

## INTRODUCTION

Workplace Health and Safety (WHS) often referred to as Occupational Health and Safety (OH&S) involves the assessment and migration of risks that may impact the health, safety or welfare of those in workplace. This may include the health and safety of customers, employees, visitors, contractors, volunteers and suppliers.

Creating a safe work environment is a legal requirement and critical to the long term success. It can:

- Help to retain staff.
- Maximise employee productivity.
- Minimise injury and illness in the workplace.
- Reduce the costs of injury and workers' compensation.
- Ensure you meet your legal obligations and employee responsibilities.

## Types of Diseases and their Spread at Work Place

An infectious disease sometimes referred to as "contagious" or "communicable," spreads from person to person by various routes and is caused by pathogens (i.e., germs or "bugs"). Preventing the spread of infectious diseases requires basic infection-control procedures, including appropriate hand washing technique, personal hygiene and keeping the workplace clean. Educating employees on these basic practices and other information on transmission and common prevention measures can have a huge impact on your ability to control infectious diseases in the workplace.

Employees can be exposed to communicable diseases at work, home, recreational facilities, health clubs and while traveling. Business travel, and in particular global travel, can increase workers potential exposure to infections, if they are not immunized properly. Multiple exposures may occur as these travellers return to the workplace, possibly exposing associates to communicable diseases. Contractors and temporary agency workers can expose on-site employees to various communicable diseases, too.

Various types of communicable diseases at work place may spread thorough airborne and contact.

### Airborne Diseases

TB (Tuberculosis), SARS (Severe Acute Respiratory Syndrome), Meningitis, Chickenpox, Measles, Smallpox, Influenza (flu), etc. are transmitted primarily from airborne droplets from an infected person's cough, sneeze, or spit, which can then be inhaled by others.

### Contact Diseases

Hepatitis A virus (HAV), Dysentery, Salmonellosis, E. Coli, Typhoid Fever and Methicillin - Resistant Staphylococcus Aureus (MRSA) are spread primarily by person-to-person contact, generally from an infected person's feces, urine, nasal discharge or infected

skin, directly or indirectly from contaminated food, drinking water, someone else's hands or objects. These diseases are spread more easily where there are poor sanitary conditions or poor personal hygiene is practiced.

### **Best practices for preventing infectious disease**

Best practices for preventing infectious disease exposure include the following:

- Written policies and procedures for infection control.
- Employee screening, vaccination, and education.
- Communication and follow up with the physician regarding the employee's clearance to work.
- Absence Management program that allows sending a sick employee home, encouraging the employee to stay at home while feeling ill, and seeking medical attention.
- Good housekeeping including cleaning/disinfecting contaminated work areas with an EPA- approved detergent/disinfectant.
- Properly managing an occupational exposure.

These prevention techniques should minimize your workers' compensation and liability exposures. Aside from these prevention techniques, effective controls include early recognition of symptoms, prompt diagnosis and adequate isolation or treatment.

### **HEALTH EMERGENCY**

Workplaces need a plan for health emergencies that can have a wider impact. Quick and effective action may help to ease the situation and reduce the consequences. However, in emergencies people are more likely to respond reliably if they:

- Are well trained and competent.
- Take part in regular and realistic practice.
- Have clearly agreed, recorded and rehearsed plans, actions and responsibilities.

The type of medical emergency determines how quickly response team personnel must react. OSHA medical and first aid standard 29 CFR 1910.151 says that for a life-threatening emergency such as cardiac arrest, choking or profuse bleeding, on-site life support services must begin within the first three to four minutes and continue until professional help arrives. With a non-life-threatening emergency, teams must provide first aid services within 15 minutes. Emergency response teams should receive first aid and cardio pulmonary resuscitation training. If you have older employees or any with known heart conditions, it's a good idea to purchase and provide automated external defibrillator training.

