

RISK ASSESSMENT & HAZARD IDENTIFICATION

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a. Risk Assessment

Risk assessment is a process to identify potential hazards and analyze what could happen if a hazard occurs. Risk assessment is done on the basis of past accident analysis at analogous projects, previous judgments and expertise in the field of risk analysis especially in accident analysis.

b. Hazard Identification

Hazard Identification is used as the first step in a process used to assess risk. The result of a hazard analysis is the identification of different type of hazards. A hazard is a potential condition and exists or not (probability is 1 or 0). It may in single existence or in combination with other hazards (sometimes called events) and conditions become an actual Functional Failure or Accident (Mishap).

Hazard Identification and Risk Assessment is a method, by which, we try to identify the main hazardous substance, and then try to reduce the effect of hazard. For this purpose we will use various risk assessment methodologies by knowing hazards consequences and by analyzing all the processes which are being carried out during handling.

Occupational Health and Risk

Following operations pose serious health hazards to the workers at the site:

1. Air pollution from operation of DG sets
2. Noise generation from DG sets and blower operations
3. Handling of chemicals and fuels. Apart from storage of chemicals other possibilities of accidental events may be encountered in the proposed CETP tanks construction

activities & potential failure causes for storage vessels of flammable liquids like HSD.

4. The proposed common effluent treatment plant activity does not involve major hazardous chemicals except hydrochloric acid during operation phase.

Instruments & Equipments Handling

The workforce of Treatment plant is anticipated to handle following instruments/equipment:

- Laboratory equipment.
- Measuring and metering devices.
- Mechanized lifting and disposal equipment.
- Portable mechanical working tools.
- Pumps and blowers.

CETP installation needs to be equipped with proper protocol for O & M. The first step in preparation for O & M is preparing inventory of maintenance requirements. This inventory is generally included in the Operation & Maintenance (O&M) Manual written down for the installation by the contractor who designs and builds the installation. He on completion of the work hands over this manual to the Principal for whom he builds the installation. The following sections of the O & M Manual would lay down the maintenance requirements:

1. **Maintenance of Equipment:** This section provides schedules that list periodic maintenance requirements for the various equipments and also includes record-keeping forms as necessary. A list of equipment suppliers and service representatives along with telephones is also given therein. Also, the manufacturer's O&M requirement is provided in this section. The CETP maintenance staff / the Operation & Maintenance contractor should particularly review this section of the O&M Manual.

2. **Storeroom and Spare Parts Inventory:** It includes a list of critical replacement parts that may have long delivery times associated with them. Contact details of manufacturers or dealers of various equipment used in the installation, which are located nearby is helpful in seeking recommendations/ guidance. This section also indicates where the spares are to be stored. To optimize spare parts inventory, the CETP Staff/ O&M Contractor can make/ procure computerized maintenance software programs to help keep track of spares, supplies and lubricants.

3. **Manufacturer's O&M Literature.** In the O & M manual, cut-sheets and other manufacturer's literature are also contained. CETP staff/ O & M Contractor should familiarize itself with all these documents to ensure proper planning and execution of O & M activities. In case these documents are not available the same should be prepared based on study of the plant, process, equipments, past experience, and interaction with manufacturers/ suppliers.

The manpower requirement for CETP O & M can broadly be listed as follows:

Plant Manager: is an individual with environmental engineering or science background with experience of at least three years on similar plant(s). He must have thorough understanding of unit operations and application of microbiology and environmental chemistry in the effluent/ sewage treatment. He should be able to take decisions to divert / bypass/ distribute the flow in the event of disruptions / breakdown of mechanical or electrical equipment until resumption is in place and repairs / replacements are successfully carried out. He should understand and be able to plan a forecast and use of chemicals / nutrients for the plant operations and the laboratory. He should be well versed in working out dosages of chemicals and nutrients based on the raw effluent quality and change it as the treatment progresses and results start forthcoming. AS CETP Manager, he should prepare a weekly roster of duties for each individual and broadly lay down in writing the duties and responsibilities of each category of staff. He should ensure that the staff on plant should get rotated in various shifts during each month. Needless to mention that he is the backbone of CETP operation.

Plant Operator(s): comprise a team of qualified / trained operators who work in shifts in operating and maintaining screens, grit removal devices, pumps, aerators, valves, etc. in directing the effluent and settled sludge to various units for / after treatment.

They should be able to sense troubles and act as ears and eyes of the Plant manager. They should also assist the electrical / mechanical maintenance technician(s) in carrying out the preventive and breakdown maintenance tasks.

Electrical / Mechanical Technician (s): form team of qualified maintenance technicians with the ability and experience of diagnosing health of equipment and motors with the aim of taking these on for preventive maintenance, assigning causes and reasons for faults and ultimate failure, quickly carrying out minor repairs / replacements by reaching, removing, stripping / opening, repairing, assembling of routine electrical and mechanical machines / equipment including piping and valves.

Laboratory Analyst: is a qualified individual who has knowledge of water and waste water chemistry and is trained in preparation of laboratory chemicals, use of laboratory instruments, collection and preservation of water / waste water samples and analysis for various environmental parameters such as pH, SS, BOD, COD, TDS etc.

