process.

H. Electrical

1. Electrical Wiring

- a. Electrical wiring and equipment shall conform to the provisions Civil Defense regulations.
- b. Electrical wiring located in spray areas must be rigid metal conduit, Type MI cable, or in metal boxes or fitting containing no taps, splices or terminal connections.

2. Electrical Equipment

- a. Electrical equipment outside of, but within 20 feet horizontally and 10 feet(3meters), vertically, of any spraying area and not separated from it by partitions extending at least to the boundary of the Division 2 location shall be of non-spark producing design.
- b. This equipment shall also conform to the provisions of Jordanian Electrical Equipment code, for Class I or Class I, Division 2 locations as applicable.
- c. If spraying operations are confined to an enclosed spray booth or room, the space adjacent to the booth or room shall be considered non-hazardous except for the space within 3 feet(1meter) in all directions from any opening in the booth or room.

3. Grounding

All metal parts of spray booths and exhaust ducts conveying flammable or combustible liquids or aerated combustible solids shall be electrically grounded.

I. Location of Paint Shops and Spray Finishing Operations

1. Paint Shops

Paint shops may be located in specially constructed rooms if they are separated from other operations by fire resistant walls. Paint shops shall be provided with automatic sprinkler protection. Avoid locating these shops near ignition sources.

2. Spray Booths

When possible, paint spray booths shall be located in the paint shop.

3. Prohibited Locations

Spray finishing operations shall not be conducted in a building classified as administrative or public assembly unless a room is specifically designed for that purpose, is protected with an automatic sprinkler system, and is separated vertically and horizontally from such occupancies by not less than two hour fire resistance construction.

J. Airless Paint Spraying

1. Never point an airless spray gun at any part of the body. Paint can be hypodermically injected into the body by the high operating pressures.
2. Do not disconnect the gun from the fluid hose or the hose from the pump until the pressure has been released from the hose. This is accomplished by first closing off the main line air pressure to the pump and then bleeding off the pressure in the fluid hose by triggering the gun before disconnecting it.
3. When handling the gun but not actually spraying (such as while changing parts or work position), hold the gun by the grip and remove the fingers from the trigger. This will prevent the gun from being activated if the operator should inadvertently tighten his hold due to slipping or stumbling. Guns should be equipped with trigger guards and a safety lock. The lock should be in the non-operating position except when the gun is actually in use.
4. Check all hose connections and fittings to make sure they are tight and not leaking. The fluid hose must be designed to withstand the high pressure to which it is subjected. The hose, gun, and pressure vessel should be equipped with special fittings that are not interchangeable with low pressure fittings.
5. Check the fluid hose to be sure that there are no weak or worn spots. Make certain the hose does not contact moving parts of machinery, lie over or around sharp edges and corners, or come near objects that would damage it. Check for deterioration caused by exposure to chemicals or ordinary wear and tear. High-pressure leaks from the hose or from the connections can also cause hypodermic injection.
6. Never pass the finger over the gun orifice to clean it, as this will result in hypodermic injection of paint into the finger. Consult the manufacturer's operating manual for cleaning procedures.
7. The object being sprayed as well as the spray gun should be grounded to prevent static electricity from being created. Periodic continuity checks should be performed to ensure the hose ground wire is intact.
9. The operator shall wear eye protection and gloves to guard against accidental contact with the spray. Respiratory protective equipment shall be worn if exhaust ventilation is not available. The (EHSS) shall be contacted to determine appropriate protective equipment needed for the operation.

K. Paint Spray Booths

1. Extinguishers

Provide portable fire extinguishers adequate to handle the most flammable of the coating materials being used. The EHSS shall be consulted for appropriate extinguishers needed.

2. Floor Covering

It is desirable that the floor of paint spray booths be covered with a non-combustible mat, removable for cleaning or disposal.

3. Hoses and Couplings

Pressure hoses and couplings shall be regularly inspected for condition and shall be replaced as needed. When positive displacement pumps are used, a relief valve shall be installed in the discharge line to prevent overpressure.

L. Portable Paint Spray Equipment

1. Description

Such equipment consists of an air compressor, paint spray gun and hose. The paint reservoir on most portable spray guns holds one quart of fluid or less. When a considerable amount of paint is to be applied, a (2.5 or 5) gallon (11.4 or 22.7) Liters pressure tank is usually employed.

2. Compressor

The air compressor shall be equipped with an (ASME) rated air tank, a visible pressure gauge on the tank, a pressure reducer with its own gauge, a guard fully enclosing the drive belt and pulleys, and a pressure limiting switch to shut down the compressor when the system's working pressure has been reached. The equipment should be securely mounted on a wheeled carriage for portability. For interior painting only electric motor-driven equipment shall be used.

3. Overpressure Protection

When separate paint pressure tanks are used, they shall be equipped with a gauge and a relief valve to prevent overpressure. Hoses shall be rated for the maximum working pressure of the system.

4. Maintenance

- a. A preventive maintenance program shall be implemented to cover periodic inspection and testing of all components.
- b. Storage of compressors, hoses, paint pressure tanks and spray guns shall be in areas designated and approved by the supervisor in conjunction with the EHSS.

M. Aerosol Spray Paint Cans

The same general safety and health precautions apply to spray painting from pressurized cans as to spray painting by other means. The following specific items are noted:

1. Storage

- a. Pressurized cans of spray paint are to be considered flammable materials and stored in appropriate locations.
- b. Office desks are not to be used for the storage of pressurized cans of spray paint.

- c. Office store rooms are not to be used for the storage of pressurized cans of spray paint unless the storage area has been designated safe for the storage of flammable materials by the (EHSS).

2. Disposal

- a. Disposal of malfunctioning paint spray cans still containing paint under pressure shall be in accordance with the (EHSS) hazardous waste disposal procedures.
- b. Office waste cans shall not be used for the disposal of cans of spray paint or for the disposal of wiping rags and other waste material.
- c. Disposal of wiping rags and other waste materials shall be in self-closing metal containers labeled to indicate the contents.

3. Protective Equipment

The same general rules governing the use of personal protective equipment apply to painting with pressurized cans.

SECTION 6.12 Landscape/Grounds Maintenance

A. Mowing

Maintenance of JUST grounds involves the use of various sizes and types of lawnmowers. The most significant dangers are being struck by the blade or a foreign object thrown by the high speed blades and noise-induced hearing loss.

1. Personal Protective Equipment and Safeguards

Workers shall wear face shields or safety goggles or glasses with side shields, safety-toe boots, and hearing protection during the operation of all lawn mowers. Gloves may be worn when using walk-behind mowers. Bump caps should be worn when using a riding or towed mower around tall brush and low hanging tree limbs. All mower discharge chutes shall be guarded with shields or approved grass catchers to deflect or stop foreign objects during operation.

2. Operating Practices Applicable to Push, Self-Propelled, and Riding Mowers

- a. Operators shall be trained and qualified to operate the different type(s) of mowers available. Manufacturer's instructions and operating procedures shall be followed.
- b. Prior to mowing, operators shall clear the area to be mowed of all people and inspect for foreign objects, raised sprinkler heads, holes, soft ground, and obstructions.
- c. The mower shall not be left running unattended. For riding mowers, the engine shall be shut off and all drives disengaged prior to getting off the mower. No riders are permitted on riding lawn mowers. The engine on push and self-propelled mowers shall be turned off while moving to another job location or while passing over curbs, loose gravel, or other similar obstructions. Power to attachments shall be disengaged on riding or towed mowers while passing over similar obstructions and when traveling over unobstructed areas and roads on the way to the next job site or return to the shop.

- d. Mower blades cutting height should normally be set as near to 2 inches (5cm) as possible. Blades shall never be set lower than 1.5 inches (3.8cm).
- e. When mowing hills and slopes, operators shall know the special precautions to follow. Slopes, hills, or banks exceeding a 30 degree angle shall be mowed with a push or self-propelled walk-behind mower in a horizontal (across) direction.
- f. Electric hedge clippers shall be inspected, cleaned, oiled, and sharpened as required when in use. A grounded power cord shall be used if the tools are not double insulated. The cord shall be inspected before use and daily for condition. The cord shall be kept away from the cutting surface and out from under the feet of the operator. The cutting teeth of the clipper shall not be pointed toward the body of the operator. The unit shall be shut off and unplugged while moving from job to job. Gloves shall be worn when operating hedge clippers. No electric power tool shall be operated in rain, sprinklers, or any kind of precipitation.

3. General Rules for Maintaining Lawn Care Equipment

- a. Always refuel with engines off and allow the engine to cool first. Do not permit smoking in the area. Refuel mowers prior to use versus refueling prior to storing inside a building. Complete refueling outside, at least 10 feet(3m) away from the building or any open flame.
- b. Use boards or ramps to load and unload mowers from vehicles ensuring the engine is off and the spark plug wire is disconnected. Always shut off the fuel supply line when parking mowers inside or outside at the end of the day. As storage space permits, leave (1 to 3) feet (0.3to1)m separation space between parked gasoline-operated riding mowers.
- c. Clean mowers or perform other maintenance on mowers only after turning engine off and disconnecting the spark plug wire.
- d. Use manufacturer's guidelines for operation and use of mowers.

4. Tractor Operations

- a. Roll-over protective structures (ROPS) are required on tractors used for landscape maintenance. Seat belts shall be installed on all ROPS-equipped tractors and used whenever the vehicle is in motion.
- b. When pulling a load, operators shall hitch only to the draw bar. The draw bar hitch shall be kept at least 13 inches (33cm), but less than 17 inches (43cm), off the ground.
- c. When moving a front load, the load shall be kept low to the ground and the rear wheels as level as possible.
- e. Operators shall avoid holes and obstacles; both on the ground and overhead. Speed shall be reduced with heavy loads when vision is limited or when operating on rough terrain.
- f. When stuck, operators shall try carefully to back out. Increasing engine speed or fastening a post to the rear wheels greatly increases the chances of tipping over backward; therefore, these methods shall not be used. Operators shall get help if needed.

- g. Grass shall not be mowed with a tractor on slopes greater than a 4-inch rise or drop per foot of travel. Lower gears shall be used when going down hill and the wheels shall be allowed to control the tractor speed.
- h. The engine shall be shut off before the operator dismounts from the tractor or makes adjustments to either the tractor or towed equipment.
- i. Riders shall not be allowed on tractors, on the draw bar, or on towed equipment, except where the equipment is specifically designed to allow riders or passengers.
- j. Fenders are guards for the worker's protection. Fenders shall be kept in place at all times.
- k. Tractors shall only be left on an incline after the engine has been turned off, gear shift has been placed in park position (or the lowest gear if standard transmission), and the wheels have been braked and blocked. Where possible, tractors shall be parked on level ground.
- l. The power take-off guard shall always be in place.
- m. Hearing protection and safety-toe shoes shall be worn by the operator, when required. The (EHSS) should be consulted to determine the need for respiratory protection.

5. Flower Bed and Shrub Maintenance

- a. Workers shall wear clothing and gloves that will protect their hands and arms from thorns and leaves which may cut or puncture the skin.
- b. Dust masks may be required to prevent reactions to fine dust or pollen.
- c. Personnel shall not work on flower or shrub beds within 24 hours after application of herbicides.
- d. Shovels, hoes, and cultivators shall be kept sharp, used in moist soil, and placed where stepping on the cutting surface will not cause the handle to strike a person.

6. Fertilizer Storage and Handling

- a. Fertilizer can become a very combustible material and, at temperatures in excess of 130 F (54°C), it may explode. When fertilizers become wet and start to decompose, they give off a gas that will burn. Some fertilizers give off a very toxic gas when burning.
- b. No more than 2,500 tons of fertilizer shall be stored in a building unless that building is equipped with an automatic sprinkler system.
- c. When spreading fertilizer, pellets shall not be directed toward other personnel. If personnel enter the area, the spreader shall be turned off. Fertilizer spreaders shall be cleaned and lubed daily. Safety glasses and gloves shall be worn during fertilizing spreading operations.

7. Herbicides

The use of herbicides for weed control poses a significant potential safety and health hazard. Herbicides shall be applied per manufacturer's instructions and used only by certified personnel. Due to the absorption properties of herbicides, coveralls shall be worn during application, in addition to safety goggles and appropriate respiratory protection, as required.

CHAPTER7 FOOD HYGIENE

SECTION 7.1 Licenses

- a. It shall be unlawful a food service establishment, or mobile food unit, a temporary food service operation or a restricted food service operation without having first obtained a valid food service license from JUST and Ministry of Health (MOH)
- b. The licenses shall be invalidated by change of ownership or location;
- c. The license shall be prominently displayed at all times, as near the main entrance as practicable;
- d. The license shall be the property of JUST and shall be returned within seven days to JUST when the food service establishment ceases to operate or is moved to another location or when license is revoked;
- e. Any addition of a "food item" that changes the method of food preparation must be reported to JUST prior to implementation.