Regardless of the type of emergency, medical procedures focus on three basic steps, which the American Red Cross identifies as Check-Call-Care. The first step is to secure the scene and check the injured person. For example, you might turn off malfunctioning machinery, find and turn off the source of a gas leak or secure items that appear ready to fall. Next, check

the injured person. Starting at the person's head, look for any cuts, bleeding or bruises. Feel his forehead for temperature, check his skin colour and note whether the person is sweating. Check the limbs and torso for injuries and listen for signals of pain. Watch for changes in consciousness and look for signs of breathing trouble. If the situation is serious or life-threatening, the next step is to call emergency number. Then, begin providing emergency life-support and/or first aid services.

Treat non-life-threatening injuries such as minor cuts or burns with common first aid procedures. For example, cover open wounds with a sterile dressing and apply direct pressure to control or stop the bleeding. Treat minor burns with cold running water and a loose, sterile dressing. For serious emergencies, such as choking, response teams should know how and when to administer back-blows and perform the Heimlich maneuver, which a series of abdominal thrusts is. CPR is a combination of chest compressions and rescue breaths that help oxygenate and keep blood circulating to vital organs. When giving CPR, the standard is to repeat a cycle of 30 compressions and two rescue breaths until help arrives or defibrillation begins.

## PERSONAL PROTECTIVE EQUIPMENT

Under the various provisions of the factory act and rules the management of any factory has to their employees the required personal protective equipment. The safety equipment's are to be used in any working industry. It may be inconvenient initially, but one should get used to it, here we have to remember the personal protective equipment's are only substituting in preventing injuries, or bad health, if the hazards of the work place cannot be controlled by engineering method or administrative control, The appliance are the last line of defence against any hazard, and they are only a barrier between person and the hazard. If the barrier fails or turns in effective due to one reason or other, the person using the equipment's will be a victim, Hence the following are the requirement's to be remembered while selecting the equipment's:

- Adequate protection against the hazards to which the worker will be exposed.
- Maximum comfort and minimum weight.
- No restriction of essential movements.
- Durability and susceptibility of maintenance at the premises, where it is used.
- Construction in accordance with the accepted standards of performance and material.
- Attractive looking.

Personal protective equipment's may be divided into two based groups:

1. Non respiratory
2. Respiratory

### 1. NON RESPIRATORY

The common safety appliances are:

1. Helmet

2. Face shield
3. Goggles
4. Hand gloves
5. Ear plug/ muff
6. Aprons (leather asbestos PVC etc.,)
7. Safety boots
8. Leg guard and
9. Partisan covers etc.

All personal protective equipment provided to the workers as required under the act shall have Indian standard bureau.

The factory inspectorate having regard to the nature of the hazards involved in work and process carried out, order the occupier or the manager in writing to the supply to the workers exposed to particular hazard any personal protective equipment as may be found necessary.

The various type of personal protective equipment's is detailed here under.

### **Head Protection**

When workers are employed in areas where there is danger of falling objects they shall wear safety helmets.

### **Eye Protection**

Suitable goggles are to be worn by all workers engaged in the following processes:

- The cutting out or cutting off of cold rivets, bolts from boilers or other plant.
- Chipping, sealing or scurfing of boilers or ship plates.
- Drilling by means of portable machine tools.
- Dry grinding of metals.
- Cutting and welding.
- Handling of chemicals injuries to eyes.

### **Hand Protection**

Adequate protection for the hands shall be available for all workers when using cutting or welding apparatus or when engaged in machine cutting or machine riveting or in transporting or stacking plates or in handling plates at machines or in handling chemicals.

### **Protection in Connection With Cutting or Welding**

Suitable goggles fitted with tinted eye pieces shall be provided and maintained for all persons employed when using cutting or welding apparatus and also when engaged in the process of electric welding. Other appliance required when doing such works are helmets or head shields suitable hand shields to protect the eyes and face from hot metal and from rays

likely to be injurious. Suitable gauntlets to protect the hands and force arms hot metal and from rays likely to be injurious.