Labour / Helpers: In addition to the above trades, labour / helpers are required to assist the above individuals and upkeep and maintenance of the various units, structures, areas, floors, rooms, equipment, tanks, vessels, beds etc. and removal, loading, haulage/carriage of wastes, screenings, stores and chemicals and other such material as the need be.

It is essential that each CETP staff shall be well trained in related tasks and be equipped in resources such as tools, spares and tackles.

CETP O & M skills are acquired mostly through on-job training. Trainees usually start as attendants or operators-in-training and learn their skills on the job under the direction of an experienced operator. They learn by observing and doing routine tasks such as recording meter readings, taking samples of liquid waste and sludge, and performing simple maintenance and repair work on pumps, electric motors, valves, and other plant equipment. CETP Operators need mechanical aptitude and should have knowledge of basic mathematics, chemistry, and biology. They must have the ability to apply data to formulas prescribing treatment requirements, flow levels, and concentration levels.



CETP operation is a team work. It requires proper team selection, training need assessment, training, on-job moulding, laboratory and statistical analysis for ensuring desired performance, trouble forecasting and trouble shooting. O & M staff profile should address all these requirements.

Since it is not feasible to position a Repair/Maintenance Shop at the site to carry out major overhauls / repairs to electrical and mechanical equipment, it is essential to identify back-up workshop facilities. A good CETP operating contractor may have his own central resources in place within workable co-ordinates which will help to carry out such heavy repairs and maintenance or he may have agreement to move such resources, own or from trade, to the site with matching capability to establish temporarily for completion of task. This should be taken in to account if CETP operation is to be outsourced.

RISK ASSEMENT AND ITS MANAGEMENT

Types of Hazards in CETP

Risk is a probability that damage to life, health and / or the environment. Risk will occur as a result of the hazard. Hazard is an inherent property of a substance, agent, and source of energy or situation having potential of causing undesirable consequences.

The following two methods of hazard identification have been employed in the study:


- Identification of major hazards based on Manufacture, Storage, and Import of Hazardous Chemicals Rules, 1989 Government of India, as amended till date.
- Primary Hazard Analysis.

The following are the various hazards considered during different phases of the project i.e. construction and operation phase.

A) Natural Hazards:

Several natural hazards like flooding, earthquake, lightening, etc. may be possible and may cause danger to surrounding environment.

B) Activity Hazards:

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The following activity hazards along with proposed safeguard measures were studied for construction and operation phase of the project.

(i) Chemical Hazards:

As CETP, there is no such chemical used except alum, poly-electrolyte, activated carbon, and the quantity required is very less, so there are no any hazards associated with handling of chemicals. However, for further reduction in the chemical hazards, following measures should be follow.

Safety Measures for Chemical Hazards:

- Development of safe working procedures.
- Reduction of number of workers exposed to hazards & duration and frequency of exposure.
- Use of personal protective equipment.
- Regular environmental and medical monitoring.

Accident Hazards:

Different accident hazards associated with CETP construction and operation activities are as follows:

- Fire hazards,
- Electrical hazards,
- Slips, Trips, and Falls at work, and
- Biological hazards.

Fire Hazards:

Accidental fires due to electrical short circuit represent minor hazards. Special precautions must be taken for electrical fitting and appliances uses. Sources of ignition for fire hazards are direct flames, Heat radiation, and Electric spark.

Safety Measures for Fire Hazards:

- Automatic fire detection system and control system should be provided.
- Emergency back-up power like D.G. Sets should be provided for the automatic systems.

- Matches, cigarettes, etc. should be prohibited.
- Soldering, welding or cutting torches should be used after taking hot work permit from the consent authority.
- Being a CETP project, in case of fire treated water reservoir will be use for emergency operation.

Electrical Hazards:

Poor electrical installations and faulty electrical appliances can lead to fires which may also cause death or injury to workers. Hazards involved with electrical network are:

- Contact with live parts causing shock and burns
- Faults which could cause fires

Safety Measures for Electrical Hazards:

- Ensure safety of electrical installation and its maintenance.
- Provision of safe and suitable equipment.
- Provision of safety device.
- Carry out preventive maintenance.

Slips, Trips, & Falls at Work:

Slips and trips are the most common cause of fatal injuries as well as non-fatal major injuries. The hazards related to slip and trips at work can be reduced through good housekeeping as well as health and safety arrangements.

Safety Measures for Slips, Trips, & Falls at Work:

The risk associated with slip and trip hazards can be reduced by avoid spillages in workplace, especially on uneven floors, and trailing cables, and by maintaining good housekeeping. However, for further reduction in the slips and trips, following measures should be follow.

- Safety railing / grills, and safety stairs should be provided.

- Safety operating procedure should be followed for tank cleaning, pipeline maintenance work at depth or height, chemical handling, and doing regular maintenance work.

Biological Hazards:

The workers working in the CETP are prone to following biological hazards:

- Diseases caused by infectious agents present in raw effluent.
- Diseases caused by insects or rodents proliferating in the sludge drying beds.

Safety Measures for Biological Hazards (infection & illness):

- Employees shall understand the risks through proper instruction, training and supervision, there will be no any direct contact with chemicals.
- Provisions and use of suitable personal protective measures.
- Provision of adequate welfare and sanitation facilities as well as first-aid measures considering the heavy contamination.
- Provision of separate eating facilities to avoid food poisoning.
- Effective arrangement for monitoring health of staff.