SECTION 7.2 Food Care

1 Food Supplies:

- a. Food shall be in sound condition, free from spoilage, filth, or other contamination and shall be safe for human consumption and comply with all Jordanian Standards related to food (Annex 1)
- b. Food shall be obtained from approved sources that comply with all laws relating to food processing and shall have no information on the label that is false or misleading.
- c. The use of food in hermetically sealed containers that was not prepared in a food-processing establishment is prohibited.
- d. Fluid milk and fluid milk products used or served shall be pasteurized and shall meet the Jordanian Milk quality standards (JS 4/ 1987) JS 46/1997; JS 7/1997; JS 108/1987; and JS 135/ 1991). Dry milk products shall be made in compliance with JS 121/1989.
- e. All bakery products shall have been prepared in licensed food service establishments or in an approved food processing establishment; JUST Bakery requirements and in compliance with JS 19/1981 and JS 6/1984.
- f. Only clean whole eggs, with shell intact and without cracks shall be used.

2 Food Protections:

- a. At all times, including while being stored, prepared, displayed, served, or transported, food shall be protected from potential contamination, including toxic materials, dust, insects, rodents, unclean equipment and utensils, unnecessary handling, cross contamination, coughs and sneezes, flooding, drainage, and overhead leakage or overhead drippage from condensation.
- b. The temperature of potentially hazardous food shall be 5°C (41° F) or below, or 60°C (140° F) or above at all times, except as otherwise provided in the previous general requirements.

- c. In the event of a fire, flood, power outage, or similar event that might result in the contamination of food, or that might prevent potentially hazardous food from being held at required temperatures, the person in charge shall immediately contact JUST Food Department and EHSS Upon receiving notice of this occurrence, JUST shall take whatever action it deems necessary to protect the public health.
- d. Frozen food products: Frozen food products shall be transported with a temperature of (-18°C). A rise of (+3°C) is allowed (-15° C) provided that it can be restored to (-18° C) as soon as possible. All frozen products shall be in compliance with Jordanian Standards (JS 174/1994; JS 381/1994; JS 400/1997; and JS 471/1995)

3. Food Storage.

A. General requirements (Apply to all storage facilities)

- 1. Stored goods shall be handled on first-in first-out bases.
- 2. It is prohibited to store chemicals, detergents and sterilizers with food products in the same room. They shall be stored in a separate room or a special closed cabinet.
- 3. All commodities shall be inspected on receipt and any unsatisfactory item must be refused.
- 4. Food, whether raw or prepared, if removed from the container or package in which it was obtained, shall be stored in an approved, clean, and covered container except during necessary periods of preparation of service.
- 5. Container covers shall be tight fitting, impervious, nonabsorbent and have safe material.
- 6. Loading halls and rooms used for receiving and storing raw or processed food products, packaging or wrapping materials shall always be kept clean.
- 7. Each type of stored goods shall be arranged separately in order to differentiate, inspect and take samples if necessary.
- 8. At least once a year, the food store shall be emptied for cleaning, and maintenance ensuring to clean each part of the storage to maintain hygiene.
- 9. Incoming goods shall be separately stacked and identified with the date of receipt to enable good stock rotation
- 10. All goods should be either palletized or stored on racking of the floor at a minimum. 45 cm from walls and 15 cm above ground
- 11. Stocks should be regularly inspected for signs of deteriorations or infestation.
- 12. Non-compatible foods or food where the possibility of cross contamination exists must be segregated.
- 13. A cleaning schedule shall be designed to ensure the storage area regularly cleaned.
- 14. All open foods should be covered.
- 15. Storage areas for different commodities should be designated and identified
- 16. During wet cleaning, of floors, care must be exercised to prevent food becoming damp
- 17. Detergents and sterilizers shall be stored away from food products.
- 18. Storage areas shall be insect and rodent proof

B. Dry Storage

- 1. Dry storage maximum temperature 25 C.

2. If the top layers are liable to become heavily spoiled, they must be protected with suitable covering material.
3. Food and containers of food shall not be stored under exposed plumbing
4. Sufficient space must be left between stacks to allow air circulation and access for inspection.
5. Conditions of extreme heat or cold should be avoided especially products with high fat or oil content (Maximum temperature 25 C).
6. Non-food or highly odorous products must be segregated from foods liable to tainting.
7. Bulk food such as cooking oil, syrup, salt, sugar, and flour shall be stored in an approved, clean and covered container with the contents identified by common name.
8. Spillage must be cleaned away immediately.
9. Direct sunlight must be avoided
10. It is prohibited to use the storage for sleeping, cooking or keeping employees' belongings
11. Dry goods must be considered unsatisfactory if:
 - a. There are an excessive number of damaged, leaking, blown or rusted cans
 - b. Evidence of infestation by rodents or insects.
 - c. Excessive soiling on outers
 - d. Excessive damage resulting in food products being exposed to possible contamination.
 - e. Dampness.
 - f. Other spoilage or contamination

C Chilled Storage:

1. Chilled temperature must be 0° C -7° C (32 -45 ° F)
2. None compatible foods, or food where the possibility of cross contamination exists, must be segregated.
3. It is prohibited to store cooked or ready-to-eat food with any uncooked raw food products in the same refrigeration equipment so as to prevent cross contamination in the preparation area in restaurants, canteens and others.
4. Hot food products shall not be placed in refrigeration equipment until it cools down. To a temperature of 50 – 60 C.
5. When opening the refrigerator's door, there shall be sufficient light to enable adequate performance of filling, emptying, cleaning or inspecting.
6. Stand-by electrical generator shall be installed to operate automatically upon power failure in the cooled-storage
7. Refrigerators shall be cleaned and sanitized at least once every 2 weeks
8. All temperatures must be checked daily, logged and reported for corrective action if exceeding (7° C) 45 ° F
9. Enough conveniently located refrigeration facilities or effectively insulated facilities shall be provided to assure the maintenance of perishable and potentially hazardous food at required temperatures during storage.

10. Each refrigerated facility storing potentially hazardous food shall be provided with a numerically scaled thermometer, (accurate to $\pm 1.5^{\circ}\text{C}$) measuring the air temperature in the warmest part of the facility and located to be easily readable.
11. Potentially hazardous foods requiring refrigeration after preparation shall be placed in shallow pans not to exceed 10 cm in depth and shall be rapidly cooled by refrigeration to an internal temperature of 5°C (41°F) or below within four (4) hours.
12. Using smaller portions, chilling in refrigerator and/or agitation, may accelerate rapid cooling.
13. Accumulated times in the danger zone, (5°C) 41°F to 60°C (140°F) shall not exceed four (4) hours.
14. Food products shall be arranged properly and not stacked in cool rooms without touching against the walls or the ceiling. Passageways should be between the stacks for cleaning and inspection.
15. It is prohibited to switch off the refrigerator or cool room at night or at any other time as long as it contains food. Refrigerator's temperature shall always be observed and kept according to the set temperature of its contents
16. Cool rooms shall not be stacked with food products beyond its capacity, which may prevent free air circulation especially in the vegetables' refrigerators.
17. It is prohibited to use sterilizers (whose odor affects food nature) in cleaning refrigeration equipment to prevent food contamination.

D. Freezer Storage

1. Freezer temperatures should be (-18°C) - (-15°C) or (0°F) - (5°F)
2. Freezers must be periodically defrosted, to enable through wet cleaning, and removal of large ice formulations
3. After defrosting, even partially, it is prohibited to refreeze stored frozen food products.
4. All temperatures must be checked daily, and logged.
5. A temperature control log book for each refrigerator unit shall be maintained of a minimum of four (4) times per day
6. Freezers shall be cleaned at least once every 2 months
7. Frozen goods must be considered unsatisfactory, if:
 - a. There is evidence of defrosting
 - b. Excessive soiling on outers.
 - c. Excessive damage resulting in food products being exposed to possible contamination.
 - d. Other spoilage or contamination

SECTION 7.3 Food Preparation area

1. It shall be spacious and suitable for the work volume (30% of total restaurant area)
2. The floor shall be tiled, free from cracks and cavities with a natural slope towards the drains.
3. The ceiling shall be painted with emulsion or any other easily cleaned paint.
4. Provide a sufficient number of stainless steel or marble tables for preparing food.

5. Provide a sufficient number of basins or sinks at least 2, supplied with soaps and hand drying utilities (paper or electric)
6. Provide refrigerating equipment to preserve raw and ready-made food products.
7. Provide a glass screen with openings for sales and services if required.
8. Preserve general hygiene in food preparation area
9. It is prohibited to use containers with sharp-edged kitchen utensils that are hard to clean or clearly damaged
10. Sanitary instructions and guidance signs shall be posted .

SECTION 7.4 Food Preparations:

1. Food shall be prepared with the least possible manual contact, with suitable clean utensils, and on surfaces that prior to use have been cleaned, rinsed and sanitized to prevent cross-contamination.
2. Raw fruits and vegetables shall be thoroughly washed and sterilized before being cooked or served. A separate sink shall be provided for this purpose.
3. All potentially hazardous foods requiring cooking except as stated below shall be cooked to heat all parts of the food to a temperature of at least 60°C (140° F)
4. Nondairy creaming, whitening, or whipping agents may be reconstituted on the premises only when they will be stored in sanitized, covered containers not exceeding one-half gallon in capacity and rapidly cooled to and maintained at 7 ° C (45° F) or below.
5. Dry milk products may be used as an ingredient in nutritional supplement or prescription formulas when served immediately after preparation.
6. Liquid, frozen, dry eggs and egg products shall be used only for cooking and baking purposes.
7. When potentially hazardous foods that have been cooked and then refrigerated, are to be served hot, they shall be reheated rapidly to 74° C (165° F) or higher throughout before being served or before being placed in a hot food storage facility.
8. Steam tables, bainmaries, warmers, and similar hot food holding facilities are prohibited for the rapid reheating of potentially hazardous foods.
9. A metal stem-type numerically scaled thermometer, accurate to $\pm 1.5^{\circ}$ C, shall be provided and used to assure the attainment and maintenance of proper internal cooking, holding, or refrigeration temperatures of all potentially hazardous foods.
10. Potentially hazardous foods shall be thawed:
 - a. In refrigerated units at a temperature not to exceed 5°C (41°F); or
 - b. Under potable running water of a temperature of 21°C (70°F) or below with sufficient water velocity to agitate and float off loose food particles into the overflow; or
 - c. In a microwave oven only when the food will be immediately transferred to conventional cooking facilities as part of continuous cooking process or when the entire, uninterrupted cooking process takes place in the microwave; or
 - d. As part of the conventional cooking process, additional time must be allowed for product to reach required internal temperature.

11. For special events, foods requiring only cooking may be prepared, if served immediately, in an outside area on the premise of a permitted food service establishment. Prior approval must be obtained from EHSS.

SECTION 7.5 Food Display and Food Service:

1. Potentially hazardous food shall be kept at an internal temperature of 5°C (41°F) or below or at an internal temperature of 60° C (140° F) or above during display and service, except that rare roast beef shall be held for service at a temperature of at least 54° C (130° F)
2. Frozen food products: Frozen food products shall be displayed at a temperature not exceeding (-12°C) and shall be reduced to (-18°C) where possible.
3. Animal products, which are to be consumed raw, must be served at a temperature of 5° C (41° F) or below.
4. Containers used for selling of food products shall be clean and preserved in a hygienic method to prevent cross contamination.
5. "Shawerma" shall not be displayed on the main sidewalk. It shall be sold and served inside the shop in the designated area.
6. Meat, poultry and raw materials of Shawerma shall be bought from known sources and shall meet the standards.
7. Samples of cooked and stored food products shall be periodically (at least once every week) examined in food quality laboratories periodically.
8. It is prohibited to dispose machine wastewater directly on the floor
9. In sales area
 - a. Provide a front-glass screen if needed.
 - b. Provide paper-napkins for customers' use
10. Milk and milk products for drinking purposes shall be provided to the consumer in an unopened, commercially filled package not exceeding 0.5 liter in capacity, or drawn from a commercially filled container stored in mechanically refrigerated bulk milk dispenser.
11. Where a bulk dispenser for milk and milk products is not available and portions of less than one-half are required for mixed drinks, cereal, or dessert service, milk and milk products may be poured from a commercially filled container or not more than 2 liter capacity.
12. Cream or half and half shall be provided in an individual service container, protected pour type pitcher, or drawn from a refrigerated dispenser designed for such service.
13. Nondairy creaming or whitening agents shall be provided in an individual service container, protected pour-type pitcher, or drawn from a refrigerated dispenser designed for such service.
14. Condiments, seasonings and dressings for self-service use shall be provided in individual packages, from dispensers, or from protected containers.
15. Food shall be served fresh.
16. Food shall be made of fresh products (vegetables and meat) if possible.