### **Safety Belts and Life Lines**

Whenever any worker is engaged on work at a place from which he is liable to fall more than 2m. He shall be provided with safety belts equipped with life lines which are secured with a minimum of slack, to a fixed structure unless any other effective means such as provision of grand rails or ropes are taken to prevent his falling.

All safety belts and life line shall be examined once in six months by a competent person to ensure that no belt or life line which is not in good condition is used.

The provision of clean, uncontaminated air to workers should be accomplished by suitable engineering technique. However, this is not possible under all circumstances notably during shutdown, plant emergencies or non- routing work- and suitable respiratory devices must, in these cases, be worn by workers.

## **2. RESPIRATORY PROTECTIVE DEVICES**

Respiratory protective devices are based on two main principles:

1. Decontamination of local air by filtration, absorption etc., using respirators.
2. Segregate external supply using "breathing apparatus" breathing apparatus.

Breathing apparatus may be subdivided into the following classes:

- a) Short distance fresh air breathing apparatus.
- b) Compressed air line breathing apparatus.
- c) Self- contained breathing apparatus.

The selection of equipment used will depend upon the type of operation and the nature and concentration of the contaminants.

Obviously an external breathing supply is essential in an oxygen deficient atmosphere therefore breathing apparatus should be specified whenever oxygen level are below 20% volume. Even perfect respiratory protection may not always prevent contaminants entering the body and a relatively large number of substances will penetrate unbroken skin on liquid or vapour contact.

Since respiratory protection depends upon the proper use of the equipment (particularly under emergency conditions) all prospective user must be carefully trained in its use.

In a breathing apparatus the overall efficiency depends largely on the face piece seal which is affected by the shape and size of the wearer's features e.g. whether smooth shaven or whether spectacles are worn. For the latter, in some locations, regular users of breathing apparatus are issued with a special type of spectacles with flexible flat side-pieces or templar to help obtained a satisfactory seal. Numerous design of face piece e.g. full or half are available of which the Baxter and pneu-seal safe piece fitted with an inflatable pneumatic peripheral seal and the double face piece type are probably the most recent developments.

Entry into confined spaces and atmospheres immediately hazardous to life, by personnel wearing respiratory protection, should not be permitted unless the wearer is equipped with a rescue harness with a life- line either attached or available and similarly equipped personnel are standing by keeping observation.

### **EFFECT OF EXPOSURE TO MSW**

Municipal solid waste include commercial and domestic waste generated in municipal or notified areas or in either solid or semisolid form excluding industrial hazardous waste but including treated Bio-medical wastes.

Problems faced due to solid wastes handling and disposal are; workers and other persons who manually collect and process Solid waste regularly are especially at high risks. Workers are exposed to a multitude of health hazards that result from direct handling and contact with (wastes) workers will be experiencing health hazards in 3 ways these are

- Accidents,
  - Infections and
  - Chronic diseases.
1. The first type of health impact is accidental injuries such as cuts and injuries from sharp object in the wastes, muscular and skeletal disorders resulting from the handling heavy containers. Intoxication and injuries resulting from contact with small amounts of hazardous chemical wastes collecting with garbage and burns and other injuries result with garbage and burns and other injuries resulting from accidental occupation at waste disposal site or from methane gas fires or explosions at landfill site.
  2. The second type of health impacts is infections caused by exposure to humans to Solid waste, or its products of decomposition. Blood borne infections such as tetanus resulting from injuries caused by infected sharp items in the waste are common. Ophthalmologic and dermatological infections from exposure to contaminated dust are also possible. Many tropical diseases transmitted by vectors such as mosquitoes have their origins in the breeding ponds created by indiscriminate wastes disposal garbage forms a source of food for rates, flies and various insects. Hence typhoid, plague, dysentery, epidemics would occur many also result in zoonosis which results from bite by wild or stray animals feeding on wastes.
  3. The third type of health impact is chronic disease causes by exposure to toxic chemicals. Incinerations operators are especially exposed to chronic respiratory diseases resulting from exposure to dust, to toxic and carcinogenic risks resulting from exposure to hazardous compounds, cardiovascular disorders and heat stress resulting from exposure to excessive temperature and to loss of hearing functions due to exposure to excessive noise.