Fire Fighting System

- The Statutory requires that a 'responsible person' must carry out, and keep up to date, a risk assessment and implement appropriate measures to minimize the risk to life and property from fire. The responsible person will usually be the main or principal contractor in control of the site.
- You should identify sources of fuel and ignition and establish general fire precautions including, means of escape, warning and fighting fire, based on your fire risk assessment.
- In occupied buildings such as offices, make sure the work does not interfere with existing escape routes from the building, or any fire separation, alarms, dry risers, or sprinkler systems.

Key issues:-

- Risk assessment
- Means of escape

- Means of giving warning
- Means of fighting fire
- Construction of timber frame will require significant additional measures

Risk and Hazard Assessment

In most cases, conducting a risk assessment will be a relatively straightforward and simple task that may be carried out by the responsible person, or a person they nominate, such as a consultant.

There are five steps in carrying out a fire risk assessment:

- 1. Identify hazards:** consider how a fire could start and what could burn;
- 2. People at risk:** employees, contractors, visitors and anyone who is vulnerable e.g. disabled;
- 3. Evaluation and action:** consider the hazards and people identified in 1 and 2 and act to remove and reduce risk to protect people and premises;
- 4. Record, plan and train:** keep a record of the risks and action taken. Make a clear plan for fire safety and ensure that people understand what they need to do in the event of a fire; and
- 5. Review:** your assessment regularly and check it takes account of any changes on site.

Means of Escape

Key aspects to providing safe means of escape on construction sites include:

- **Routes:** your risk assessment should determine the escape routes required, which must be kept available and unobstructed;
- **Alternatives:** well-separated alternative ways to ground level should be provided where possible;
- **Protection:** routes can be protected by installing permanent fire separation and fire doors as soon as possible;
- **Assembly:** make sure escape routes give access to a safe place where people can assemble and be accounted for. On a small site the pavement outside may be adequate; and

- **Signs:** will be needed if people are not familiar with the escape routes. Lighting should be provided for enclosed escape routes and emergency lighting may be required.

Means of Giving Warning

Set up a system to alert people on site. This may be temporary or permanent mains operated fire alarm (tested regularly), a klaxon, an air horn or a whistle, depending on the size and complexity of the site.

The warning needs to be distinctive, audible above other noise and recognizable by everyone.

Means of Fighting Fire

Fire extinguishers should be located at identified fire points around the site. The extinguishers should be appropriate to the nature of the potential fire:

- Wood, paper and cloth – water extinguisher;
- Flammable liquids – dry powder or foam extinguisher;
- Electrical – carbon dioxide (CO₂) extinguisher.

Nominated people should be trained in how to use extinguishers.

Process Fire Risks

The Regulatory Reform (Fire Safety) and National Building Code sets out the law on construction site general fire safety, including means of escape.

The CDM Regulations 2015 also impose duties including the requirement to prevent risk from fire. The fire risk from site activities must be assessed and precautions taken to control:

- **Combustible material** – the quantity of combustible materials on site should be kept to the minimum and all such materials safely stored and used.
- **Ignition sources** – action is needed to eliminate, reduce and control ignition sources on site.
- Construction of timber frame buildings will require significant additional measures to those outlined here. You should refer to the specific guidance listed in Resources, below.

A) Combustible material

Many solids, liquids and gases can catch fire and burn. It only takes a source of ignition, which may be a small flame or an electrical spark, together with air. Preventive actions that can be taken include:

- **Quantity:** fire risk can be reduced by controlling the amount of combustible material in the work area until it is needed;
- **Flammability:** it may be possible to specify materials that are less combustible. Remember that when worked on, materials may become more easily ignited e.g. solids turned to dust or crumb;
- **Storage:** combustible materials should ideally be stored outside buildings under construction, especially volatile materials e.g. LPG. Internal storage must be planned and located where it will not put workers at risk;
- **Rubbish:** good housekeeping and site tidiness are important to prevent fire and to ensure that emergency routes do not become obstructed;
- **Volatile flammable materials:** extra precautions are needed for flammable liquids, gases and oxygen cylinders especially when internally stored;
- **Coverings and sheeting:** protective coverings and scaffold sheeting may add to fire risk. This can be reduced by use of flame retardant materials;
- **Tanks and services:** demolition projects can involve an increased risk of fire and explosion. Dismantling of tank structures may cause ignition of flammable residues or disruption and ignition of buried gas services.
- **Ignition sources:** It is important that you take action to control ignition sources including:
- **Hot work:** all hot work generating heat, sparks or flame can cause a fire.

Precautions include:

- Clearing the area of combustible materials;
- Suitable fire extinguishers; and
- maintaining a careful watch throughout the work.
- A permit to work (PTW) system can help manage the risk on larger projects.



