

**DRAFT ELECTRICAL SAFETY MANUAL**

**AND**

**GENERAL SAFETY INSTRUCTIONS**

**FOR**

**GENERATION WING**



**HIMACHAL PRADESH STATE ELECTRICITY BOARD  
LIMITED**

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# **CHAPTER-1**

## **Safety Policy and Fundamentals of Safety**

### **Safety Policy:**

HPSEBL is committed to provide a safe working place under the environment to its authorized staff and other stakeholders as an integral part of its business philosophy and values. All work shall be carried out with utmost care, giving due consideration to safety; which shall not be compromised under any circumstance.

We will make safety a top-of-the-mind matter for all authorized staff and will integrate it with all business processes through an Integrated Safety Management approach, which focuses on People, processes, Systems, Technology and Facilities, supported by demonstrated leadership and authorized staff commitment at all levels as the prime drivers.

We believe that accidents and risks to health are preventable through a continual improvement in Working environment and the involvement of all authorized staff in creating a Safe, Healthy & Accident-free work place for themselves and the society at large.

To this effect we will also enhance the awareness, skill and competent level of our authorized staff.

### **Fundamentals of Safety:**

#### **1.1 Safety:-**

Safety is the proper planning of work, proper usage of safety tools, following safety procedures and exercise of good judgment and intelligent supervision. Experience proves that majority of the accidents are preventable. Prevention or accidents requires the whole hearted co-operation of all authorized staff and supervising engineering officers of the organization. Capable, mentally alert authorized staff and engineers will avoid accidents.

An unsafe man is a liability to the organization. He is a danger to himself, his fellow workers and the public and the company. Accidents Do Not "Just Happen". Accidents are the result of unsafe conditions or unsafe acts or a combination of both operating without authority.

#### **1.2 Unsafe Acts:**

Accident occurs due to

- Non adherence of the safety rules.
- Non usage of proper safety gadgets for the specific work.

##### **1.2.1 Non-adherence of the safety rules**

These are due to the fault of the authorized staff and engineers engaged in the work which may cause accident such as:

- Opening and closing of switches without authority or warning, operating hoists and trucks without warning, failure to place warning signs or signals where needed.
- Making safety devices inoperative.
- Using unsafe equipment. Wrong tools for the job or using hands instead of hand tools
- Working on live electrical equipment that could conveniently be de-energized.
- Taking unsafe position or posture too close to opening and lifting while in awkward position (riding on running boards or other unsafe places of vehicles).
- Distracting, teasing, practical joking, horseplay, quarrelling or annoying.
- Failure to use safe clothing or protective equipment such as failure to use rubber gloves, safety belts, helmet on energized equipment.
- Ask subordinate to supervise the work & leave the site.

### **1.2.2 Non usage of proper safety devices: -**

Failure to use safe clothing or protective equipment such as wearing loose sleeves neckties or jewellery near rotating machinery. Failure to use rubber gloves on energized equipment and failure to use goggles, Helmet, Gas masks. Respirator, safety belt, ladders or gloves when necessary.

### **1.2.3 Unsafe Conditions:**

These are the conditions that may result in the Fatal or Non-Fatal accidents. Some of which are as follows:

- Unguarded equipment and bare conductor carrying power at various voltages particularly at road crossings and public places.
- Use of defective material or equipment such as poorly constructed scaffolding, broken ladder, torn gloves, torn tools and safety devices.
- Improper illumination such as insufficient light or unsuitable location producing glare or objectionable shadows.
- Unsafe design and construction such as poor supporting structures like poles platforms having low safety factors and their construction and design in general not having required safety features.
- Poor Earthing of equipment lines and absence of continuous earth wire on electric overhead line.
- Non-explaining of anticipated hazards to the workers.
- Power cable for lighting / air compressor / air conditioner being run together with Common switch box 3rd with less capacity switches.
- Sacrificing safety for speed.
- Control cable and power cable running together.
- The authorized staff and engineer-in-charge of work failing to ensure that the power mains & the apparatus are free from dangerous leakage or induction and has been effectively earthed locally before permitting men to work upon it.
- Failure to place warning boards by the authorized staff and Sub-Station staff-in-charge on all switchgear before men are permitted to work which should only be removed by the authorized staff who has placed them. It is desirable that the authorized staff issuing the permit shall place one warning board on the switch energizing the mains for each permit issued so that he can be sure that all the permits-to-work are returned when he has to charge the mains.
- Visitors and unauthorized persons shall not be allowed in the vicinity of live mains and apparatus, unless accompanied by an authorized staff and it shall be the responsibility of the authorized staff to ensure that instructions regarding safety are strictly complied with.

### **1.2.3 Handling of heavy objects and Storage:**

- Authorized staff shall not attempt to lift and stretch beyond their capacity. Necessary assistance should be obtained if it is inevitable or use equipment like crane, lifting shackles. Pulley blocks etc.
- Extra care should be exercised during lowering and lifting when two or more authorized staff carry heavy objects.
- Authorized staff should avoid twisting or excessive bending when lifting or setting down loads.
- Pushing should be resorted when moving a load horizontally rather than pulling it.
- Gripping, grasping and lifting with just the thumb and index finger should be avoided and whole hand and all the fingers should be used.
- Storage of materials and equipment closer to energized lines or exposed energized parts of equipment should be avoided. If it becomes necessary, it should be stored, keeping the safe clearance into account of the system voltage, sag, side swing etc., so that under no circumstances there will be any chance of the stored material coming into contact with the live lines.

## CHAPTER-2

### Definitions/Terms

#### **2.1 Authorized Person:**

One who is properly authorized to perform specific duties under certain conditions or who is carrying out order from competent authority.

#### **2.2 Authorized Staff:**

One who receives salary and other benefits from the company from time to time and authorized by competent Engineer to work at licensee's Generation system.

#### **2.3 Clearance (for work):**

Authorization to perform a specified work or permission to enter a restricted area.

#### **2.4 Clearance (between objects):**

The clear distance between two objects measured surface-to-surface.

#### **2.5 Dead:**

Dead means at or about earth potential and disconnected from any live system. Provided that the apparatus separated from a live conductor by a spark gap shall not be deemed to be DEAD.

**Note:** The term Dead is used only with reference to the current carrying parts, when there parts are not alive.

#### **2.6 De-Energized:**

Free from any electrical connection to a source of potential difference and from electric charge; not having a potential difference from that of the earth.

#### **2.7 Disconnected:**

Disconnected from any energy source.

#### **2.8 Earth:**

Earth means the conducting mass of earth or of a conductor /strip / wire connected to it through very small impedance.

#### **2.9 Earthed:**

Earthed means connected with the general mass of earth in such manner as to ensure at all times as immediate discharge of electricity without danger.

#### **2.10 Earthing System:**

Earthing system means an electrical system in which all the conductors and appliances are earthed.

#### **2.11 Electric System:**

The generation, transmission, distribution and other facilities operated by an electric utility or a portion thereof.

#### **2.12 Electrical Equipment:**

It means all the electrical apparatus pertaining to the Generation and sub-transmission, utilization of electrical energy.

#### **2.13 Emergency:**

Emergency means the occurrence of a condition occur that may endanger life & property.

#### **2.14 Guarded:**

Guarded means covered, shielded, lanced or otherwise protected by means of suitable casings, rails or metals screens to remove the possibility of dangerous contact or objects at a point of danger.

**2.15 Hazard:**

It is any unsafe act or unsafe condition that may lead to injury of persons or damage to property.

**2.16 Isolated:**

Isolated means physically disconnected from all the supply sources.

**2.17 Installation:**

It means any composite electrical unit used for the purpose of generating, transforming, transmitting, converting, distributing or utilization of electricity.