### **EFFECTS OF EXPOSURE TO EPOXY PRODUCTS (Engineering Industry)**

Epoxy products are used for paints and other surface coatings, moulded and reinforced plastics, electronic components and adhesives ranging from spray foams to dental cement. They are often used in jobs where tough durable coatings or adhesives are needed.

#### **Health Risks Associated With Epoxy Resins**

The primary risks associated with epoxy use in sensitization to the hazardous that can induce allergic reactions, the most common effects of over exposure to the chemical used in epoxy resin systems are eyes, nose, throat, skin irritation, skin allergies and asthma. The solvent additives can cause other effects such as headache, dizziness and confusion.

#### **Lungs**

Vapours and spray mists of most epoxy resin system chemicals can irritate lungs. Some people develop asthma from these agents symptoms of asthma includes chest tightness, shortness of breath, wheezing and coughing, these symptoms may occur after work or at night. Once a person becomes allergic to these agents even the dust from sanding or grinding causes an asthma attack.

#### **Skin**

Epoxy resins can cause skin irritations, symptoms include redness include redness swelling, flecking and itching on the hands, face or other areas of contact. Skin allergies may develop often just a few days of contact or many years of exposure.

#### **Eyes, Nose and Throat**

Most epoxy resin system chemicals and their vapour can irritate our eyes, nose and throat. Some people develop headache as a result of this irritation. If liquid are splashed into eyes they can severely damage the eyes. In that case, immediately rinse the eyes with water continuously for 15 to 30 min and then seek medical attention.

#### **Nerves System**

Solvents inhaled or absorbed through our skin can affect central nerves system in the same way as alcoholics. Symptoms of our exposure include headache, nausea, dizziness, confusion and loss of consciousness.

#### **Reproductive Systems**

From the research it has been concluded that epoxy resin systems affects reproductions in humans as the epoxy solvents vapour inhaled by a human can reach a developing features and may contaminate the women breasts milk. Therefore, pregnant and nursing women should minimize an exposure to these solvents.

### CONTROL OF EFFECTS OF EPOXY RESIN

When feasible, employers must use engineering controls rather than PPE'S to prevent over exposures. Engineering control methods include installing ventilation, changing the work process, changing work practices; it can be attend by the following measures

- ❖ Containers and vats of epoxy resins and solvents should be tightly covered to prevent evaporation.
- ❖ Local exhaust ventilation system is the most effective type of ventilation control.
- ❖ Heating epoxy's during process can cause chemicals to evaporate more quickly, the higher the temperature the greater the amount of chemical released into air, therefore use of lowest possible temperature or avoid heating epoxies unnecessarily and be sure that adequate ventilation is used then epoxy's must be heated.
- ❖ Certain work process such as heating of epoxy systems can be isolated, enclosed or automated to reduce explosions.
- ❖ Protective equipment's such as gloves, goggles or face shields should be warned if there is frequent or prolonged skin contact with epoxy resin.

### EFFECTS OF EXPOSURE IN WASTEWATER TREATMENT PLANT

#### Occupational health and safety considerations in waste water treatment plants

Wastewater is the used water of a community which includes domestic, industrial wastewater. Combined sewer system will include storm water such as road runoffs which carries oils, metals, salts and asbestos. Many systems will receive infiltrations which carries pesticides and herbicides from soil application.

The primary route of exposure for workers is inhalation, wastewater treatment plant workers may be exposed to chemicals or organisms by direct contact with wastewater and sludge's or by inhalation of gaseous particles, aerosols, vapours or droplets. These hazards may enter the plant in the soluble form or attached to solids. Some chemically related health complaints are acute in nature involving short term exposures and complaints such as irritations of eyes, nose, throat and other problems are chronic in which related exposures have caused effects upon internal organs and have involved occupationally related allergies.