Up gradation of existing CETP from 4 MLD to 10 MLD capacity at Kundli, Sonipat, Haryana	
Promoter: HSIIDC Industrial Estates	Risk Assessment & Hazard Identification

- Plant and equipment: select electrical and engine driven plant of suitable capacity to prevent overheating. Fasten lamps to a solid backing and, if mounted on tripods, make sure the tripod is stable. Electrical equipment in flammable atmospheres must be suitable for the nature and extent of the flammable atmosphere;
- Smoking: bring the rules on smoking to the attention of all workers and visitors to the site and enforce them;
- Electrical installations: should be of sufficient capacity for the intended use and designed, installed, inspected and maintained by competent people;

A) Event Classification and Modes of Failure

Component failures are the initiating events for the failure scenarios, which can escalate to consequences like fires, explosions and equipment damage. Eventual failures could be in the form of small gasket leaks in a flange joint or guillotine failure of a pipeline or even rupture / catastrophic failure of equipment. Major failure modes identified in this project are:

- Pipeline - small/large leaks;
- Storage tank - small/large leaks


B) Power Failure / Load Shedding

Operational difficulties may be experienced at CETP plant when there will be power failure. Since, there is a provision made for DG sets for running plant during power failure, there will not be significant effect on the treatment efficiency of the CETP.

Two D G sets of cumulative capacity 300 KVA (200 kVA and 100 kVA) are installed in existing unit. Additional one DG set of capacity 500 kVA will be provided during power failure or load shedding period, which would reduce the chances of inadequate treatment of the effluent.

Training programme for plant operation and maintenance activities have been included as part of the project's technical assistance programme.

Health & Safety Measures

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During the operation of CETP and during handling chemicals, a practice of preventive and protective maintenance will be adopted to take care of employee's health. The various safety equipments like breathing apparatus, gum boots, goggles and helmet will be provided to the workers/operators. Besides, all the first aid, firefighting devices will also be inspected, tested and maintained all the time in ready to use condition.

Health of all the employees in plant area will be regularly monitored by the physician. If any abnormality is found, necessary treatment will be given from time to time. Necessary of the safety measures proposed to be carried out to ensure prevention of occupational hazards is delineated below.

- Safety equipments and fittings for handling of chemicals.
- Housekeeping of the plant as per prescribed norms. Floors, platforms, staircases, passages will be kept free of any obstruction.
- All operations will be explained to the workers. They will be periodically trained on the processes.
- Should impart safety training to the employees engaged.
- Only authorized persons will be allowed inside the plant.
- All instruments and safety devices will be checked and calibrated during installation and at frequent intervals.
- All electrical equipments will be installed as per prescribed standards.
- All the equipments of the plant will be periodically tested as per standard and results will be documented. All equipments will undergo preventive maintenance schedule.
- Number of fire extinguishers will be installed at different locations within premises.
- Adequate ventilation arrangement will be provided for safe and better working in the plant as per the standard.
- Sufficient access for firefighting will be provided in the plant.
- Protection against lightning will be taken care in the plant

Disaster Management Plan

An accident is an unplanned event which has a probability of causing personal injury or property damage or both. It may result in physical harm (injury of disease) to personnel

and also damage to property, loss to the company, a new miss or combination of these effects.

Major accident

It will be a sudden, unexpected, unplanned event, resulting from uncontrolled developments during an industrial activity, which causes, or has the potential to cause;

- Serious adverse effect immediately or delayed (death, injuries, poisoning or hospitalization) to number of people inside the installation and/or to persons outside the establishments or,
- Significant damage to crops, plant or animals, or significant contamination of land, water or air or,
- An emergency intervention outside the establishment (ex. Evacuation of local population, stopping of local traffic) or,
- Significant changes in the process operating conditions, such as stoppage or suspension or normal work in the concerned plan for a significant period of time, or
- Any combination of above effects.

Emergency

It could be defined as any situation which presents a threat of safety of persons or/and property. It may require outside help also. Emergency due to operating conditions (small fire, spill, failure of power, water, air etc.) and which can be locally handled by plant personnel alone (without outside help) will be considered as emergency.

Objectives of the On Site Emergency Plan

1. To define & assess emergencies, including risk & environment impact assessment.
2. To control & contain incidents.
3. To safeguard employees, visitors & other people in the vicinity.
4. To minimize damage to property &/or the environment.
5. To inform employees, the general public and the authorities about the hazards/ risk assessed safeguard provided residual risk if any and the role to be played by them in the vent of emergency.

6. To be ready for the mutual aid if need rises to help the neighboring unit. Normal jurisdiction of an OEP(on-site emergency plan) will the own premises only, but looking to the time factor in the arriving the external help of off-side plan agency, the jurisdiction must be extended outside to the extent possible in case of emergency occurring outside.
7. To inform authorities and mutual aid centers to come for help.
8. To affect rescue and treatment of casualties to count injured.
9. To identify and list any dead.
10. To inform and help relatives.
11. To secure the safe rehabilitation of affected area and to restore normalcy.
12. To provide authoritative information to the news media.
13. To preserve records, equipments, etc., and to organize investigation into the cause of the emergency and preventive measure to stop its recurrence.
14. To ensure safely of the works before personnel re-enter and resume work.
15. To work out a plan with all provisions to handle emergencies and to provide for emergency preparedness and the periodical rehearsal of the plan.

In order to meet the above objectives, detailed procedure for handling On Site Emergency has been prepared, which will intended to cover all foreseeable eventualities even those leading to the evacuation of the site.