17. Hot dishes shall be served hot at a temperature of minimum 60°C.
18. Cold dishes shall be served cold at a temperature ranging between 2-8°C.
19. It is prohibited to sell and prepare food outside on sidewalks
20. Ice for consumer use shall be dispensed only by employees using a scoop that has a handle and is constructed of approved materials, tongs, or other ice-dispensing utensils or through automatic self-service, ice-dispensing equipment.
21. Ice-dispensing utensils shall be stored on a clean surface or in the ice with dispensing utensil's handle extended out of the ice.
22. Ice transfer container shall be stored and used in a way that protects the container and ice from contamination.
23. Ice storage bins shall be drained through an air gap or indirect connection.
24. To avoid unnecessary manual contact with food, other than ice, suitable dispensing utensils shall be used by employees or provided to consumers who serve themselves. Between uses during service, dispensing utensils shall be:
 - a. Stored in the food with the dispensing utensil handle extended out of the food; or
 - b. Stored clean and dry; or
 - c. Once served to a consumer or placed on the table for service, portions of food shall not be served again, except that; unopened packaged food, other than potentially hazardous food, still in sound condition, may be re-served.
25. Food on display shall be protected from consumer contamination by the use of packaging or by the use of easily cleanable counter, serving line or salad bar protective devices, display cases, or by other effective means.
26. Protective devices for counters, serving lines, salad bars and other similar food displays in public eating establishments shall be designed and constructed so as to intercept contaminants which may be expelled from the customer's mouth or nose.
27. All food, whether on display, being prepared for service or placed for consumer self-service must be protected from contamination from consumers..
28. Enough hot or cold food facilities shall be available to maintain the required temperature of potentially hazardous food on display.
29. All food display facilities shall be designed or operated to minimize contact by consumer.
30. The presentation of food orders is permissible from a licensed food service establishment in an adjoining outdoor seating area.

SECTION 7.6 Food Transportation:

1. During transportation, food and food utensils shall be kept in covered containers or completely wrapped or packaged so as to be protected from contamination and spoilage.
2. Foods in original individual packages do not need to be over wrapped or covered if the original package has not been torn or broken.
3. During transportation, including transportation to another location for service or catering operations, potentially hazardous food shall be maintained at 7 ° C (45° F) or below for cold foods or 60 ° C (140° F) or above for hot foods.

SECTION 7.7 Personnel

A. Employee Health:

1. Food handlers must have health certificate when employed.
2. All staff must have signed the "agreement to report infection"
3. Any person suffering from diarrhea, vomiting or possible a contagious infection must be excluded from work immediately and directed to attend the appropriate medical center.
4. Food handlers must obtain medical clearance before retaining to work when affected by an infectious condition.
5. Daily personal inspections should be performed on food handlers (Cleanliness of hands, nails, cuts, abrasions, boils etc).
6. Wash hand basins inside kitchen are to be used only for hand washing;
7. . Specific persons shall be assigned for sanitation duties and easily recognized by wearing different uniforms
8. No person, while infected with or suspected of having a disease that can be transmitted by food or who is a carrier of microorganisms that cause such a disease or while afflicted with a boil, a cut or wound, or an acute respiratory infection, shall be permitted, by food service management, to work in a food service establishment in any capacity in which there is a likelihood of such person contaminating food or food-contact surfaces or transmitting disease to other persons.

B. Personal Cleanliness:

1. Employees shall thoroughly wash their hands and the exposed portions of their arms with soap and warm water before starting work, during work as often as is necessary to keep them clean,
2. Employees shall keep their fingernails clean and trimmed.
3. Personnel are required to maintain an excellent appearance both in their clothing and their person
4. Smoking, spitting, eating, drinking etc. are prohibited throughout the food preparation and storage areas
5. Approved measures should be taken to prevent perspiration from contaminating foods, food contact surfaces, equipment and utensils.

C. Clothing:

1. The outer layer of clothing of all employees shall be clean.
2. Employees serving food or sweet by hand should wear disposable gloves.
3. Employees preparing, handling and serving food shall wear caps or other hair restraints

D. Employee Practices:

1. Employees shall consume food or use tobacco products only in approved designated areas separate from food preparation and serving areas.
2. Employees shall not use tobacco in any form while engaged in food preparation or service, nor while in areas used for equipment of utensil washing or for food preparation.

3. Employees shall handle soiled tableware in a way that minimizes contamination of their hands.
4. Employees shall maintain a high degree of personal cleanliness and shall use good hygienic practices during all working periods in the food service establishment.
5. All personnel must observe the strict hand washing regimes outlined below
 - a. After using the toilet.
 - b. On entering the Kitchen.
 - c. On commencement of duties.
 - d. After handling garbage
 - e. After changing operations.
 - f. After eating or smoking

SECTION 7.8 Equipment and Utensils

A. Materials:

1. Multi-use equipment and utensils shall be constructed of and repaired with safe materials, including finishing materials; shall be corrosion resistant and nonabsorbent; and shall be smooth, easily cleanable, and durable under conditions of normal use. Equipment, utensils, and single-service articles shall not contribute to the contamination of food.
2. If solder is used, it shall be composed of safe materials and be corrosion resistant.
3. Single-service articles shall be made from clean, sanitary, safe materials. Re-use of single service articles is prohibited. Wood may be used for single-service articles, such as chopsticks, stirrers, or ice cream spoons.

B. Design and Fabrication:

1. All equipment and utensils, including plastic ware, shall be designed and fabricated for durability under conditions of normal use and shall be resistant to denting, breaking, bulking, pitting, chipping, and crazing.
2. Food-contact surfaces shall be easily cleanable, smooth, and free of breaks, open seams, cracks, chips, pits, internal corners, and crevices and similar imperfections.
3. Cast iron may be used as a food-contact surface only if the surface is heated, such as in grills, griddles tops, and skillets.
4. Equipment containing bearings and gears requiring unsafe lubricants shall be designed and constructed so that the lubricant cannot leak, drip or be forced into food or onto food-contact surfaces. Only safe lubricants shall be used on equipment designed to receive lubrication of bearings and gears on or within food-contact surfaces.
5. Sinks and drain boards shall be self-draining.
6. Unless designed for in-place cleaning, food-contact surfaces shall be accessible for cleaning and inspection:
 - a. without being disassembled; or
 - b. by disassembling without the use of tools; or
 - c. by easy disassembling with the use of only simple tools such as a mallet, a screwdriver, or a wrench kept available near the equipment.
7. Equipment intended for in-place cleaning shall be so designed and fabricated that:

- a. cleaning and sanitizing solutions can be circulated throughout a fixed system using an effective cleaning and sanitizing procedure; and
 - b. cleaning and sanitizing solutions will contact all interior food-contact surfaces; and
 - c. The system is self-draining or capable of being completely emptied.
8. Fixed equipment designed and fabricated to be cleaned and sanitized by pressure spray methods shall have sealed electrical wiring, switches, and connections.
 9. Thermometers required for immersion into food or cooking media shall be of metal stem type construction, numerically scaled, and accurate to $\pm 1.5^{\circ}$ C.
 10. Surfaces of equipment not intended for contact with food, but which are exposed to splash or food debris or which otherwise require frequent cleaning, shall be designed and fabricated to be smooth, washable, free of unnecessary ledges, projections, or crevices, and readily accessible for cleaning, and shall be of an approved material and in such repair as to be easily maintained in a clean and sanitary condition.
 11. Ventilation hoods and devices shall be designed or operated to prevent grease or condensation from collecting on walls and ceilings, and from dripping into food or onto food-contact surfaces. Filters or other grease extracting equipment shall be readily removable for cleaning and replacement if not designed to be cleaned in place.
 12. Equipment that was installed in a food service establishment prior to the effective date of these requirements, and that does not fully meet all of the material, design and fabrication requirements of these requirements shall be deemed acceptable in that establishment if it is in good repair, capable of being maintained in a sanitary condition, and the food-contact surfaces are nontoxic. Replacement equipment and new equipment acquired after the effective date of these Requirements shall meet these requirements.

C. Equipment Installation and Location:

1. Equipment, including icemakers and ice storage equipment, shall not be located under exposed plumbing, tubes and refrigeration components or otherwise located where contamination may occur.
2. Equipment that is placed on tables or counters, unless portable, shall be sealed to the table or counter or evaluated on legs to provide at least a 10 cm clearance between the table or counter and equipment and shall be installed to facilitate the cleaning of the equipment and adjacent areas.
3. Equipment is portable within the meaning of this section if:
 - a. It is small and light enough to be moved easily by one person; and
 - b. It has no utility connection, or has a utility connection that disconnects quickly, or has a flexible utility connection line of sufficient length to License the equipment to be moved for easy cleaning.
4. Floor-mounted equipment, unless easily movable, shall be:
 - a. sealed to the floor; or
 - b. installed on a raised platform of concrete or other smooth masonry or

- c. elevated on legs to provide at least a 15 cm clearance between the floor and equipment, except that vertically mounted floor mixers may be elevated to provide at least a 10 cm clearance between the floor and equipment
 - d. Sufficient space shall be provided for easy cleaning between, behind, and above all fixed equipment.
5. Aisles and working spaces between units of equipment and walls shall be unobstructed and of sufficient width to permit employees to perform their duties readily without contamination of food or food-contact surfaces by clothing or personal contact.

SECTION 7.9 Cleaning, Sanitization and Storage of Equipment and Utensils

A. Equipment and Utensil Cleaning and Sanitization:

1. After each use tableware shall be washed, rinsed, sanitized, and air-dried. A spoon or other utensil, once used for tasting food, shall not be reused until it has been cleaned and sanitized.
2. To prevent cross-contamination, kitchenware and food-contact surfaces of equipment shall be washed, rinsed, and sanitized after each use and following any interruption of operations during which time contamination may have occurred.
3. Where equipment and utensils are used for the preparation of potentially hazardous foods on a continuous basis, utensils and the food-contact surfaces of equipment shall be washed, rinsed, and sanitized at intervals throughout the day on an approved schedule based on food temperature, type of food, and amount of food particle accumulation.
4. The food-contact surfaces of grills, griddles, and similar cooking devices and the cavities and door seals of microwave ovens shall be cleaned at least once a day; except that this shall not apply to hot oil cooking equipment and hot oil filtering systems. The food-contact surfaces of all cooking equipment shall be kept free of encrusted grease deposits and other accumulated soil.
5. Non-food-contact surfaces of equipment shall be cleaned as often as is necessary to keep the equipment free of accumulation of dust, dirt, food particles, and other debris.
6. Cloths use for wiping food spills on tableware, such as plates or bowls being served to the consumer, shall be clean, dry and used for no other purpose.
7. Moist cloths and sponges shall be cleaned and rinsed frequently in one of the approved sanitizing solutions and shall be stored in a freshly prepared sanitizing solution between uses.
8. Moist cloths and sponges used for wiping food spills on kitchenware and food-contact surfaces of equipment shall be used for no other purpose.
9. Moist cloths and sponges used for cleaning non-food-contact surfaces of equipment such as counters, dining table tops and shelves shall be used for no other purpose.

B. Manual Cleaning and Sanitizing:

1. For manual washing, rinsing, and sanitizing of utensils and equipment, a sink with not fewer than three compartments shall be provided and used.
2. These sinks shall not be used for the preparation of food, such as thawing and washing of vegetables.
3. Sink compartments shall be large enough to accommodate utensils, and each compartment of the sink shall be supplied with hot and cold potable water
4. Fixed equipment and utensils and equipment too large to be cleaned in sink compartments shall be washed, rinsed, and sanitized manually or cleaned through pressure spray methods.
5. Drain boards or easily movable dish tables of adequate size shall be provided for proper handling of soiled utensils prior to washing and for cleaned utensils following sanitizing and shall be located so as not to interfere with the proper use of the dishwashing facilities.
6. Equipment and utensils shall be preflushed or prescraped and, when necessary, presoaked to remove gross food particles and soil.
7. Manual washing, rinsing, and sanitizing shall be conducted in the following sequence:
 - a. preflushed or prescraped, when necessary presoaked;
 - b. sinks shall be cleaned prior to use;
 - c. utensils shall be thoroughly washed in the first compartment with warm detergent solution that is kept clean;
 - d. utensils shall be rinsed free of detergent and abrasives with clean warm water in the second compartment;
 - e. utensils shall be sanitized in the third compartment;
 - f. utensils shall be air dried only.
8. The food-contact surfaces of all equipment and utensils shall be sanitized by:
 - a. immersion for at least one-half ($\frac{1}{2}$) minute in clean, hot water at a temperature of at least 77°C (170°F); or
 - b. immersion for at least one minute in a clean solution containing at least 50 parts per million of available chlorine as hypochlorite and at a temperature of at least 24°C (75°F); or
 - c. immersion for at least one minute in a clean solution containing at least 12.5 parts per million of available iodine and having a pH not higher than 5.0 and at a temperature of at least 24°C (75°F); or
9. Large equipment which cannot be immersed must be sanitized by: Rinsing, spraying, or swabbing with a chemical sanitizing solution of at least twice the strength required for the sanitizing solution used for utensils.
10. In the case of equipment in which steam can be confined, may be treated with steam free from materials of additives
11. When hot water is used for sanitizing, the following facilities shall be provided and used:
 - a. an integral heating device or fixture, installed in, on, or under the sanitizing compartment of the sink, capable of maintaining the water at a temperature of at least 77°C (170°F), and

- b. a numerically scaled thermometer, accurate to $\pm 1.5^{\circ}$ C, convenient to the sink for frequent checks of water temperature; and
 - c. Dish baskets of such size and design to permit complete immersion of the tableware and kitchenware in the hot water.
12. When chemicals are used for sanitization, they shall not have concentration higher than the maximum indicated by the manufacturer.