Diseases causing organisms have been found in wastewater or in sludge, therefore workers may be at increased risk of infection or diseases. A wide variety of diseases causing organisms are present both in the liquid face and sludge stage. Amongst these are salmonella, shigella and vibrio that cause diarrhoea and other intestinal tract problems. Virus are also present in wastewater sludge's which causes infections like hepatitis, polio myelitis, sore throat and gastro intestine problems, protozoa such as endamoeba and giardia (elephantities) that cause intestinal distress which are common in wastewater treatment workers, helminthic such as round worm, tape worm and wip worm are also part of biological breakdown processes, but the ova of these can pass through the body which is fairly resistant to normal treatment processes and which can survive in soil for several years are found in high counts in sludge's.



## CONTROL MEASURES

Administrative control can be used for rotating personal among the various treatment plants. This would reduce the inhalation of air strip chemicals and aerosols and may help in development of immunity to diseases by keeping its exposure low.

Engineering controls involve the use of ventilation for processes located within building. As well as splash guards and a variety of design or operational features to reduce air stripping and aerosols of diseases potential.

Some of the other control measures are as follows:

1. Enforce pre-treatment regulation to reduce air strippable particles at the source.
2. Plant trees around the aeration basin the droplets and particles.
3. Reduce the amount of air stripping and aerosol formation by using fine bubbles for aeration or using diffused aeration rather than mechanical aeration and if possible reduce the rate of aeration.
4. Use floating covers on the mixed liquor of the aeration basins such as biodegradable oils, Collapsing foam permanent foam i.e., poly ethylene sheets and ping-pong balls floating on the surface.
5. Avoid handling screenings by hand to prevent injuries.
6. Label piping so that potable and non-portable water are clearly distinguish.

## ENVIRONMENTAL MANAGEMENT PLAN (EMP)

Preparation of environmental management plan is required for the formulation, implementation, and monitoring of environmental protection measures during and after commissioning of projects. The plans indicate the details as to how various measures have been taken or proposed to be taken including cost components as may be required. Cost of measures for environmental safeguards is treated as an integral component of the project cost and environmental aspects have been taken into account at various stages of the projects.

- **Conceptualization:** Preliminary environmental assessment.
- **Planning:** Detailed studies of environmental impacts and design of safeguards.
- **Execution:** Implementation of environmental safety measures.
- **Operation:** Monitoring of effectiveness of built-in safeguards.

The management plans should be necessarily based on considerations of resource conservation and pollution abatement, some of which are:

1. Liquid Effluents
2. Air Pollution
3. Solid Wastes
4. Noise and Vibration
5. Occupational Safety and Health
6. Prevention, maintenance and operation of Environment Control Systems

7. House-Keeping
8. Human Settlements
9. Transport Systems
10. Recovery - reuse of waste products
11. Vegetal Cover
12. Disaster Planning
13. Environment Management Cell

### **1. Liquid Effluents**

- Effluents from the industrial plants should be treated well to the standards as prescribed by the Central/State Water Pollution Control Boards.
- Soil permeability studies should be made prior to effluents being discharged into holding tanks or impoundments and steps taken to prevent percolation and ground water contamination.
- Special precautions should be taken regarding flight patterns of birds in the area. Effluents containing toxic compounds, oil and grease have been known to cause extensive death of migratory birds.
- Location of plants should be prohibited in such type of sensitive areas.
- Deep well burial of toxic effluents should not be resorted to as it can result in re-surfacing and ground water contamination. Re-surfacing has been known to cause extensive damage to crop and livestock's.
- In all cases, efforts should be made for re-use of water and its conservation.