Emergency Organization

No plan will succeed without effective emergency organization. Key personnel to combat emergency should be nominated with specific responsibilities according to the set procedures and making the best use of the resources available with different department and to avoid confusion. Respective department's key personnel are important part to combat emergency as part of organization. Such key personnel include Incident controller, Site main controller, Communication officer, messenger, Essential workers etc. Assembly point for non essential workmen, occupational health center, emergency control room, firefighting arrangement, first aid arrangement and other arrangement and persons to manage them and also important part of emergency organization. Other key personnel will be required to provide advice to and implement the decisions made by the

Site Main Controller (SMC) in the light of information received on the developing situation at the emergency. Such key personnel (i.e. Fire fighters, First-Aider, Emergency rescue, Communication officer, messenger, security people, P&A officer etc.) will included from various department. All key personnel will responded on instruction given by Site Main Controller / Incident Controller. Their roles and responsibilities will mention bellow;

Incident Controller (IC)

Responsibility of Incident Controller

- Rush to accident site, ask field person to close the required valves.
- Inform control room from field to take required action.
- Take charge at the scene of incident and assess the scale of emergency.
- Decide for continuing the operation of the plant.
- Decide the need of external help.
- Ensure that outside emergency services have been called in.
- Ensure that SMC and Key personnel have been called in.
- Direct firefighting operations to internal as well as external agencies

Deputy Incident Controller (Dy. LC)


Responsibility of Dy. Incident Controller

- Immediately reach at the scene of Incident and help IC
- Will act as IC in his absence
- Will ensure about the emergency internal communication to utilities, security, effluent plant & other departments
- Will act as a link with ECC (SMC) and IC (Accident Site)
- Arrange for any control devices to stop the leakage

Site Main Controller (SMC)

Responsibility of Site Main Controller

- In consultation with IC will declare major emergency.
- Ensure for mutual aid help to neighboring industries.

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- Will direct key personnel for transportation, evacuation, medical help, traffic control help.
- Will appraise government and statutory authorities
- Take actions for rehabilitation of victims at hospitals

Key Personnel (KP)

Responsibility of KP

- Individual key person will act in his respective pre-assigned duties to help control emergency.
- Come at site with all required equipments and gadgets.
- Will take other directives from IC and SMC

Essential Workers (EW)

Responsibility of EW

- On hearing the siren, will rush to the scene of incident to take directives from IC
- Help in Fire Fighting, First Aid and other work
- Check the wind direction & rush to the scene of incident with personal protective equipment

Fire & Security Team

Responsibility of Fire Fighter

- Team consists of employees on duty in general shift/ shifts.
- Will rush to the scene of incident immediately after sounding the siren
- Help to control emergency & fire.
- Confirm about emergency on telephone.
- Direct outside services to the scene.

First Aid Team

Responsibility of First Aid Team

- On hearing the siren, send vehicle in the plant.
- Be prepared for any causality to treat.
- Inform medical officer about emergency & probable causalities

Telephone Operator

Responsibility of Telephone Operator

- Keeping ready the forms for recording telephone directory and list of important telephone numbers
- Informing SMC/IC if they will not on site. Operating mobile system to inform SMC & Key Personals.
- Contacting and giving message about emergency to these needed at site without waiting.
- Being precise, sharp, attentive and quick in noting down the message.
- Inform External Agencies for the required aid on Hot Lines/ Wireless communication system.

Non- Essential Workers

Responsibility of Non-Essential Workers

- Take instructions from shift in-charge for the plant activities.
- Assemble at assembly point if situation demands.
- Do not get panic.
- Do not obstruct any activity being done for controlling emergency.
- Do not engage any phone to know about emergency.
- Be alert to hear instructions from speakers/ loud phones

a) Major Emergency

Major Emergency could be defined as any situation which may affect several departments within and/ or may cause serious injuries, loss of life, extensive damage to

property of serious disruption outside the work. It will require the use of outside resources to handle it effectively.

Usually the result of a malfunction of the normal operating procedure, it may also be participated by the intervention of an outside agency, such as severe electrical storm, flooding, crashed aircraft or deliberate acts of arson or sabotage.

b) Disaster

It will be a catastrophic situation in which the day to day patterns of life are, in many instances, suddenly disrupted and people are plunged into helplessness, suffering and as a result need protection, clothing, shelter, medical & social care and other necessities of life such as: Disaster resulting from natural phenomena like earthquakes, volcanic eruptions, storm, surges, cyclones, tropical storms, floods, landslides, forest fires and massive insect infestation. Also in this group, violent drought which will cause a creeping disaster leading to famine disease and death must be included.

Second group includes disastrous events occasioned by man or by man's impact upon the environment, such as armed conflict, industrial accidents, fires, explosions and escape of toxic gases or chemical substances, rivers, pollution, mining / deep excavations or other structural collapse, air, sea, rail and road transport accident, aircraft crashes, collisions of carrying inflammable liquids, oil spills at sea and dam failures.


c) Risk

The likelihood of an undesired event (i.e. accident, injury or death) occurring within a specified period or under specified circumstances. It may be either a frequency or a probability depending on the circumstances.

d) Hazard

Hazard is a physical situation which may cause human injury, damage to property or the environmental or combination of these criteria.

HAZARD DURING CONSTRUCTION & OPERATION

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Increased urban development and requirements for strict control of the quality of effluents discharged into streams, rivers, estuaries and coastal water has led to the need to set up individual wastewater/effluent treatment plant and common effluent treatment plants.