C. Mechanical Cleaning and Sanitizing:

1. Cleaning and sanitizing may be done by spray-type or immersion dishwashing machines or by any other type of machine, device or procedure if it is demonstrated that it thoroughly cleans and sanitizes utensils. These machines and devices shall be properly installed and maintained in good repair. Machines and devices shall be operated in accordance with manufacturer's instructions, and utensils and equipment placed in the machine shall be exposed to all dishwashing cycles. Automatic detergent dispensers, wetting agent dispensers, and liquid sanitizer injectors, if any, shall be properly installed and maintained.
2. Machine or water line mounted numerically scaled thermometers, accurate to $\pm 1.5^{\circ}$ C, shall be provided to indicate the temperature of the water in each tank of the machine and the temperature of the final rinse water as it enters the manifold.
3. Rinse water tanks shall be protected by baffles, curtains, or other effective means to minimize the entry of wash water into the rinse water. Conveyors in dishwashing machines shall be accurately timed to assure proper exposure times in wash and rinse cycles in accordance with manufacturer's specifications.
4. Separate drain boards shall be provided for the proper handling of soiled utensils prior to washing and for cleaned utensils following sanitization. Such drain boards shall be of adequate size and shall be located and constructed as not to interfere with the proper use of the dishwashing facilities. This does not preclude the use of easily movable dish tables for the storage of soiled utensils or for the storage of clean utensils following sanitization.
5. Kitchenware and tableware shall be flushed or scraped and when necessary, soaked to remove gross food particles and soil prior to being washed in a dishwashing machine unless a pre-wash cycle is a part of the dishwashing machine operation.
6. Utensils shall be placed in racks, trays or baskets, or on conveyors, in a way that food-contact surfaces are exposed to the unobstructed application of detergent wash and clean rinse waters and that Licenses free draining.
7. Machines (single-tank, stationary-rack, door-type machines and spray-type glass washers) using chemicals for sanitization may be used; provided that,
 - a. The temperature of the wash water shall not be less than 50° C.
 - b. The wash water shall be kept clean.
8. Chemicals added for sanitization purposes shall be automatically dispensed.
9. Kitchenware and tableware shall be exposed to the final chemical sanitizing rinse in accordance with manufacturers' specifications for time and concentration. After sanitization, all equipment and utensils shall be air dried only.
10. The chemical sanitizing rinse water temperature shall be not less than 24° C (75° F) nor less than the temperature specified by the machine's manufacturer.

11. A test kit or other device that accurately measures the parts per million concentration of the sanitizing solution shall be available and used according to recommended procedure.
12. Machines using hot water for sanitizing may be used provided that wash water and pumped rinse water shall be kept clean and water shall be maintained at not less than the temperature listed below:
 - a. Single-tank, stationary-rack, dual-temperature machine:
 - b. Wash Temperature: 66 ° C (150° F)
 - c. Single-tank, conveyer machine:
 - d. Wash temperature: 71 ° C (160° F)
 - e. Final rinse temperature: 82 ° C (180° F)
 - f. Multitank conveyor machine:
 - g. Wash temperature: 66 ° C (150° F)
 - h. Pumped rinse temperature: 71 ° C (160° F)
 - i. Final rinse temperature: 82 ° C (180° F)
 - j. Single-tank, pot, pan, and utensil washer (either stationary or moving-rack):
 - k. Wash temperature: 60 ° C (140° F)
 - l. Final rinse temperature: 82 ° C (180° F)
13. All dishwashing machines shall be thoroughly cleaned at least once a day or more often when necessary to maintain effective cleaning and sanitizing of utensils.

D. Equipment and Utensil Storage:

1. Cleaned and sanitized equipment and utensils shall be handled in a way that protects them from contamination. Spoons, knives, and forks shall be touched only by their handles. Cups, glasses, bowls, plates, and similar items shall be handled without contact with inside surfaces or surfaces that contact the user's mouth.
2. Cleaned and sanitized utensils and equipment shall be stored at least 15 cm above the floor in a clean, dry location in a way that protects them from contamination by splash, dust, and other means. The food-contact surfaces of fixed equipment shall also be protected from contamination. Equipment and utensils shall not be placed under exposed plumbing, tubes and refrigeration components or otherwise located where contamination may occur. This requirement does not apply to automatic fire protection sprinkler heads.
3. Utensils shall be air dried only before being stored or shall be stored in self-draining position.
4. Glasses and cups shall be stored inverted. When stacked, a clean rack shall be used between each layer. Other stored utensils shall be covered or inverted, wherever practical. Facilities for the storage of knives, forks, and spoons at self-service locations shall protect these articles from contamination and present the handle of the utensil to the consumer.
5. Single-service articles shall be stored at least 15 cm above the floor in closed cartons or containers, which protect them from contamination and shall not be placed under exposed sewer lines or water lines, except for automatic fire protection sprinkler heads.

6. Single-service articles shall be handled and dispensed in a manner that prevents contamination of surfaces, which may come in contact with food or with the mouth of the user.
7. Single-service knives, forks and spoons packaged in bulk shall be inserted into holders or be wrapped by an employee who has washed his hands immediately prior to storing or wrapping the utensils. Unless single-service knives, forks and spoons are prewrapped or prepackaged, holders shall be provided to protect these items from contamination and present the handle of the utensil to the consumer.

SECTION 7.10 Sanitary Facilities and Controls

A. Water Supply:

1. Enough potable water for the needs of the food service establishment shall be provided from a an approved source
2. Enough water under pressure at the required temperatures shall be provided to all equipment that use water and at approved temperatures at all fixtures.
3. Ice for human consumption shall be made from potable water.

B. Sewage:

1. All sewage, including liquid waste, shall be disposed of by a sewerage system or.
2. Non-water-carried sewage disposal facilities are prohibited, except if permitted by JUST in remote areas or because of special situations.

C. Plumbing:

1. All plumbing shall be sized, installed, and maintained according to Jordanian Building Code.
2. There shall be no cross-connection between the potable water supply and any non-potable water supply nor any source of pollution through which the potable water supply might become contaminated.
3. A non-potable water system is permitted only for purposes such as air-conditioning and/or fire protection The non-potable water shall not contact, directly or indirectly, food, potable water, equipment or surfaces that contact food, or utensils.
4. The piping of any non-potable water system shall be adequately and durably identified, such as by distinctive yellow-colored paint, so that it is readily distinguished from piping which carries potable water. Such piping shall not be connected to equipment or have outlets in the food-preparation area.
5. The potable water system shall be installed to preclude the possibility of backflow.
6. Devices shall be installed to protect against backflow and back siphonage at all fixtures and equipment.
7. A hose shall not be attached to a faucet unless a backflow prevention device is installed.
8. Drain screens shall be made of easily cleaned metallic non-rusting ferrous materials
9. Grease traps, when used, shall be located to be easily accessible for frequent cleaning.

10. Garbage grinders, when used, shall be probably installed and well maintained according to law.
11. Except for properly trapped open sinks, there shall be no direct connection between the sewerage system and any drains originating from equipment in which food, portable equipment, or utensils are placed.

D. Toilet Facilities:

1. Toilet facilities for males and females shall be provided and shall be accessible at all times. When not on the same premises location shall be approved by JUST.
2. Toilets and urinals shall be designed to be easily cleanable.
3. Toilet rooms shall be completely enclosed and shall have tight fitting, self-closing, doors with solid surfaces, which shall be closed except during cleaning or maintenance, except as provided by law.
4. Toilet fixtures and receptacles shall be kept clean and in good repair.
5. A supply of toilet tissue in an appropriate, wall-mounted holder shall be provided at each toilet at all times.
6. Easily cleanable receptacles shall be provided for waste materials. Toilet rooms used by women shall have covered waste receptacle(s).
7. Toilets shall be equipped with self-closing doors
8. Toilets shall not be directly connected to the food production area

E. Lavatory Facilities (washbasins):

1. Lavatories shall be provided in appropriate number and shall be located in food preparation areas, and other areas deemed necessary by JUST, to permit convenient use by all employees.
2. Lavatories shall be accessible to employees at all times.
3. Lavatories shall also be located in or immediately adjacent to toilet rooms or vestibules.
4. Sinks used for food preparation or for washing equipment or utensils shall not be used for hand washing.
5. Each lavatory shall be supplied with warm water by means of a mixing valve, combination faucet.
6. Any self-closing, slow-closing, or metering faucet used shall be designed to provide a flow of water for at least 15 seconds without the need to reactivate the faucet.
7. A supply of hand-cleaning soap or detergent shall be available at each lavatory. A supply of sanitary towels dispensed from an approved dispenser or a hand-drying device providing heated air shall be conveniently located in each lavatory area.
8. Common towels are prohibited. If sanitary towels are used, easily cleanable waste receptacles shall be conveniently located near the hand washing facilities.
9. Lavatories, soap dispensers, hand-drying devices, waste receptacles, and all related equipment shall be kept clean and in good repair.

F. Garbage and Refuse:

1. Garbage and refuse shall be kept in durable, easily cleanable, insect-proof, and rodent-proof containers that do not leak and do not absorb liquids. A sufficient

- number of garbage containers shall be provided and used. Plastic bags or wet-strength paper bags shall be used to line these containers.
2. Containers used in food preparation and utensil-washing areas shall be kept covered after they are used, and emptied and cleaned at least once a day. Each container shall be thoroughly cleaned on the inside and outside in a way that does not contaminate food, equipment, utensils, or food preparation areas. Suitable facilities shall be provided and used for washing containers.
 3. Containers stored outside the establishment including dumpsters, compactors and compactor systems shall be easily cleanable, shall be provided with tight-fitting lids, doors or covers, and shall be kept covered when not in actual use. Soiled containers shall be cleaned at a frequency to minimize insect and rodent attraction. In containers designed with drains, drain plugs or screening shall be in place at all times, except during cleaning.
 4. Liquid waste from compacting or cleaning operations shall be disposed of as sewage.
 5. Garbage and refuse on the premises shall be stored in a manner to make them inaccessible to insects and rodents.
 6. Garbage or refuse storage rooms, if used, shall be constructed of easily cleanable, nonabsorbent, washable materials, shall be kept clean, shall be insect-proof and rodent-proof and shall be large enough to store the garbage and refuse containers that accumulate and shall be adequately ventilated.
 7. Garbage and refuse shall be disposed of often enough to minimize the development of an obnoxious odor and the attraction of insects and rodents.
 8. Garbage or refuse shall not be burned on site.

G. Insect and Rodent Control:

1. Effective measures intended to minimize the presence of rodents, flies, cockroaches, and other insects on the premises shall be utilized. The premises shall be kept in such condition as to prevent the harborage or feeding of insects or rodents.
2. All openings to the outside shall be effectively protected against the entrance of rodents and insects.
3. Outside openings shall be protected by tight-fitting self-closing doors, screening, controlled air currents, or other means.
4. Screen doors shall be self-closing, and screens for windows, doors, skylights, transoms, intake and other openings to the outside shall be tight-fitting and free of breaks.
5. Screening material shall not be less than 6 meshes to the cm.
6. Each insecticide and rodenticides must be approved by JUST for use in food service establishments and shall be used in accordance with label directions.
7. Insect control devices shall be installed in accordance with manufactures instruction
8. .It is prohibited to use pesticides during preparation and serving food.

SECTION 7.11 Constructions and Maintenance of Physical Facilities

A. Floors:

1. Floors and floor coverings of all food preparation, food storage, utensil washing areas, and the floor of all walk-in refrigerating units, dressing rooms, locker rooms, toilet rooms and vestibules shall be constructed of smooth, durable, nonabsorbent, easily cleanable material such as but not limited to quarry tile, terrazzo, ceramic tile, and durable grades of linoleum or plastic, and shall be maintained in good repair.
2. The use of nonabsorbent antislip floor products in areas certain may be permitted for safety reasons. only
3. Floors and floor coverings shall be properly installed, easily cleanable by conventional methods, and maintained in good repair.
4. Carpeting is prohibited in food preparation, equipment-washing and utensil-washing areas, in food storage areas, and in toilet room areas where urinals or toilet fixtures are located.
5. The use of sawdust, wood shavings, peanut hulls, or similar material as a floor covering is prohibited.
6. Properly installed, trapped floor drains shall be provided in floors that are water-flushed for cleaning or that receive discharges of water or other fluid waste from equipment, or in areas where pressure spray methods for cleaning equipment are used.
7. Mats and duckboards shall be of nonabsorbent, grease resistant materials and of such size, design, and construction as to facilitate their being easily cleaned.
8. The junctures between walls and floors shall be covered and sealed in the food preparation, food storage, and utensils-washing rooms and areas, and in walk-in refrigeration facilities, dressing or locker rooms and toilet rooms.
9. Exposed utility service lines and pipes shall be installed in a way that does not obstruct or prevent cleaning of the floor or present a safety hazard.

B. Walls and Ceilings:

1. Walls and ceilings, including doors, windows, skylights, and similar closures, shall be maintained in good repair.
2. The walls, including nonsupporting partitions, wall coverings, and ceilings of walk-in refrigeration facilities, food preparation areas, food storage, equipment-washing and utensil-washing areas, and toilet rooms shall be light colored, smooth, nonabsorbent, and easily cleanable.
3. Studs, joists, and rafters shall not be exposed in walk-in refrigerating units, food preparation areas, equipment-washing and utensil washing areas, toilet rooms and vestibules. If exposed in other rooms, or areas, they shall be finished to provide an easily cleanable surface.
4. Exposed utility service lines and pipes shall be installed in away that does not obstruct or prevent cleaning of the walls and ceilings or present a safety hazard.
5. Light fixtures, vent covers, wall-mounted fans, decorative materials, and similar equipment attached to walls and ceilings shall be easily cleanable and shall be maintained in good repair.