### **2. Air Pollution**

- The emission levels of pollutants from the different stacks should conform to the pollution control standards prescribed by Central or State Boards.
- Adequate control equipment should be installed for minimising the emission of pollutants from the various stacks.
- In-plant control measures should be taken to contain the fugitive emissions.
- Infrastructural facilities should be provided for monitoring the stack emissions and measuring the ambient air quality including micro-meteorological data (wherever required) in the area.
- Proper stack height as prescribed by the Central/State Pollution Control Boards should be provided for better dispersion of pollutants over a wider area to minimise the effect of pollution.
- Community buildings and townships should be built up-wind of plant with one-half to one kilometre greenbelt in addition to physiographical barrier.

### **3. Solid Wastes**

- The site for waste disposal should be checked to verify permeability so that no contaminants percolate into the ground water or river/lake.
- Waste disposal areas should be planned down-wind of villages and townships.

- Reactive materials should be disposed of by immobilising the reactive materials with suitable additives.
- The pattern of filling disposal site should be planned to create better landscape and be approved by appropriate agency and the appropriately pre-treated solid wastes should be disposed according to the approved plan.
- Intensive programs of tree plantation on disposal areas should be undertaken.

#### **4. Noise and Vibration**

- Adequate measures should be taken for control of noise and vibrations in the industry.

#### **5. Occupational Safety and Health**

- Proper precautionary measures for adopting occupational safety and health standards should be taken.

#### **6. Prevention, Maintenance and Operation of Environment Control Systems**

- Adequate safety precautions should be taken during preventive maintenance and shut down of the control systems.
- A system of inter-locking with the production equipment should be implemented where highly toxic compounds are involved.

#### **7. House - Keeping**

- Proper house-keeping and cleanliness should be maintained both inside and outside of the industry.

#### **8. Human Settlements**

- Residential colonies should be located away from the solid and liquid waste dumping areas. Meteorological and environmental conditions should be studied properly before selecting the site for residential areas in order to avoid air pollution problems.
- Persons, who are displaced or have lost agricultural lands as a result of locating the industries in the area, should be properly rehabilitated.

#### **9. Transport Systems**

- Proper parking places should be provided for the trucks and other vehicles by the industries to avoid any congestion or blocking of roads.
- Siting of industries on the highways should be avoided as it may add to more road accidents because of substantial increase in the movements of heavy vehicles and unauthorised shops and settlements coming up around the industrial complex.
- Spillage of chemicals/substances on roads inside the plant may lead to accidents. Proper road safety signs both inside and outside the plant should be displayed for avoiding road accidents.

### 10. Recovery - reuse of waste products

- Efforts should be made to recycle or recover the waste materials to the extent possible. The treated liquid effluents can be conveniently and safely used for irrigation of lands, plants and fields for growing non-edible crops.

### 11. Vegetal Cover

- Industries should plant trees and ensure vegetal cover in their premises. This is particularly advisable for those industries having more than 10 acres of land.

### 12. Disaster Planning

- Proper disaster planning should be done to meet any emergency situation arising due to fire, explosion, sudden leakage of gas etc. Fire fighting equipment and other safety appliances should be kept ready for use during disaster/emergency situation including natural calamities like earthquake/flood.

### 13. Environment Management Cell

- Each industry should identify within its setup a Department/Section/Cell with trained personnel to take up the model responsibility of environmental management as required for planning and implementation of the projects.

## QUESTION BANK

1. State various modes of transmission of diseases at work place. Recommend preventive methods for them.
2. Write a note on health emergency plan at a work place.
3. Explain the role of personal protective equipment during occupational activity.
4. Write a note on use of personal protective equipment's for health and safety considerations.
5. Discuss the effects of exposure to solid waste.
6. Discuss the effect of exposure to Engineering Industries.
7. What is Environmental Management Plan (EMP)? Explain the process of EMP for any given project.
8. Illustrate the health and safety considerations to be followed in wastewater treatment plant.
9. Discuss the safety considerations to be followed in water treatment plant.
10. State the precautionary measures to be followed handling chemicals at lab.
11. Discuss the safety considerations to be followed in
  - i. Cement Industry
  - ii. RMC plants
  - iii. Precast plants
  - iv. Construction sites.