**2.18 Live:**

Live means electrically charged.

**2.19 Mesh voltage:**

The maximum touch voltage within a mesh of a ground grid.

**2.20 Permit to Work:**

Permit to work is a form of affirmation issued by an authorized person to another authorized person/ authorized staff (Generation) to carry out work on the electrical apparatus and lines / equipment in normal and break down conditions. The authorized staff working on electrical equipment should ensure that the lines are dead and earthed for safe working conditions.

**2.21 Safety Devices:**

Safety devices are the equipment designed for the protection of workmen and the Electric system such as Rubber Gloves, Safety Belts, Fire extinguisher, etc.

**2.22 Step voltage:**

The difference in surface potential experienced by a person bridging a distance of one meter between two feet without containing any other grounded objects.

**2.23 Transferred Voltage:**

It is a special case of the touch voltage where a voltage is transferred into or out of the substation from or to a remote point external to the substation site.

**2.24 Touch voltage:**

The potential difference between the ground potential rise (GPR) and the surface potential at the point where a person is standing while at the same time having a hand in contact with a grounded structure.

**2.25 Unauthorized staff:**

One who is not permitted to work on electrical apparatus, except under the supervision of an authorized staff.

**2.26 Unsafe conditions:**

Dangerous conditions, hazardous conditions, defective conditions or unusual conditions that could be conducive to accidents.

## **CHAPTER-3**

### **Statutory Requirement Pertaining to Safety**

**The Himachal Pradesh State Electricity Board was constituted on 1st September, 1971 in accordance with the provisions of Electricity Supply Act (1948) and has been reorganized as Himachal Pradesh State Electricity Board Ltd. w.e.f. 14.06.2010 under company act 1956. HPSEBL is responsible for supply of continuous & Quality power to all categories of consumers in Himachal Pradesh. It is therefore necessary to see that the:**

- I) Interest of the company (HPSEBL) and all its customers and general public are protected.
- 2) Safety precautions are taken while carrying out construction, operation and maintenance of electrical installations.
- 3) Safety of General Public, HPSEBL Employees as well as the property is kept in mind.

For observance of the above, provisions of various Acts, Regulations, Rules, standards are to be abided. The relevant Acts, rules, standards are described below.

#### **3.1 Electricity Act 2003**

##### **A) Section 53:-provisions with respect to supply generally**

##### **Provision relating to safety of electricity supply-**

The Authority may, in consultation with the state Government specify suitable measures for-

- a) Protecting the public (including the persons engaged in the generation, transmission or distribution or trading) from dangers arising from the generation, transmission or distribution or trading of electricity, or use of electricity supplied or installation, maintenance or use of any electric line or electrical plant.
- b) Eliminating or reducing the risks of personal injury to any person or damage to property of any person or interference with use of such property.
- c) Prohibiting the supply or transmission of electricity except by means of a system which conforms to the specifications as may be specified.
- d) Giving notice in the specified form to the Appropriate Commission and the Electrical Inspector, of accident and failures of supplies or transmissions of electricity.
- e) Keeping by generating company or licensee the maps, plans and sections relating to supply or transmission of electricity.
- f) Inspection of maps, plans and sections by any person authorized by it or by Electrical Inspector or by any person on payment of specified fee.
- g) Specifying action to be taken in relation to any electric line or electrical plant, or any electrical appliance under the control of a consumer for the purpose of eliminating or reducing the risks of personal injury or damage to property or interference with its use.