The wastewater treatment ranks of industrial occupations where on-the-job injuries are frequent. The wastewater treatment plant operators are exposed to a variety of hazardous chemical agents contained within the effluent and the reagents used in the water processing or generated during the wastewater treatment which may cause poisoning and a number of ailments in the operators.

The operators are also exposed to hazards related to work in confined spaces, which include electric shocks, explosions, entanglement in moving machinery, etc Against natural calamities like floods, earthquakes, lightening, possible accidental hazards Fire & explosion hazards – Electricity – Slips, trips and falls at work; chemical hazards, biological hazards and ergonomic, psychological and organization factors and the preventive measures required in common effluent treatment plants.

Risk and Hazard during Construction:

Excavation: Any person-made cut, cavity, trench depression in an earth surface, formed by earth Trench:

A narrow excavation with its depth greater than width, but the width at the bottom is not greater than top.

Competent Person: One who is capable of identifying existing and predictable hazards in the surrounding working conditions that are unsanitary, hazardous and dangerous Hazards

- Excavation cave-ins
- Underground and overhead utilities
- Materials falling into excavations
- Hazardous atmosphere of work.
- Vehicle movement and equipment operation
- Water accumulation.

- No protective system
- Ladder is not angled working height (vertical)
- Poor housekeeping
- The excavated soil is close to the edge and not retained to prevent from falling into the trench/excavated area.
- Overnight rain can make excavated area unsafe.

Hazards of Mechanized Excavators

- Struck by vehicle
- Blind spot
- Toppling of the equipment
- Contact with power transmission

Basic Safety Requirements

- Sloping or benching for excavations deeper shall be designed.
- Means of access/egress (ladder) required if it is 4 feet deep or more.
- Spoil dirt must remain at least 1 meter from of the trench/excavation.
- Trench/ Excavations are to be identified and barricaded.
- Personnel are not permitted to work in trench excavations where water is accumulating.
- Fall Protection is required for walkways over deeper than 2 feet.
- Identification, isolation, protection of underground utilities and structures nearby to be taken care.

Electrical safety in construction

The law says you must take precautions against the risk of death or injury from electricity. Electrical equipment must be safe, and properly maintained. Only in exceptional circumstances should work be carried out on live systems, and then only by a competent authorized person.

- Electrical systems in buildings - Refurbishment work in buildings presents the greatest risk and must be planned, managed and monitored to ensure that workers are not exposed to risk from electricity.

- Overhead power lines - Any work near electric overhead power lines must be carefully planned and carried out to avoid danger from accidental contact or close proximity to the lines.
- Underground cables - Damage to underground electrical cables can cause fatal or severe injury you must take precautions to avoid danger. These precautions include a safe system of work based on planning, use of plans, cable locating devices and safe digging practices.

Personal Protective Equipment (PPE)

Always wear the proper gloves when working with acids. Neoprene and rubber gloves are effective against most acids and bases. Polyvinyl chloride (PVC) is also effective for most acids. A rubber coated apron and goggles should also be worn. If splashing is likely to occur, wear a face shield over the goggles. Always use corrosives in a chemical fume hood.

While planning the list of PPE, the following types of situations should be catered for:

1. Impact / Penetration / Compression while doing maintenance tasks
2. Chemical Handling
3. Heat/cold and wetting
4. Harmful dust
5. Oxygen deficiency
6. Obnoxious odours of decomposing matter
7. Hydrogen Sulphide presence
8. Light (optical) radiation
9. Biological exposure from raw / treated effluents and sludge handling
10. Noise of machines and vibrations.
11. Electric shock
12. Rain / Storm

Checklist for PPE

1. Safety Boots with non-skid soles and Steel Toes.
2. Electrical Hazard safety Toe shoes



3. Gas Masks and Face Shields
4. Oxygen meters for ascertaining type of atmosphere in a confined area.
5. Single-use Ear Plugs / Ear-muffs
6. Safety Goggles
7. Helmets / Hard Hats
8. Latex Rubber/ Butyl Rubber/ Fabric / Chemical Resistant Gloves
9. Overall Clothing
10. Safety Belts
12. First Aid Box
13. Fire extinguishers
14. Respiratory Protective mask with man pack cylinders

**DO'S & DONT'S FOR HANDLING OF CHEMICALS, MATERIAL HANDLING,
FIRE PREVENTION AND HOUSEKEEPING**



Handling of Chemicals

Do's	Don'ts
<ul style="list-style-type: none"> • Know the hazards of the chemical before handling. • Know the antidotes for chemical, which you are handling. • Do keep material safety data sheet in locations where chemicals are being handled and study it. • Use appropriate personal protective equipment like gloves, aprons, and respirator; face shield etc. depending upon nature of the work. • Label every chemical that you use and tightly close the container. • Use eye wash fountain / safety shower in case of splash of chemicals in the eye or body for at least 15 minutes. • Segregate toxic, flammable chemicals and keep them under control. • In addition to draining and closing valves, lines should be blanked before taking up maintenance work. • Provide proper ventilation at the chemical handling area to limit their concentration within prescribed level. 	<ul style="list-style-type: none"> • Do not store the chemicals that are incompatible with other chemicals. • Do not spill the chemicals. • Do not dispose chemical without neutralizing. • Do not keep large inventory of chemicals. • Do not allow empty containers of hazardous chemicals to be used by others. • Do not use compressed air for transferring chemicals. • Do not stand near chemical transfer pump while it is in operation with temporary hose connection. • Pouring of chemicals by hand or doing siphoning by mouth should never be adopted. • Chemicals drums should never be moved without protection. • Do not attempt to neutralize the acid / alkali on the skin. Use water only. • Do not use solvent for cleaning hands.