6. Wall and ceiling covering materials shall be attached and sealed so as to be easily cleanable.

C. Cleaning of Physical Facilities

1. Cleaning of floors and walls, except emergency cleaning of floors, shall be done during periods when the least amount of food is exposed, such as after closing or between meals.
2. Floors, mats, duckboards, walls, ceilings, and attached equipment and decorative materials shall be kept clean.
3. Only dustless methods of cleaning, wet cleaning, or the use of dust-arresting sweeping compounds with brooms is acceptable.
4. At least one utility sink or curbed cleaning facility shall be provided and used for cleaning of garbage containers, mops or similar wet floor cleaning tools and for the disposal of mop water or similar liquid waste. Such facilities shall have a floor drain and be supplied with hot and cold running water, under pressure or steam.
5. The use of lavatories, utensil washing or equipment washing, or food preparation sinks for this purpose is prohibited.

D. Lighting:

1. Permanently fixed artificial light sources shall be installed to provide at least 50 foot candles of light on all food preparation surfaces and at equipment or utensil-washing work levels.
2. Permanently fixed artificial light sources shall be installed to provide, at a distance of 30 inches from the floor:
 - a. at least 20 foot candles of light in utensil and equipment storage areas and in lavatory and toilet areas; and
 - b. at least 10 foot candles of light in walk-in refrigerating units, dry food storage areas, and in all other areas. This shall also include dining areas during cleaning operations.

E. Ventilation:

1. All rooms shall have sufficient mechanical ventilation to keep them free of excessive heat, steam, condensation, vapors, obnoxious odors, smoke and fumes. Ventilation systems shall be installed, cleaned, and operated according to law and, when vented to the outside, shall not create an unsightly, harmful or unlawful discharge.
2. Intake and exhaust air ducts shall be designed and maintained to prevent the entrance of dust, dirt, and other contaminating materials.

F. Dressing Rooms and Locker Areas:

1. Enough lockers or other suitable facilities shall be provided and used for the orderly storage of employee clothing and other belongings.
2. Lockers or other suitable facilities shall be located only in the designated dressing rooms or areas containing only sealed packaged food and/or single service articles.
3. If employees routinely change clothes within the establishment, rooms or areas shall be designated and used for that purpose.

G. Poisonous or Toxic Materials:

1. There shall be present in food service establishments only those poisonous or toxic materials necessary for maintaining the establishment, cleaning and sanitizing equipment and utensils, and controlling insects and rodents.
2. Containers of poisonous or toxic materials shall be prominently marked "poison" and distinctly labeled for ingredients according to law for easy identification of contents. The use of food containers for storage of toxic materials is prohibited.
3. Poisonous or toxic materials necessary for the maintenance of the establishment consist of the following two categories:
 - a. insecticides and rodenticides; and
 - b. Detergents, sanitizers, related cleaning or drying agents and caustics, acids, polishes and other chemicals.
4. Each of the previous categories of these requirements shall be stored physically separate from each other and from foods.
5. Personal medication shall not be stored in food storage, preparation or service areas.
6. First-aid supplies, if provided, shall be stored and used in a way that prevents them from contaminating food and food-contact surfaces.

H. Premises:

1. Maintenance and cleaning tools such as brooms, dry and wet mops, vacuum cleaners and similar equipment shall be maintained and stored in a way that does not contaminate food, utensils, equipment, or linens and shall be stored in an orderly manner.
2. Live animals, including birds, shall be excluded from within the food service. This exclusion does not apply to edible fish, crustacea, shellfish or to fish in aquariums.

SECTION 7.12 Special Food Service Operations

A. Mobile Food Units:

1. Mobile food units shall comply with the requirements of the previous general requirements. JUST may impose additional requirements to protect against health hazards related to the conduct of the food service establishment as a mobile operation, may prohibit the sale of some or all potentially hazardous food, and when no health hazard will result,
2. Mobile food units serving only food prepared, prepackaged in individual servings, transported and stored under conditions meeting the requirements of the previous general requirements, or beverages that are not potentially hazardous and are dispensed from covered urns or other protected equipment, need not comply with requirements of the previous general requirements pertaining to the necessity of water and sewage systems nor to those requirements pertaining to the cleaning and sanitization if the required equipment for cleaning and sanitization exists at the commissary or other approved base of operation.

3. JUST may waive requirements relating to temperature control and sanitization requirements when a unit operates on the premises and as an extension of a fixed, permitted food service establishment.
4. Mobile food units shall provide only individually wrapped single-service articles for use by the consumer.
5. A mobile food unit requiring a water system shall have a potable water system under pressure. The system shall be of sufficient capacity to furnish enough hot and cold water for food preparation, utensil cleaning and sanitizing, and handwashing in accordance with the requirements of this regulation. The water inlet shall be located so that it will not be contaminated by waste discharge, road dust, oil, or grease, and it shall be kept capped unless being filled. The water inlet shall be provided with a connector of a size or type that will prevent its use for any other service. All water distribution pipes or tubing shall be constructed and installed in accordance with the requirements of the previous general requirements.
6. (f) If liquid waste results from the operation of a mobile food unit, the waste shall be stored on the unit in a permanently installed retention tank that is of at least 15 percent larger capacity than the water supply tank.
7. Mobile food units shall operate from a commissary or other fixed food service establishment and shall report at least daily to such location for all supplies and for all cleaning and servicing operations.
8. Fixed food service establishment used as a base of operation for mobile food units shall be constructed and operated in compliance with the requirements of the previous general requirements.
9. When not in use units shall be properly stored at the commissary or base of operation. Units serving only food prepared, prepackaged in individual serving and beverages that are not potentially hazardous and are dispensed from covered urns or other approved methods.
10. A mobile food unit servicing area shall be available and shall include at least overhead protection for any supplying, cleaning, or servicing operation.
11. There shall be a location and equipment for the flushing and drainage of liquid wastes separate from the location and equipment provided for water servicing and for the loading and unloading of food and related supplies.
12. The servicing area will not be required where only packaged food is placed on the mobile food unit or where mobile food units do not contain waste retention tanks.
13. The surface of the servicing area shall be constructed of a smooth, nonabsorbent material, such as concrete or machine-laid and sealed asphalt and shall be maintained in good repair, kept clean, and be graded to drain.
14. Potable water servicing equipment shall be installed according to law and shall be stored and handled in a way that protects the water and equipment from contamination.
15. The mobile food unit liquid waste retention tank, where used, shall be thoroughly flushed and drained during the servicing operation. All liquid waste shall be discharged to a sanitary sewerage disposal system
16. All mobile food units shall be identified by a sign or lettering indicating the name and address of the owner, the operator and the license number.

B. Temporary Food Service Operations:

1. A temporary food service operation means any food service establishment which operates at the same location for a temporary period of time, not to exceed 14 consecutive days in conjunction with a graduation ceremony, fair, carnival, circus, public exhibition, or similar transitory gathering.
2. A temporary food service operation may be permitted to operate when food preparation and service are restricted
3. Temporary Food Service Operations shall meet the stated health requirements for restaurants
4. JUST may impose additional requirements to protect against health hazards related to the conduct of the temporary food service operation.
5. Those potentially hazardous foods requiring limited preparation only, such as seasoning and cooking, may be prepared and served.
6. The preparation of other potentially hazardous foods, including pastries filled with cream or synthetic cream, custards, and similar products, and salads containing meat, poultry, eggs or fish is prohibited.
7. Any potentially hazardous food that has been prepared, stored and transported under conditions meeting the requirements of the previous general requirements, is stored at a temperature of 7°C (45°F) or below or at a temperature of 60° C (140°F) or above in facilities meeting the requirements of the previous general requirements may be served.
8. Ice that is consumed or that contacts food shall be made under conditions meeting the requirements of the previous general requirements.
9. The ice shall be obtained only in chipped, crushed, or cubed form and in single-use safe plastic or wet strength paper bags filled and sealed at the point of manufacture.
10. The ice shall be held in these bags until it is dispensed in a way that protects it from contamination.
11. Equipment shall be located and installed in a way that prevents food contamination and that also facilitates cleaning the establishment.
12. Food-contact surfaces of equipment shall be protected from contamination by consumers and other contaminating agents. Effective shields for such equipment shall be provided, as necessary, to prevent contamination.
13. Temporary food service operations shall provide only individually wrapped single-service articles for use by the consumer.
14. Facilities for cleaning and sanitizing utensils and equipment shall be provided at the temporary site or permitted base of operation. Such items shall be cleaned and sanitized at least daily or more often if prescribed by JUST.
15. When food is prepared on the site, a system capable of producing enough hot water for cleaning and sanitizing utensils and equipment shall be provided on the premises.
16. Storage of packaged food in contact with water or undrained ice is prohibited. Wrapped sandwiches shall not be stored in direct contact with ice.
17. All sewage including liquid waste shall be disposed of according to law.

18. A convenient handwashing facility shall be available for employee handwashing. This facility shall consist of, at least, warm running water, soap, and individual paper towels.
19. Floors within food preparation and display areas shall be constructed of concrete, asphalt, tight wood, or other similar materials kept in good repair and clean.
20. Doors to food preparation areas shall be solid or screened and shall be self-closing.
21. Screen material used for walls, doors, or windows shall be at least 6 mesh in the cm.
22. Counter-service openings shall not be larger than necessary for the particular operation conducted. These openings shall be provided with tight-fitting solid or screened doors or windows to restrict the entrance of flying insects. Counter-service openings shall be kept closed, except when in actual use.
23. All food preparation and food display areas shall be adequately protected from dust, contamination by patrons, and from insects by provision of walls, ceilings, shields, screens or other approved barriers or devices.
24. Open, unprotected display or service of food is prohibited.

CHAPTER 8 RODENT CONTROL

SECTION 8.1 Introduction

Rats are one of the most destructive creatures known to man in terms of the economic losses they cause, destruction of property and in their effects on human health.

Losses caused by rats can be divided into three categories:

1. Losses to food stuffs consumption and contamination
2. Damage caused by gnawing and tunneling
3. Disease transmission

The purpose of these requirements is to prevent the spread of infectious diseases by rats, mice, and other rodents (hereinafter referred to as “rodents”).

SECTION 8.2 Rat life history

1. The rat is a shy, secretive and primarily nocturnal animal. It seeks shelter not so much to keep warm but to hide from enemies including other rats.
2. A rat shelter can be almost any object rats can crawl under including planks, plywood, buildings or structures resting on the ground.
3. Once secure, rats will quickly seek food. The diet of a rat is remarkable; it can survive on a wide range of food items from domestic garbage, rotten meat and fish, stale grain, green feed and straw to fresh fruits and vegetables, packaged foods, sugar and candies.
4. Following about a three-week gestation period, 12 to 18 rats are born to a female rat that can be as young as eight weeks of age.
5. A rat can produce up to 12 litters per year. Male rats are sexually mature at approximately 90 days of age.
6. Rats may live up to 18 months in the wild.
7. It has been estimated that, under ideal conditions, a single pair of rats could produce 15,000 offspring in one year.

SECTION 8.3 Recognizing rat presence

A. Burrows and runways

1. The cylindrical burrow entrance of a rat in soil or in straw or hay bales measures about five to seven and a half centimeters.
2. The burrow entrance of a rat is clean of debris and excavated soil particles.
3. Rats leave well beaten trails about five centimeters wide from their nest areas to food and water sources.
4. Rats often dig lengthy travel runs under objects such as bales, planks, granaries, ply board (even idle machinery) to move from area to area.

B. Wall and floor holes

1. The average size of the circular shaped rat hole in walls and floors is five to seven and a half centimeters in diameter, but can be considerably larger, depending upon the material.

2. Rats will make holes in walls or floors soon after invasion; wall holes are usually just few centimeters above the floor.
3. Holes in floors are generally close to walls or under supporting skids or poles.

C. Gnawing

1. Rats must chew continuously to wear down front teeth that grow five to 10 cm year.
2. Most often rats will chew materials close by such as plywood, structural woodwork, plastic paneling, ground and even concrete.

D. Droppings

1. Rats produce up to 25,000 droppings per year, so they can usually be detected if they have been present for even a short time.
2. Rat droppings are blunt at both ends and the shape and size of an olive pit, measuring one and a quarter to one and a half centimeters, and shiny black in color.
3. Droppings fade in time and soon turn to gray-white.

E. Nests and caches

1. Rats are ground dwellers, so their nests and caches are built on or below ground level.
2. The nest of a rat can consist of almost any material, usually food remains and other available items such as paper, straw, cardboard, rags or shredded plastic bags.
3. Rats may horde and cache food, which may or may not be eaten.

F. Odors and smudges

The distinctive, musky odor of rats can be easily detected, particularly if rats are confined to a small area.

The oily hair of a rat leaves noticeable smudge marks on trails or hole entrances.