### **3.2 Section 73 of Electricity Act 2003**

#### **Functions and duties of Authority-**

The Authority shall perform such function and duties as central Govt. May prescribe or direct and In particular to:

- a) Advise the Central Government on the matters relating to the national electricity policy, formulate short-term and perspective plans for development of the electricity system and co-ordinate the activities of the planning agencies for the optimal utilization of resources to sub-serve the interests of the national economy and to provide reliable and affordable electricity for all consumers.
- b) Specify the technical standards for construction of electrical plants, electric lines and connectivity to the grid.
- c) Specify the safety requirements for construction, operation and maintenance of electrical plants and electric lines.
- d) Specify the Grid Standards for operation and maintenance of transmission lines.
- e) Specify the conditions for installation of meters for transmission and supply of electricity.
- f) Promote and assist in the timely completion of schemes and projects for improving and augmenting the electricity system.
- g) Promote measures for advancing the skill of persons engaged in the electricity industry.
- h) Advise the Central Government on any matter on which its advice is sought or make recommendation to that Government on any matter if, in the opinion of the Authority, the recommendation would help in improving the generation, transmission, trading, distribution and utilization of electricity.
- i) Collect and record the data concerning the generation, transmission, trading, distribution and utilization of electricity and carry out studies relating to cost, efficiency, competitiveness and such like matters.
- j) Make public from time to time the information secured under this act and provides for the publication of reports and investigations.
- k) Promote research in matters affecting the generation, transmission, distribution and trading of electricity.
- l) Carry out, or cause to be carried out, any investigation for the purpose or generating or transmitting or distributing electricity.
- m) Advise any State Government, licensees or the generating companies or such matters which shall enable them to operate and maintain the electricity system under their ownership or control in an improved manner and where necessary, in co-ordination with any other Government, licensee or the generating company owning or having tile control of another electricity system.
- n) Advise the Appropriate government and the Appropriate Commission on all technical matters relating to Generation, Transmission and Distribution of electricity.
- o) Discharge such other functions as may be provided under this act.

#### **3.3 Provision of Indian Standards:**

Provision of Indian standard vide its specifications number IS : 5216( Part 1) 1982 ( Reaffirmed 1995) “ Recommendations on safety procedures and practices in Electrical works general” and IS:5216 ( Part2) 1982 ( Reaffirmed 1995) “ Recommendations on safety procedures and practices in electrical work life saving



techniques detail out the safety instructions and precautions which every employee who may be concerned with the installation, operation and maintenance of electric lines and apparatus to be conversant with. It further expects that supply undertakings have normally to prepare a written document which should be strictly performed by the employees of undertaking while under taking the construction operation and maintenance of electric lines and apparatus.

### **3.4 Central Electricity Authority Notification**

In exercise of the power conferred by section 177 with clause (c) of section 73 of the Electricity Act 2003(36 of 2003), the Central Electricity Authority New Delhi vide notification dated 24.01 .2010. Made the regulations called "Central Electricity Authority (Safety requirements for construction, Operation and maintenance of electrical plants and electric lines), Regulations, 2011".

Important and noteworthy clauses of the notification are as under:

CL. no. 4 Safety Provisions relating to the owner.

CL. no. 5 Preparation of Safety Manual.

CL. no. 6 The appointment of Safety Officer and construction of Safety Committee.

CL no. 7 Safety provisions relating to the Contractors.

CL. no. 8 Reporting of Accidents.

CL. no. 9 Emergency Management Plan.

CL. no. 10 Medical facilities

CL. no.11 Safety Training & Awareness.

Schedule I - Minimum contents of Safety Manual for construction of electric plants & Electric lines.

Schedule II - Minimum contents of Safety Manual for operation and maintenance of electric plants & electric lines.

(Note: In Sch. I&II, generation plant is not applicable for transmission side)

Schedule III - Elements of onsite emergency plant for electrical plant/electrical lines.