Fire Prevention

Do's	Don'ts
<ul style="list-style-type: none"> Follow 'NO SMOKING' signs. Deposit oily rags and waste combustible material in the identified containers and dispose them suitably. Fire Hose used for any other purpose should be permanently marked and taken out of fire hydrant system. Keep minimum inventory of flammable and combustible substances. Take permission before breaking or removal of fire barrier and ensure subsequent relocation of fire barrier. Check periodically the operability of fixed fire fighting system. Attend any abnormality / deficiency with fire protection system promptly. Provide earthing or bonding to prevent accumulation of static charges to tanks where flammable chemicals are stored / handled. Use instruments that are intrinsically safe in explosive atmosphere. 	<ul style="list-style-type: none"> Do not leave flammable material like acetone, kerosene etc. used as cleaning agent at the work area. Do not over tighten fire hydrant valves with P-lever. Do not allow wild grass growth around storage of the gas cylinders and switchyard. Do not obstruct accessibility to the fire related equipment. Do not destroy the inspection tag provided with the fire equipment. Do not misuse fire-fighting equipment other than intended purpose. Do not store the flammable material in the open container. Do not use instruments that are not intrinsically safe in the explosive atmosphere.



Material Handling

Do's	Don'ts
<ul style="list-style-type: none"> • Use proper lifting tool and tackle having adequate capacity. • Only authorized persons should operate material handling equipments. • Each tool, tackle or equipment should have number and safe working load (SWL) marked on it. • Assess weight of the material, distance to be carried and hazards etc. before lifting the load. • Inspect and test all the lifting tools and tackles regularly as per Factory Rules. • Wear Personal Protective Equipments while handling of material. • Wherever possible, mechanized material handling shall be adopted. • While lifting a load physically, keep the load as near as possible to the body with feet properly placed for body balance. • Bend knees, keep back straight, keep the load closed to the body and lift the load. 	<ul style="list-style-type: none"> • Do not use the equipment for the purpose other than its design intention. • Do not allow personnel to move underneath lifted load. • Do not load the equipment above its safe working load. • Do not use makeshift arrangements for lifting equipment without inspection and test. • Do not use defective tool and tackles. • Keep the tools & tackles free from adverse effect of atmosphere by applying suitable protective coating. • The angle between the legs of two leg sling should not exceed 90 degree. • Do not allow male and female adult to lift a load manually higher than 55 kgs and 30 kgs respectively. • Do not hold the load with tip of the fingers; grasp the load firmly with palm.



House Keeping

Do's	Don'ts
<ul style="list-style-type: none"> • Assign places for everything and maintain things at assigned places. • Clean the area after completion of work. • Use aisle space free for personnel and material movement. • Ensure adequate illumination and ventilation for the job. • Drop paper, plastic, glass, metal and bio-medical waste in a separate bin kept for this purpose. • Know the location where emergency equipment such as first aid box, fire fighting equipment, SCBA, Stretchers are kept. • Arrest all types of spills such as chemical, water, oil, air / gas, steam etc. and clean up the area immediately. • Ensure exits are indicated / painted for use during emergency. 	<ul style="list-style-type: none"> • Do not leave combustible materials in the work area. • Do not smoke in the area of work. • Do not allow dust bin to overflow. • Do not generate extra waste. • Do not disturb the safety equipment from assigned location. • Do not block emergency switches and on/off switches of the equipment by storing of materials in front of work. • Do not leave cleaning agent like acetone, isopropyl alcohol, kerosene etc. at the work area after completion of work. • Do not block fire exit point by storing materials or by means. • Do not leave a spillage unattended.

Conclusion

Risk assessment should be carried out in order to identify the needs in handling these hazards. Risk assessment shall include: Identifying the possible hazards` The Receptors who would be harmed because of the hazards` Adequacy of the existing precautionary measures` Reviewing and revising the assessment from time to time` Identifying the greater risk of damage` based on Recognize, Evaluate and Control. In evaluation we have to adopt both Qualitative and Quantitative Analysis.

To adopt Japanese PDCA model this insists us to

PLAN

DO



CORRECT

ACT

Testing the electrical appliances regularly .After completion of risk assessment, following findings can be used for reducing the risks.

Safe installation of electrical appliances as per standards.

- Use of safe and suitable equipments for the working environment
- Provision for safety devices for detecting faults
- Preventive maintenance by testing the equipments and visual inspection
- Safe working conditions considering underground power cables overhead power lines

These are the most common causes of non-fatal injuries at work but may cost workers heavily. Slip and trip hazards can be reduced through good health and safety arrangements of the workers/employers.

There should be adequate information on appropriate use of the safety equipments provided. A good management system for health and safety shall include: planning for minimizing or removing risks by identifying the risk areas organization setup with responsibilities to ensure safe working conditions control on working practices and processes by record keeping and maintenance to ensure good health and safety monitoring and reviewing the reports regularly based on experience and improving the existing conditions. good working practices by choosing suitable floor surfaces, lighting levels, provision for footwear, removing obstructions, warn signs, etc.