The combination of oily hair and dust and dirt results in obvious dark stained surfaces.

SECTION 8.4 Rodent Controls

A. General Requirements

1. All buildings, docks, storerooms, warehouses, grain elevators, slaughterhouses, and residences within JUST Campus shall be maintained in a clean and sanitary condition and rendered free from rodents.
2. It is unlawful for any person to keep, store, or expose for sale any food products or other goods, wares, or merchandise; or to occupy or maintain any building or premises; or to reside in any residence without complying with the provisions of these requirements. It shall be the duty of the owner, or occupant thereof to take such preventive and remedial rodent proofing measures as shall be prescribed by EHSS.
3. It is not permitted for any person to maintain any building, lot, premises, vehicle or any place in such an unsanitary condition as to permit the breeding or harboring therein or thereon of flies, rats, bedbugs, cockroaches, lice, fleas or any vermin. It

- is unlawful for any person to permit an accumulation of rubbish material that may serve as a harborage for rats unless such material be elevated not less than 45 cm above the ground with a clear intervening space there under
4. No person shall use any building or structure or portion thereof for the storage, handling, preparation or sale of any grain products, which, in the opinion of the JUST, is or is likely to become infested with rats unless such building or structure or portion thereof be rat proofed

B. Prevention of rat infestation:

1. Rat infestations can be prevented by any of the three methods: food source removal; rat shelter removal; rat proofing
2. Food source removal
 - a. Because rats are capable of eating almost anything, it is important to remove all possible food items such as garbage, empty food containers, spilled grain or feed.
 - b. All food products or other goods, whether kept for sale or for any other purpose, shall be so protected as to prevent rodents from gaining access thereto or coming in contact therewith.
 - c. Food service establishments shall comply with the rodent control requirements of JUST.
 - d. It is unlawful for any person to keep, store or expose for sale any food products or other goods, or to occupy or maintain any building, storeroom or warehouse or to reside in any residence without complying with the provisions of these requirements.

C. Elimination of Rat Harborage:

1. Rodent harborage includes, but is not limited to, rubbish, grass, weeds, and any other vegetation providing harborage.
2. Rats can and will make any object their temporary or permanent home so long as they can crawl underneath. Until a rat can seek out permanent cover, it will use any flat object lying on the ground including tires, planks, square bales, etc.
3. When evidence is found of rodent activity, the JUST may order the cutting and removal of any thing that provides rodent harborage. This requirement is in addition to any preventive and remedial rodent-proofing measures required
4. All basements and walls of all buildings within Aqaba Municipality shall be so constructed or repaired by the use of screens, nettings, cement or other material or materials approved by JUST as to prevent rodents from gaining entrance to or harboring beneath the same.
5. It is further unlawful to store in a building that is open to the weather any materials or objects in which rodents may find breeding and nesting space

D. Rat proofing

1. No person shall use any building or structure or portion thereof for a slaughterhouse, packing house or bakery, or for the manufacture, preparation, storage, handling or display of any food or food product for human or animal

- consumption which, in the opinion of the JUST, is or is likely to become infested with rats unless such building or structure or portion thereof be rat proofed
2. When determined by the JUST, or his duly authorized representative, that any building or structure constitutes a rat harborage, he may serve upon the person in charge or control thereof a notice in writing to rat proof so much of such building or structure as he deems necessary, within the time stated in such notice.
 3. By elevating outbuildings, protecting doorways and windows, utility connections and other openings to warehouses and industrial structures, rats can be successfully turned away from potential shelter.

E Rat traps-

1. All buildings, storerooms, warehouses and residences shall be provided by the occupant with such number of rat traps of a pattern approved by JUST.
2. Traps shall be freshly baited at such intervals as may be ordered by JUST and shall be inspected by the owner, or occupant daily and any rat or rats caught shall be removed.

F. Rat Poisoning

1. Poisons.

- a. Poisons, suitable for the extermination of rats, will be placed at or in buildings, storerooms, warehouses and residences when the director of health shall determine that a need exists for the placing of such poisons.
- b. It shall be the duty of each owner, lessee or occupant of such building, storeroom, warehouse or residence to comply with all orders and directives of the director of health regarding the placing of poisons and the type to be used.

2. Use of poisons

- a. The most common and most effective rat bait used today is anti-coagulant bait that causes death in one to three days by painless internal bleeding.
- b. Pre-mixed Warfarin rat bait in rolled oats or in concentrated form for water baiting are the most suitable rat baits. They are also one of the safest rat baits in use today.
- c. Warfarin rat bait may require several feedings to produce death.
- d. Newer rat baits such as bromodialone and brodifacoum require only a single feeding to kill rats but are less safe to non-targets, such as pets and livestock, than Warfarin.
- e. For safety reasons, Warfarin rat bait should be used near occupied buildings.
- f. Rats can obtain daily moisture requirements from solid foods such as grain, green feed and even packed and covered garbage.

3. Baiting strategies

- a. Use appropriate baits (Warfarin rolled oats) where moisture or water is available and water bait (Warfarin water soluble bait) in dry conditions.
- b. Always use dry bait.
- c. Proper placement of rat bait will ensure maximum results.
- d. Place bait where only rats will find it.
- e. Place bait in all potential rat habitat.
- f. Keep fresh bait out at all times.

- g. Set bait in obvious rat habitat such as bale stacks, under granaries, barns, shelters, silage pits, abandoned buildings, nuisance grounds and garbage facilities.

4. First Aid

- a. First aid and antidote treatment appear on all rat bait containers Manufacturer's instructions on containers should be read before the use of the bate and should be followed laterally.

CHAPTER 9 NUISANCE ABATEMENT

Purposes

The purpose is to protect the inhabitants of JUST Campus against all forms of nuisances, public or private, not specifically prohibited by Jordanian or JUST laws and regulations, resulting out of any action, activity, condition, circumstances or situation permitted to exist within the Campus and caused or produced by any person, reptile or insect, or by any mechanical or other contrivance, and which is injurious to health, or detrimental to the public safety, morals or general welfare, or is indecent, or offensive to the senses or an obstructive to the free use of property to such an extent as to interfere with the comfortable enjoyment or life or property by the entire community or neighborhood, or by any considerable number of persons.

Nuisances

The following are expressly declared to be nuisances, and any person maintaining or permitting such nuisances or any of them to be maintained or to exist on his premises whether as owner or otherwise, shall be guilty of a misdemeanor punishable as hereinafter provided and each and every day in which the nuisance shall be permitted to be continued shall constitute a separate offense:

A. Nuisances affecting public safety:

Keeping or maintaining animals or bees or other insects within the Campus, unless a permit has been obtained from the Campus council, on application regularly filed, setting forth the location and manner in which such reptiles or insects are to be kept.

B. Nuisances affecting health:

Foodstuffs or Materials Dangerous to Public Health such as: the keeping or maintaining of decayed or unwholesome food, sold or offered for sale to the public;

The accumulations of manure, rubbish or debris or animal or vegetable matter of any kind or character from which foul odors emanate or which provide or are likely to provide a breeding place for vermin, insects or rodents of any kind;

The pollution of any well, cistern, creek or other body of water, by sewage, industrial wastes or other substances, which are or may reasonably be expected to become detrimental to the public health,

The keeping or maintaining or permitting to be kept or accumulated on any private property, ponds or pools of stagnant or waste water, oil or industrial wastes,

Permitting or allowing of noxious weeds and other rank growth or vegetation on private property;

The production of dense smoke, noxious fumes, gas, soot, cinders or smog by any commercial manufacturing or industrial or other organizations, through furnaces or other facilities utilized by such industrial or manufacturing plant or other operation, when such smoke, noxious fumes, gas, soot, cinders or smog are in such quantities as are in excess of the amount necessary in the reasonable operation of such plants,

The production by any person or persons through any means, of dense smoke, noxious fumes, gas, soot, cinders, smog or other obnoxious substances which are or may

reasonably be expected to become detrimental to the public health or which unnecessarily interfere with the health, comfort or safety of any person.

C. Unhealthy Occupancy or Use.

- The use of any premises, commercial or residential, in such numbers or manner as to constitute an unhealthy environment.
- Actions damaging the use or enjoyment of property.
- Harboring or permitting any premises or permitting individuals or groups using or visiting such premises in a manner which adversely affects the use or enjoyment of surrounding properties or uses thereof.

D. Maintaining Premises Detrimental to Property of Others.

Include the following:

- Lumber, junk, trash, debris or an accumulation of substantial quantities of loose earth, rocks or pieces of concrete;
- Abandoned, discarded, unused or deteriorating materials, objects or equipment, such as furniture, bedding, machinery, packing boxes, cans or containers;
- Stagnant water, untilled excavations, any earth or sand which has eroded and sloughs onto an adjoining sidewalk or street;
- Any fence, structure or vegetation which is unsightly by reason of its condition or its inappropriate location;
- Abandoned, wrecked, dismantled or inoperative vehicles, or parts thereof, including automobiles, trucks, motorcycles, bicycles, boats, trailers or similar vehicles; or
- Barbed-wire fences or limbs of trees, shrubs, hedges or vegetable growth so situated or located as to endanger persons traversing streets or sidewalks in the immediate area thereof.

E. Acts or Behavior

- It shall be deemed a public nuisance for any person to urinate or evacuate his bowels on private property in an area exposed to the public view, or on any public street, sidewalk, alley, park or other public place except in a public restroom

F. Permits

Wherever a permit is required for the doing of any of the acts or things enumerated as nuisances, a written application should be filed, giving sufficient information concerning the subject matter thereof so as to permit JUST Campus official to obtain a clear understanding of applicant's proposal, with such details as may be necessary to determine whether there is a clear and present danger of the thing, act or operation covered by the application adversely or detrimentally affecting the public health, morals, safety or general welfare or of unduly hindering the normal flow of pedestrian or vehicular traffic or unduly or unnecessarily disturbing the peace, quiet or comfort of the community or of unduly or unnecessarily interfering with the normal conduct, operation or trade, of businesses or industrial establishments, and if in his opinion, such clear and present danger does appear, then such application shall be denied.

Nuisance Abatement Program

The Nuisance Abatement Program shall be developed by JUST EHS Office to ensure that any person owning, renting, occupying, and having charge of, or possession of any premises within JUST Campus, that it is maintained in such a manner so that it does not create a public nuisance and/or fire hazard affecting the health, safety and welfare of all citizens and visitors.

HAPTER 10 PUBLIC HEALTH

A. Housing Requirements

Purpose

1. The primary objective of these requirements is to protect and promote the health and well being of house occupants (whether owners or renters) and of those who may reside in the immediate vicinity of such premises.
2. Housing requirements are distinct and separate from building and construction codes. However, these differences are often not well understood and many people may use “housing” and “building” interchangeably. The primary intent of these requirements is to establish minimum conditions which are essential to good health and which make housing premises safe, sanitary and fit for human habitation.
3. The housing requirements govern the conditions and maintenance, the supplied utilities, and the use and occupancy of housing. In contrast, the principal purpose of a building code is to regulate the construction of buildings by setting minimum regulations for public health, fire safety and structure sufficiency.
4. Housing requirements are also different from building and other construction codes in that the latter are enforced primarily through a system of permits, which are granted after plans and specifications have been submitted and evaluated and at which time the construction would be subject to inspection.

Definitions

Dwelling

Means a unit that consists of 1 or more rooms; is used or intended to be used for accommodations purposes; and may contain cooking, eating, living, sleeping and sanitary facilities, including but not limited to; a kitchen sink, wash basin, bathtub or shower and a toilet; and may be individual or shared.

Habitable room

Means a room that is intended to be used for sleeping, living, cooking or eating purposes but does not include a lobby, hallway, closet, toilet room, bathroom, corridor, and laundry or storage space.

Potable water

Means water that is safe for human consumption.

Smoke Alarm

Means a combined smoke detector and audible alarm device designed to sound an alarm within the room or suite in which it is located upon the detection of smoke within that room or suite.

The requirements Housing Premises

The housing premises must be structurally sound and must be maintained in a waterproof, windproof and weatherproof condition.

Equipment and Furnishings

Occupants of a housing premises must be supplied with adequate heat, potable water; sanitary facilities, cooking facilities and adequate space for sleeping.

Sanitation

All rooms including other areas used in common by the occupants of housing premises must be maintained in a clean and sanitary condition.

Good repair, safe condition and structurally sound.

- (a) The housing premises shall be structurally sound.
- (b) Basements, cellars or crawl spaces shall be structurally sound, maintained in good repair and free from water infiltration and accumulation.
- (c) Building materials that have been damaged or show evidence of rot or other deterioration shall be repaired or replaced.

Windproof, waterproof, weatherproof condition

- (a) Roof and exterior cladding, The roof and exterior cladding of walls shall be maintained in a waterproof, windproof and weatherproof condition.
- (b) Windows and exterior doors
 - (i) All windows and exterior doors shall be; maintained in good repair, free of cracks and weatherproof.
 - (ii) In housing premises intended for use during the summer months, windows in habitable rooms shall protect against hot weather through the provision of a durable thermal/air resistant barrier
 - (iii) During the portion of the year when there is a need for protection against flies and other flying insects, every window or other device intended for ventilation shall be supplied with effective screens.