### **3.5 CEA Guidelines**

Some of the important recommendations of CEA on Safety:

- Formulation of Policy on Safety.
- Defining and documenting responsibilities for all levels of functionaries.
- Preparing Safety Manuals.
- Establishing procedures to identify hazards.
- Providing adequate resources.
- Providing training for accident reporting, analysis. Investigation and recommendation of corrective actions.
- Establishing system for proper communication, documentation and record management.
- Establishing procedure for auditing of safety system.
- Establishing system for periodic monitoring and review of the Safety system by the management.
- Oversetting the performance of contractors

### **3.6 ACTS, RULES, REGULATIONS AND OTHER PUBLICATIONS APPLICABLE FOR THE PLANT/PROJECT RELATED TO SAFETY**

Sr. No.		Acts, Rules & Regulations
1	a	The Factories Act, 1948
	b	The State Factories Rules
	c	State Factories (Safety Officers) Rules
2	a	The Building & Other Construction Workers(Regulation of Employment & Conditions of Services )Act, 1996
	b	The Building & Other Construction Workers (Regulation of Employment & Conditions of Services) Central Rules,1998
	c	The Building & Other Construction Workers' Welfare Cess Rules ,1998
3	a	The Motor Vehicles Act,1988 (amended 2001)
	b	The Central Motor Vehicles Rules, 1989 (amended 2005)
4	a	The Explosives Act, 1884(amended 1983)
	b	The Explosives (Amendment) Rules, 2010 (replaces the Explosives Rules, 1983, 2005 & 2008)
	c	The Static & Mobile Pressure Vessels (unfired)Rules,1981(amended 2002)
	d	The Gas Cylinders (Amendment) Rules, 2010 (replaces the Gas Cylinders Rules, 1981 and 2004)
5	a	The Electricity Act,2003(replaces the Indian Electricity Act, 1910) (amended 2007)
	b	The Electricity Rules,2005(replaces the Electricity rule,1956 (amended 2006)
	c	Central Electricity Authority (Safety Requirements for Construction, Operation & Maintenance of Electrical Plants & Electric Lines) Regulations, 2011.
	d	Central Electricity Authority (Measures relating to Safety & Electric Supply) Regulations, 2010.
6	a	The Dangerous Machines (Regulation) Act,1983.
	b	The Dangerous Machines (Regulation) Rules, 1984.
7		The Fatal Accidents Act, 1855.
8		The Disaster Management Act, 2005.
9	a	The Environment (Protection) Act, 1986 (amended 1991)
	b	The Environment Protection Rules, 1986 (amended 2010)
	c	The Noise Pollution (Regulation and Control) Rules, 2000(amended 2010)
	d	The Batteries (Management and Handling) Rules, 2001.
	e	The Air (Prevention & Control of Pollution) Act, 1981(amended 1987)
	f	The Air (Prevention & Control of Pollution) Rules, 1982
	g	The Water (Prevention & Control of Pollution) Act, 1974(amended 1988)
	h	The Water (Prevention & Control of Pollution) Rules, 1975
	i	The Water (Prevention & Control of Pollution) Cess Act, 1977(amended 2003)
	j	The Water (Prevention & Control of Pollution)Cess Rules, 1978

#### A. OTHER PUBLICATIONS:

1. Indian Standards
2. National Building Code
3. National Electrical Code
4. Publications of National Institute of Disaster Management

**Note:** - Any replacement or amendment of the above Acts, Rules, Regulations and other publications made by the concerned authority and published in the union govt. or state govt. gazette, ordinary or extra ordinary or otherwise shall be applicable to the all establishment of HPSEBL.

## CHAPTER-4

### Responsibility Assignment

Success in implementation of safety policy in the company lies in assigning clear responsibility for safety and health.