Chemical hazards Sources of chemical hazards can be exposure to chemicals and toxic effects of chemicals. Exposure to chemicals .The heaviest exposure to some chemicals often occurs during industrial activities. The four main exposure routes where chemicals enter the body are through inhalation (breathing), absorption (skin or eye), ingestion (swallowing, eating) and Accidental.

Most of the chemicals in the workplace have the potential to be dispersed into the air as dust, droplets or as gas or vapor or inhalation. The most important routes of exposure in the workplace leading to systemic effects are inhalation and skin absorption. Also, ingestion is a potential source through contaminated food or drink in the workplace.

Toxic effects of chemicals. The toxicity in chemicals may poison the body of the person exposed. The toxic chemical exposure may lead to acute, chronic, reversible, irreversible, local, systematic and synergism effect. The toxicity of chemicals can be classified as corrosive, irritant, sensitizer, asphyxiant, carcinogen, mutagen, teratogen and fetotoxicant. To avoid these toxic risk assessment should be carried out which involves identification of hazard based on chemicals of concern, adverse effects, target populations, risk characterization, assessing, exposure and estimating the risk.

Develop material safety data sheets (MSDS) for all the chemicals used in the workplace – Ensure whether chemical products clearly indicate their harmful effects and provide guidance on how to use the products as safely as possible – Instruct workers on labels and MSDS – Workers should have the right to refuse to work with chemicals which does not have safety information about the chemical To prevent, control or eliminate the risk – all the workers are required to implement effective safety procedures for protection against chemical hazards agreed jointly by employer and workers through – Regular inspections with standard checklists for particular chemicals and chemical processes.

Substitution

The most effective way is to remove the chemical entirely and replace it with less hazardous chemical, wherever possible. Similarly, dangerous processes can also be substituted to avoid the production of toxic intermediates.

Engineering controls

In case, the chemical hazard cannot be removed from the workplace by substitution then the best solution is to physically enclose the hazard to prevent it from coming into contact with either workers or the environment. Dilute or local exhaust ventilation systems can be used to remove contaminated air from the workplace.

Biological hazards: Exposure to wastewater may result in number of illnesses when entered into the body. Some of these illnesses are: Gastroenteritis – Cramping stomach pain, diarrhea and vomiting.



As the micro-organisms are inherent in wastewater they cannot be removed or eliminated. However, exposure to wastewater can be minimized to avoid these biological hazards. The following measures can be taken to reduce risk of infection and illness: Awareness on risks through instructions, training and supervision use of personal protective equipment such as water proof gloves, footwear, eye and respiratory protection, face visors, etc. workers should be of 20 to 50 years age group and must not have asthma and tuberculosis provide the workers with adequate welfare facilities such as clean water, soaps, disposable paper towels, showers, etc. Inspection and maintenance of safety equipments provision for adequate first aid facilities effective arrangements for monitoring health and safety. Ergonomic and psychological hazards: These hazards can be raised due to stress during work. Some of the problems which may lead to stress are: Boring job repetitive job too little or too much work to do too little time too little or too much training for the job selecting right person to fit into the task poor relationship with others bullying, racial or sexual harassment inflexible work schedules poor physical working conditions lack of communication and consultation lack of support for individuals to develop their skills lack of control over work activities negative work culture. These hazards can be minimized by following measures: clarity in defined objectives and responsibilities of an individual linked to business objectives selection of appropriate person for the assigned tasks prioritizing the jobs, training the individuals based on interpersonal skills and increasing the scope of work for the trained increase the variety of tasks rearrange people between the jobs in order not to get bored with the single task working in group to improve the performance setting up of an effective system to prevent and stop harassments working in shifts to ensure flexible working hours provision for regular health checkups provision for adequate control measures opportunity to contribute individual ideas in planning and organizing the jobs introducing clear business objectives, good communications and employee involvement particularly during period of change any individual should be honest and respect others support the individuals to develop their skills.

Hazardous air pollution Solvents in huge quantities are used in pharmaceutical, chemical, dyes & dye intermediate units. The recovery and reuse of these solvents in such units is



very poor because of the indigenous technology, equipment adds to pollution load in CETP.

Especially in connection with high levels of fine particulates, noxious gases like methane, CO₂, SO₂ and NO_x can lead to respiratory diseases. The duration of exposure is decisive. Injurious heavy metals (e.g., lead, mercury and cadmium) can enter the food chain and, hence, the human organism by way of drinking water and vegetable and animal products. Climatic changes such as warming and acidification of surface waters, forest depletion, etc., can occur due to acid rain and/or the greenhouse effect of methane and CO₂ and other trace gases can have long-term detrimental effects on human health. Similarly important are the effects of climatic changes on agriculture and forestry (and thus on people's standard of living), e.g., large-scale shifts of cultivation to other regions and/or deterioration of crop yields due to climate change impacts.

In view of the above we have to have to avoid/mitigate the Risk and hazard both during construction phase and operational phase of common Effluent treatment plant we have to adopt 3E system which is basically Engineering Control- for sound engineering Education and training- To improve awareness Enforcement- to follow statute and also maintain discipline.