Safe and Secure

- (a) Locking Window and Door Hardware
 - 1. Exterior windows and doors shall be capable of being secured.
- (b) Emergency Egress
 - 1. For buildings of 3 stories or less and except where a bedroom door provides access directly to the exterior or the suite is sprinklered, each bedroom shall have at least one outside window which may be opened from the inside without the use of tools or special knowledge.
 - (i) Windows referred to above shall provide unobstructed openings with areas not less than 0.35 m^2 , with no dimension less than 38 cm
 - (ii) If the window referred above is provided with security bars, the security bars shall be installed so they may be opened from the inside without the use of any tools or special knowledge.
- (c) Handrails

1. Inside or outside stairs or porches including all treads, risers, supporting structural members, rails, guards and balconies, shall be maintained in good repair and shall comply with the requirements of the Jordanian Building Code.

Ventilation

All rooms used for sleeping shall be provided with:

- (a) Openable window area at least 0.05% of floor area of each room
- (b) Mechanical ventilation in conformance with the requirements of the Jordanian Building Code.

Finishes

- a. All walls, windows, ceilings, floors, and floor coverings shall be maintained in good repair, free of cracks, holes, and loose or lifting coverings and in a condition that renders it easy to clean.
- b. Rooms containing a flush toilet and/or a bathtub or shower shall have walls and floors that are smooth, non-absorbent to moisture and easy to clean.
- c. All walls shall form a watertight joint with each other, the floor, the ceiling and where applicable with the bathtub or shower.
- d. Rooms and sections of rooms that are used for food preparation and cooking shall have walls and floors constructed of materials which do not provide harborage to dirt, grease, vermin and bacteria and that are easily kept clean.

Equipment and Furnishing

- a. Occupants of housing premises shall be supplied with adequate; sanitary facilities, heat, potable water, utilities and space for sleeping;

Plumbing and Drainage System

Every housing premises shall be connected to the sewage system, or to an approved private sewage disposal system.

- (a) The plumbing system and the sanitary drainage system or private sewage disposal system, as the case may be, including drains, fixtures, traps, vents, stacks, waste disposal facilities, pump out sewage holding tanks, septic tanks and the disposal system shall be maintained in a proper operating condition.
- (b) Adequate water volume and pressure shall be provided to ensure the proper operation and flushing of all fixtures.
- (c) All plumbing fixtures shall be serviceable, free from leaks, trapped and vented to the outside.

Washroom Facilities

Except where exempt by regulation,

Every housing premises shall be provided with plumbing fixtures of an approved type consisting of at least a flush toilet, a wash basin, and a bathtub or shower.

- (a) The washbasins and bathtub or shower shall be supplied with potable hot and cold running water.

- (b) The washbasin should be in the same room as the flush toilet or in close proximity to the door leading directly into the room containing the flush toilet.
- (c) All rooms containing a flush toilet and/or bathtub or shower shall be provided with natural or mechanical ventilation.

Shared Washrooms

- (d) Occupants of housing premises with more than one dwelling unit may share a flush toilet, wash basin and bathtub or shower provided that:
 - (i) The occupants have access to the washroom facility without going through another dwelling or outside of the building; and
 - (ii) The facility is located on the same floor as, or on the next storey up or down from the floor on which the suite is located; and
 - (iii) Each group of plumbing fixtures (toilet, washbasin, bathtub or shower) shall not serve more than eight persons.

Cooling and Heating Facilities

- (a) All cooling and heating facilities within a housing premises are to be properly installed and maintained in good working condition, and be *capable* of safely and adequately cooling or heating all habitable rooms, bathrooms, and toilet rooms within the building to a temperature of ;
 - (i) At least 22⁰C or
 - (ii) Maintained at a temperature of at least 22⁰C when the control of the supplied heat in a dwelling is the responsibility of a person other than the occupant.
- (b) Cooking appliances and portable space heaters shall not be used as the primary source for the required heat to a habitable room.
- (c) Every owner of housing premises shall ensure a continuous supply of electricity, water and heat unless the rental agreement stipulates that such utility services are the sole responsibility of the occupant.

Water Supply

Every building used in whole or in part, as housing premises shall be supplied with a potable water supply of sufficient volume, pressure and temperature to serve the needs of the inhabitants.

- (a) All hot running water shall be maintained at a temperature of not less than 46 degrees C (114⁰F), and not more than 60 degrees C (140⁰F) measured at the plumbing fixture.

Space for Sleeping purposes (overcrowding)

The owner of housing premises shall not permit it to become or remain overcrowded.

- (a) A housing premises shall be deemed to be overcrowded if:
 - (i) a bedroom in it has less than 3m² (32ft²) of total floor area and 5.6m³ (197ft³) of air space for each adult sleeping in the bedroom,
 - (ii) in the case of a dormitory, the sleeping area in the dormitory has less than 4.6m² (49.5ft²) of floor space and 8.5 m³ (300ft³) of air space for each adult sleeping in the sleeping area, or

- (iii) a habitable room in it that is not a bedroom but is used for sleeping purposes in combination with any other use has less than 9.5m² (102ft²) of floor space and 21.4m³ (756ft³) of air space for each adult sleeping in the habitable room.
- (b) For the purposes of calculating this section, a person who is more than 1 year of age but not more than 10 years of age shall be considered as a 1/2(one half) adult and a person who is more than 10 years of age shall be considered as 1 adult;
- (c) This section does not apply to a hotel/motel.

Electrical Service

Every housing premise shall be supplied with electrical service. Outlets, switches and fixtures shall be properly installed and shall be maintained in a good and safe working condition.

Smoke Alarms (optional)

Smoke alarms within dwellings shall be installed between each sleeping area and the remainder of the suite and, where hallways serve the sleeping areas; the smoke alarms shall be installed within the hallway.

- (a) Smoke alarms shall be operational and in good repair at all times.

Lighting

Every public hallway and stairway in a housing premises with multiple dwellings shall be adequately lighted by natural or artificial light at all times, providing in all parts thereof at least 5.0 foot-candle at each tread or floor level.

Food Preparation Facilities

- (a) Every housing premise shall be provided with a food preparation area, which includes:
 - (i) a kitchen sink that is supplied with potable hot and cold water and suitably sized to allow preparation of food, washing utensils and any other cleaning operation;
 - (ii) Cupboards or other facilities suitable for the storage of food;
 - (iii) A counter or table used for food preparation which shall be of sound construction and furnished with surfaces that are easily cleaned; and
 - (iv) a stove and a refrigerator that are maintained in a safe and proper operating condition. The refrigerator shall be capable of maintaining a temperature of 4 degrees C. (40⁰F).
- (b) Shared Kitchen Facilities
 - Occupants of housing premises with more than one dwelling may share food preparation facilities provided that:
 - (i) The food preparation facilities are located in a common kitchen room,
 - (ii) The occupants have access to the common kitchen room from a public corridor without going outside the building,
 - (iii) The common kitchen room is located on the same floor as, or on the next storey up or down from the floor on which the dwelling unit is located,
 - (iv) The food preparation facilities shall not serve more than eight persons, and

- (v) The refrigerator shall provide a minimum volume of two cubic feet of storage for each intended occupant.
- (c) This section does not apply to a hotel/motel, or other housing premises where meals are provided.
- (d) The owner shall be responsible for the provision and operating condition of the cooking and refrigeration equipment supplied by the owner, unless the rental agreement stipulates that the tenant is responsible.

Garbage and Refuse

Every housing premise shall have an adequate number of containers suitable for the sanitary storage of garbage and refuse awaiting final disposal.

Sanitation

1. The owner shall ensure that all rooms and other areas used in common by the occupants of the individual dwellings are maintained in a clean and sanitary condition.
 - (a) The owner shall ensure that the housing premises are free of insect and rodent infestations; and
 - (i) All situations requiring the application of pesticides shall be conducted in accordance with JUST Environment Protection Requirements
 - (ii) whenever a pesticide is applied in a dwelling, the occupant shall be notified
 - (iii) It is the occupants' responsibility to allow access to EHS Office personnel to do whatever is necessary to ensure the dwelling unit is ready for pesticide safe application.
2. Every tenant shall allow access for repairs or pes

CHAPTER 11 RESPONSIBILITIES

Environment and Safety is the concern of all employees and certain groups within the University Community have specific responsibilities.

SECTION 11.1 Higher Committee for Safety and Civil Defense

1. The Committee is responsible both for making recommendations on policy and for taking action with respect to:
 - All occupational health and safety matters;
 - The promotion of a safe and healthy work and study environment for all University staff and students;
 - Approves the formation of designated work;
 - Encourages the election of health and safety representatives;
 - The reduction of accidental injury;
 - The University's rehabilitation programs.
 - Environmental Health and safety Regulations
 - Implementation of Environmental Health and safety Standards
2. The Committee acts on behalf of the Deans Council, subject always to its direction to implement the policies of Council in the context of the University's statutory responsibilities in the area of health and safety, including the organization of health and safety committees in the University.
3. The Committee formulates reviews and disseminates, as approved by the Deans Council, standards, rules and procedures relating to health and safety generally in the University, or with respect to specific areas of the University.
4. The Committee received reports from University Officers with specific environmental health and safety responsibilities, from Departmental health and safety committees, and from any specialist sub-committees of the Committee.
6. The Committee may appoint such specialist sub-committees as it may from time to time to determine to perform specific tasks on behalf of the Committee, the membership of which includes at least one member of the Committee.
7. The Committee must meet at least quarterly.

SECTION 11.2 Environmental Health and Safety Section11

The Environmental Health and Safety Section (EHSS) is responsible for advising on all aspects of health and safety in the University (including the administration of the University Rescue team). In particular the duties will include:

- The co-ordination and reviewing of University Health and Safety management systems
- Facilitating the implementation of the University Health and Safety plan
- To provide an annual report on Health and Safety for University President or Board of Trustees
- To monitor and administer actions arising from the Health and Safety Committee

- To ensure the provision of health services as required in liaison with the Director of Personnel and the Occupational Health provider
- To advise the University on Health & Safety legislation
- To liaise with external authorities in relation to matters of Health and Safety
- To be responsible for induction safety training and, where appropriate, arranging specialist safety training courses.
- regulatory compliance activities,
- management systems and equipment audits,
- radiation, biohazard and chemical hygiene programs,
- hazardous waste management programs,
- some employee and student health and safety training,
- health and safety information and standards research,
- special incident investigations and reporting,
- workers' compensation programs,
- liaisons with regulatory authorities and safety associations, and
- Promotion of safety culture at the University.
- EHSS personnel shall report to the Vice-President through the Director of , Finance and Administration and to the Vice-President, Human Resources, and shall have "stop-work" authority as warranted for regulatory compliance or due diligence

SECTION 11.3 Director of Environmental Health and Safety Section

- Serves as a liaison between the university and the Tennessee Department of Labor and Workforce Development and other regulatory agencies.
- Supports each university location in the implementation of its various safety and health programs.
- Provides the president and the president's staff of JUST system with current information on safety and health activities.
- Develops and recommends university policy and practice relating to safety and health matters.
- Ensures the annual safety review of each university location in accordance with the university's safety and health plan.
- Develops and maintains information on safety and health as an educational resource for the university

SECTION 11.4 Safety Engineer

- Prepare a site-specific Safety and Health Plan and publish Site Safety Plan summary as required.
- Identify and cause correction of occupational safety and health hazards.
- Continuously monitor workers for exposure to safety or health hazardous conditions.
- Alter, suspend, evacuate or terminate activities that may pose immanent safety or health danger to the workers.

- Take appropriate action to mitigate or eliminate unsafe condition, operation, or hazard.
- Provide training and safety and health information.
- Perform assessment of engineering controls and PPE.
- Comply with all Jordanian Occupational Health and Safety Standards.
- Document both safe and unsafe acts, corrective actions taken on the scene , accidents or injuries, and ways to improve safety on future incidents.
- Participate in planning meetings.
- Identify hazardous situations associated with the incident.
- Prepare, implement and review the Incident Action Plan (IAP) for safety implications.
- Exercise emergency authority to stop and prevent unsafe acts.
- Investigate accidents that have occurred within the incident area.
- Assign assistants, as needed.
- Review and approve the medical plan.

SECTION 11.5 Occupational Health Officer

Occupational Health Services (OHS) is responsible for the development and implementation of occupational health programs including:

- physical demands analyses and workplace assessments,
- medical assessments and surveillance programs,
- wellness programs,
- employee assistance programs,
- occupational health counseling,
- management of short and long term disabilities and return-to-work/modified work programs, and
- Promotion of occupational health and wellness at the University.

Environmental health and Safety responsibilities of individuals and departments within JUST system are noted below:

Environmental Health Officers

The safety officer for each major location of the University system has the following responsibilities:

- Conducts annual and as needed environmental health inspections of all university facilities at his or her location and area of responsibility in regard to compliance with applicable regulations; documents findings; and provides recommendations for abatement and correction to the appropriate person(s); follows-up on the abatement of all cited items and reports the results to the appropriate university officials.
- Performs or initiates an investigation and analysis of each serious accident involving loss (bodily injury, significant property damage or environmental damage) on university property or property leased by the university. Results of the

investigation and any recommendations shall be communicated to the appropriate individual(s). Records shall be maintained on all reported losses.

