Research laboratories are unique environments that present specific risks and challenges. Many undergraduates, and even graduate students, lack rigorous instruction in biological safety. They don’t understand the risk present in the laboratory or how to protect themselves from those risks.

Introduction

Biological safety or biosafety:- is the application of knowledge, techniques, and equipment to prevent personal, laboratory, and environmental exposure to potential infectious agents or biohazards. Biosafety defines the containment conditions under which infectious agents can be safely manipulated. Its aim is to reduce or eliminate accidental exposure to, or release of, infectious agents (includes bacteria, fungi, viruses, parasites, and cell cultures). This term is used to describe efforts to minimize the potential risks that may stem from the use of biotechnology or its derived products.

Most of the biological hazards are associated with laboratory-based practices.

To avoid the hazards, universal precautions should be followed including:-

- frequent hand washing
- no mouth pipetting
- avoid eating and drinking in the lab
- proper disposal of biohazardous or medical waste.
- These should be coupled with engineering controls such as biosafety cabinets
- ventilation systems
- closed-top centrifuge rotors.
- Personal protective equipment (PPE), such as gloves, lab coats, eye protection, face shields or others, must be provided without cost to all individuals who are at risk of occupational exposure to lab-acquired pathogens.

Laboratory Safety Management

It is the responsibility of the laboratory director to ensure the development and adoption of a biosafety management plan and a safety manual. Personnel should be advised of special hazards and required to read the safety or operations manual and follow standard practices and procedures, and it is the responsibility of the laboratory supervisor that all personnel should follow practices and procedures. A copy of the safety or operations manual should be available in the laboratory.

Hand Washing:-

Hand washing is one of the most effective means of preventing diarrheal diseases, as well as respiratory infections. Hand washing interrupts the transmission of disease agents and can significantly reduce infections Curtis and Cairncross (2003) suggest that hand washing with soap, particularly after contact with feces , can reduce diarrheal incidence by 42 to 47 percent, whereas Rabie and Curtis (2006) suggest that hand washing lowered the risk of respiratory infections ranging from 6 to 44 percent. This remains true even in areas that are highly focally contaminated and have poor sanitation, which is further supported by Barclay (2009). Because hand washing can prevent the transmission of a variety of pathogens, it may be more effective than any single vaccine. While handling biohazardous materials, suitable gloves should be worn; however, this does not replace the need for regular and proper hand washing by laboratory personnel. Hands must be washed after handling biohazardous materials and animals and before leaving the laboratory. In most situations, hand washing using ordinary soap is sufficient to decontaminate hands, but in high-risk situations the use of germicidal soaps is recommended. If proper hand washing is not available, alcohol-based hand sanitizers may be used to decontaminate lightly soiled hands.

Safe Transport of Biological Material

The packaging and transportation of biological materials is subject to strict state, federal, and international regulations. Individuals involved in the packaging, transportation and shipment of infectious substances must receive training on proper packaging, labeling, and documentation according to the applicable regulations and requirements before shipping such materials. Biological materials transported by laboratory personnel between buildings must be contained in such a way as to prevent their release into the environment. Transportation should follow this procedure:

- Biological samples must be placed in a primary container or vessel that is a securely closed, leak-proof (or o-ring) tube, vial, or ampoule, which is then placed in an unbreakable, lidded, watertight, secondary container (e.g., Rubbermaid tote or Playmate-type cooler).
- If outside of the primary container or vessel is suspected of being contaminated, decontaminate before placing in secondary container using a 10-percent bleach solution, a disinfectant approved by the Environmental Protection Agency, or a disinfectant appropriate for the biological material in use.
- All biohazards must be labeled with the international biohazard symbol on the outside of the secondary container.
- When transporting liquids in glass vials or containers, place enough absorbent material, such as paper towels, in the space at the top, bottom, and sides between the primary and secondary containers to absorb the entire contents of the primary container(s) in case of breakage or leakage.
- The outside of the secondary container must be free of any biohazardous material so that the package can be carried safely between buildings without wearing gloves or lab coats.
- The package must be taken directly to its intended location.
- If a spill occurs during transport, do not attempt to clean it up without appropriate spill response material . Keep other persons clear of the spill.

Management of Biomedical Waste:-

Biomedical waste can be managed through a common biomedical waste treatment facility (CBWTF). It is a set up in which biomedical waste, generated from a number of health-care units, goes through necessary treatment to reduce adverse effects. This treated waste may finally be sent for disposal in a landfill or for recycling purposes.

The various treatment methods could include:

- Incineration: A controlled combustion process in which waste is completely oxidized and harmful microorganisms are destroyed or denatured under high temperature.
- Autoclaving: Autoclaving is a thermal process in which steam is brought into direct contact with waste in a controlled manner and for sufficient duration to disinfect the wastes. For easy and safer operation, the system should be of horizontal type and should exclusively design for the treatment of biomedical waste.
- Microwaving: In microwaving, microbial inactivation occurs as a result of the thermal effect of electromagnetic radiation spectrum lying between the frequencies 300 and 300,000 MHz. Microwave heating is an intermolecular heating process. The heating occurs inside the waste material in the presence of steam.

- Hydroclaving: It is similar to that of autoclaving except that the waste is subjected to indirect heating by applying steam in the outer jacket. The waste is continuously tumbled in the chamber during the process.
- Shredding: It is a process by which waste are deshaped or cut into smaller pieces so as to make it unrecognizable. It helps in prevention of reuse of biomedical waste and also acts as an identifier that the waste material is disinfected and safe to dispose off.