- Serves as an informational resource to the university community in regard to items such as technical support, education, information, and personal protective equipment.
- Recommends changes in existing policy or procedures to improve safety, health, and environmental protection.
- Establishes a process for the review and investigation of concerns regarding safety and health issues.
- Reviews and updates annually the safety and health manual as needed which provides general rules, policies and procedures for safety and health to be followed by employees in the safe performance of their work.
- Facilitates compliance with local, state, and federal regulations related to safety, health and environmental protection. This function shall include, but is not limited to, serving as the university's representative during regulatory inspections, reporting any findings/penalties to the appropriate administrator (including the university director), maintaining documentation and assisting with remediation.
- Prepares an annual report of safety and health activities at that location for the past fiscal year for review, provides information to the chief administrative officer of the location and forwards it to the university safety director.

SECTION 11.6 Deans and Heads of departments

Each faculty dean and department head is responsible for the maintenance of a safe and healthful environment within his or her area of responsibility to include the following:

- Provides support and enforcement for the policies and procedures contained in the safety and health manual, university policies, and any other applicable safety and health rules and regulations.
- Makes certain that all supervisors and employees within their area of responsibility are aware of the safety and health rules and regulations.
- Provides the resources needed to train employees in all aspects of their jobs relative to safety and health.
- Establishes and implements any needed operational procedures for safety and health.
- Maintain compliance with all environment, health and safety policies and procedures by regular performance review
- Ensure adherence to legislation and University policies
- Conduct regular inspections to identify risks/aspects, implement corrective action and arrange monitoring where required
- Ensure that all staff, including contractors under local control, are appropriately inducted
- Provide relevant EHS information and ensure appropriate training;
- Identify health monitoring needs, in consultation with the Occupational Physician
- Maintain appropriate records as required by the University's Records Services department

- Ensure consultative structures and staff participation by conducting regular section meetings to discuss EHS issues
- Investigate all reported incidents and report to department head all action taken to prevent a similar occurrence.
- Integrate risk management into all planning processes and activities using documented risk assessments as the basis for action
- Identify and provide resources required to develop and maintain EHS systems
- Review EHS data and evaluate EHS programs
- Ensure all reported incidents are fully investigated and preventative measures fully implemented
- Ensure effective emergency procedures are in place and practiced regularly
- Ensure all EHS responsibilities are clearly defined and allocated in position descriptions or duty statements
- In association with appropriate personnel and the Risk management Office, to formulate and promulgate specific EHS rules for activities conducted within areas under their control
- Report to the vice president any member of staff, student, contractor working in their area who by refusal or neglect, fails to observe safety rules.

In addition, ACADEMIC STAFF are responsible for ensuring that an equivalent standard of environment, health and safety is afforded to their students as is afforded to University staff generally. Academic staff are deemed to have principal supervisory duty for undergraduate and postgraduate student activities.

SECTION 11.7 Departmental / Faculty Safety Officers

Appointed by Head of Department where required. Safety officers are usually the first point of contact locally in a department on matters of health and safety and are able to provide appropriate information and advice. The Safety Officer will liaise with other departments and with the Risk Management Office to effect remedial action where a hazard of unsafe working practice has been notified, although the responsibility for health and safety within the department rests with the Head of Department.

Safety Officers must attend an approved training course or hold other relevant qualification.

Responsibilities as delegated in writing by the Head of Department, for example;

- undertake regular inspections of the workplace to ensure adequate housekeeping and implement corrective action as required
- provide safety advice and information to staff and students
- arrange safety training where appropriate
- ensure appropriate notification of accidents and hazards
- control access to restricted areas
- assess competency of equipment users
- ensure equipment is maintained.

SECTION 11.8 Supervisors (any person who controls or directs others)

- develop new work procedures as required, in conjunction with relevant persons
- provide all staff with relevant EHS information in an appropriate manner
- provide personal protective equipment and clothing if hazards cannot fully eliminated
- provide adequate supervision through technical guidance and support
- identify and control hazardous conditions
- provide appropriate facilities for safe storage, handling and transport of hazardous substances
- Ensure that all accidents and injuries are reported.

SECTION 11.9 Employees

- University employees are expected to perform their work using safe practices and procedures and are responsible for the following activities:
- Participate willingly in all safety orientation and training programs offered by the university.
- Abide by all health and safety precautions that are relevant to the assigned duties.
- Use prescribed personal protective equipment (PPE) as provided and as directed by the supervisor and in accordance with proper safety precautions.
- Report any observed health and safety problems to the university administration.
- Maintain a positive attitude toward health and safety that will promote safe working behavior.
- Must take all reasonable care for their own health and safety and that of others who may be affected by their conduct at the workplace;
- Must not willfully or recklessly interfere with or misuse anything provided in the interests of health and safety or welfare and must co-operate with the University in relation to actions taken by the University to comply with occupational health and safety legislation;
- Must not willfully place at risk the health or safety of any person in the workplace.
- Adopt work practices that support EHS programs
- Take reasonable care for the safety of his/her own health and safety and that of other people who may be affected by their conduct in the workplace
- Seek guidance for all new or modified work procedures
- Ensure that any hazardous conditions, near misses and injuries are reported immediately to the supervisor
- Must not willfully place at risk the health or safety of any person in the workplace
- Participate in meetings, training and other environment, health and safety activities
- Must not willfully or recklessly interfere with or misuse anything provided in the interest of environment health and safety or welfare
- Use equipment in compliance with relevant guidelines, without willful interference or misuse
- Must cooperate with the University relation to actions taken by the University to comply with Environmental and Occupational Health and Safety legislation.

SECTION 11.10 Students

- All students are to comply with the EHS Manual generally, And, In addition students:
- All students Are responsible for adopting safe work and study practices;
- Must not willfully place at risk the health or safety of any person at the University;
- Must not willfully or recklessly interfere with or misuse anything provided in the interests of health and safety or welfare at the University

SECTION 11.11 Contractors

- All Contractors are required to undergo appropriate induction training,
- Adhere to all contractual requirements of the University in relation to Environment Health and Safety in addition to the Environment Health and Safety requirements of the University in accordance with University Policy and Procedures and/or agreed work method statements.

SECTION 11.12 Visitors

- Visitors are required to comply with all instructions given by authorized University staff for the protection of their health and safety whilst on University premises.

APPENDIX A

POTENTIAL PEROXIDE-FORMING CHEMICALS¹

Acetal	Ether (Glyme)
Cyclohexene	Ethylene Glycol Dimethyl Ether
Decahydronaphthalene	Tetrahydronaphthalene
Diacetylene	Methyl Acetylene
Dicyclopentadiene	Isopropyl Ether
Diethyl Ether	Tetrahydrofuran
Diethylene Glycol	Sodium Amide
Dimethyl Ether	Vinyl Ethers
para-Dioxane	Vinylidene Chloride
Divinyl Acetylene	

APPENDIX B

INCOMPATIBLE CHEMICALS²

Chemical

Acetic Acid	<u>Keep out of Contact With:</u> Nitric acid, hydroxyl compounds, ethylene glycol, perchloric acid, peroxides, permanganates
Acetylene	Chlorine, bromine, copper, fluorine, silver, mercury
Alkali Metals	Water, carbon tetrachloride or other chlorinated hydrocarbons, carbon dioxide, the halogens
Ammonia, Anhydrous	Mercury, chlorine, calcium hypochlorite, iodine, bromine, hydrofluoric acid
Ammonium nitrate	Acids, metal powders, flammable liquids, chlorates, nitrites, sulfur, finely divided organic or combustible materials
Aniline	Nitric acid, hydrogen peroxide
Bromine	Same as chlorine: ammonia, acetylene, butadiene, butane, methane, propane (or other petroleum gases), hydrogen, sodium carbide, turpentine, benzene, finely divided metals
Butyl lithium	Water.
Carbon, activated	Calcium hypochlorite, all oxidizing agents
Chlorates	Ammonium salts, acids, metal powders, sulfur, finely divided organic or combustible materials
Chromic Acid	Naphthalene, camphor, glycerin, turpentine, alcohol, flammable liquids in general
Chlorine	Same as bromine: ammonia, acetylene, butadiene, butane, methane, propane (or other petroleum gases), hydrogen, sodium carbide, turpentine, benzene, finely divided metals

¹ From Manufacturing Chemists' Association, Guide for Safety in the Chemical Laboratory, pages 215-217.

² From Manufacturing Chemists' Association, Guide for Safety in the Chemical Laboratory, pages 215-217.

Chlorine dioxide	Ammonia, methane, phosphine, hydrogen sulfide
Copper	Acetylene, hydrogen peroxide
Cumene hydroperoxide	Acids, organic or inorganic
Cyanides (Na, K)	Acids
Flammable liquids	Ammonium nitrate, chromic acid, hydrogen peroxide, nitric acid, sodium peroxide, halogens, other oxidizing agents
Hydrocarbons	Fluorine, chlorine, bromine, chromic acid, sodium peroxide
Hydrocyanic acid	Nitric acid, alkalis
Hydrofluoric acid	Ammonia, aqueous or anhydrous
Hydrogen peroxide	Copper, chromium, iron, most metals or their salts, alcohols, acetone, organic materials, aniline, nitro methane, flammable liquids, oxidizing gases
Hydrogen sulfide	Fuming nitric acid, oxidizing gases
Iodine	Acetylene, ammonia (aqueous or anhydrous), hydrogen
Mercury	Acetylene, fulminic acid, ammonia
Nitric Acid	Acetic acid, aniline, chromic acid, hydrocyanic acid, hydrogen sulfide, flammable liquids, flammable gases
Oxalic acid	Silver, mercury
Perchloric acid	Acetic anhydride, bismuth and its alloys, alcohol, paper, wood, sulfuric acid, organics
Potassium	Carbon tetrachloride, carbon dioxide, water
Potassium permanganate	Glycerin, ethylene glycol, benzaldehyde, sulfuric acid
Silver	Acetylene, oxalic acid, tartaric acid, ammonium compounds
Sodium	Carbon tetrachloride, carbon dioxide, water
Sodium peroxide	Ethyl or methyl alcohol, glacial acetic acid, acetic anhydride, benzaldehyde, carbon disulfide, glycerin, ethylene glycol, ethyl acetate, methyl acetate, furfural
Sulfuric acid	Potassium chlorate, potassium perchlorate, potassium permanganate (or compounds with similar light metals, such as sodium, lithium, etc.)

APPENDIX C

POTENTIAL SHOCK-SENSITIVE CHEMICALS³

Acetylides of heavy metals	Fulminate of silver
Aluminum ophorite explosive	Fulminating gold
Amatol explosive (sodium amatol)	Fulminating mercury
Ammonal	Fulminating silver
Ammonium nitrate	Fulminating platinum
Ammonium perchlorate	Gelatinized nitrocellulose
Ammonium picrate	Guanyl nitrosamino guanyl tetrazene
Ammonium salt lattice	Guanyl nitrosamino guanylide hydrazine
Calcium nitrate	Heavy metal azides
Copper Acetylide	Hexanite
Cyanuric triazide	Hexanitrodiphenylamine
Cyclotrimethylenetrinitramine	Hexanitrostilbene
Cyclotetramethylenetrinitramine	Hexogen (Cyclotrimethylenetrinitramine)
Dinitroethyleneurea	Hydrazoic acid
Dinitroglycerine	Lead azide
Dinitrophenol	Lead mannite
Dinitrophenolates	Lead picrate
Dinitrophenyl hydrazine	Lead salts
Dinitroresorcinol	Lead styphnate
Dinitrotoluene	Magnesium ophorite
Dipicryl sulfone	Mannitol hexanitrate
Dipicrylamine	Mercury oxalate
Erythritol tetranitrate	Mercury tartrate
Fulminate of mercury	Mononitrotoluene
Nitrated carbohydrate	Silver styphnate
Nitrated glucoside	Silver tetrazene
Nitrated polyhydric alcohol	Sodatol
Nitrogen trichloride	Sodium amatol
Nitrogen triiodide	Sodium dinitro-ortho-cresolate
Nitroglycerin	Sodium nitrate-potassium nitrate explosive mixtures
Nitroglycol	Sodium picramate
Nitroguanidine	Styphnic acid
Nitroparaffins	Tetrazene (guanyl nitrosamino guanyl tetrazene)
Nitromethane	Tetranitrocarbazole
Nitronium perchlorate	Tetrytol
Nitrourea	Trimethylolethane
Organic amine nitrates	Trimonite
Organic nitramines	Trinitroanisole
Organic peroxides	Trinitrobenzene
Picramic acid	Trinitrobenzoic acid
Picramide	Trinitrocresol

³

From Manufacturing Chemists' Association, Guide for Safety in the Chemical Laboratory, pages 215-217.

Picratol explosive (ammonium picrate)
Picric acid
Picryl chloride
Picryl fluoride
Polynitro aliphatic compounds
Potassium nitroaminotetrazole
Silver acetylide
Silver azide

Trinitro-meta-cresol
Trinitronaphthalene
Trinitrophenol
Trinitrophenol
Trinitrophenol
Trinitroresorcinol
Trinitroresorcinol
Trinitroresorcinol
Urea nitrate