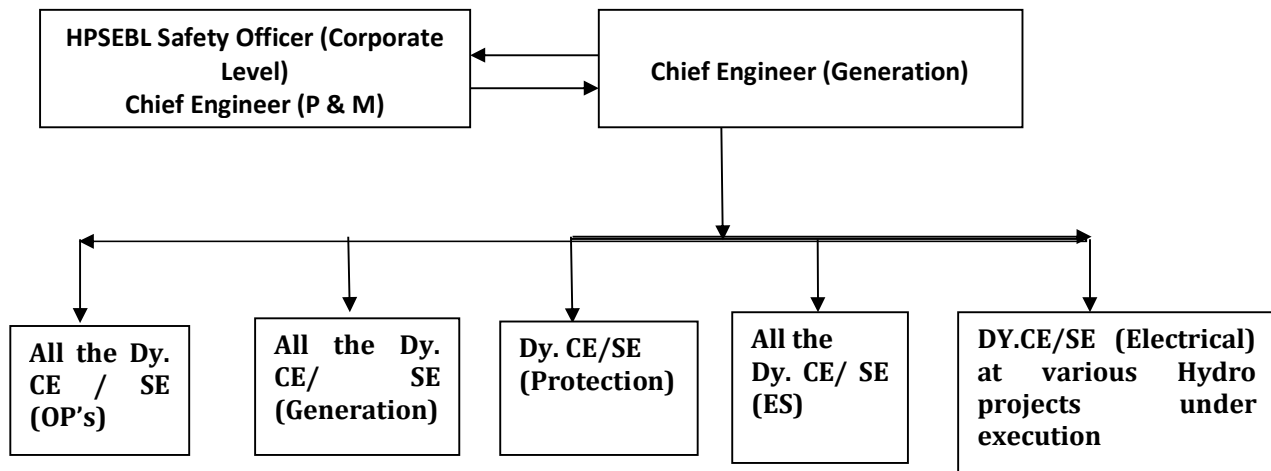
Clear assignment of responsibility as described here in after will allow each employee to know what activities and behaviors are expected of him, rather than assumption or miss interpretation of what he needs to do. Unless it is explicitly understood, it will not be possible to establish accountability for the implementation of the safety policy.

Having assessed the various activities in the company, task to be accomplished by each department is described below:

#### **4.1 Electrical Safety Officers:**

The rising trend of electrical accidents in any organization is due to safety precautions not being followed properly, besides improper maintenance of safety equipment. In HPSEBL Electric Safety officer has been nominated/designated and Safety Responsibilities has been assigned to various officers at Corporate Level as well as various Circles of HPSEBL to Implement and monitor the Safety Procedures to ensure the reduction in accidents in the organization and to minimize the loss of men and materials.

#### **HPSEBL Safety Organization Structure:**



#### **4.2 Responsibility of Chief Engineer (P & M)**

The Chief Engineer (P & M) shall be the Chief Safety Officer at the company level and his responsibilities shall be as follows:

- To check the standard and procedures set by Chief Engineer, Generation for safety in generation wing and Review the program on annual basis.
- Ensure the company's compliance with all applicable federal & local safety and health requirements.
- Ensure that the safety and health policies are comprehensive & effective.
- Promote safety & health and serve as a resource to implement safety in all power houses.
- He can suggest extra measures if required.
- Ensure that the needed financial, material and personnel resources are provided to achieve the goals and objectives of safety and health program.
- To report the progress of procedure of safety in power houses to management of HPSEBL.

#### **4.3 Responsibility of Chief Engineer (Generation):**

The Chief Engineer (Generation) shall be the Safety Officer at the Generation level and his responsibilities shall be to set a high standard and promote it for safety and health practices and healthy culture throughout the company by setting a procedure in generation wing by doing standardization of work practices to:

- Provide safe work premises.
- Identify work place hazards.
- Provide safety equipment where required.
- Demonstrate to workers how to fulfill their duties safely.
- Provide safety induction training for all new staff and necessary training to working staff.
- Take reasonable steps to avoid work place injuries.
- Assess risks and implementing measures to control them.
- Ensure that the needed financial, material and personnel resources are provided to achieve the goals and objectives of safety and health program.
- Ensure that the above practices as framed are fully implemented and effective.
- Review each accident and conduct any investigation where in an accident has resulted in serious injury (fatal/non-fatal) or property damage.
- Ensure that the program is fully implemented and effective.
- Upgrade the stipulated norms time to time and take corrective actions that are needed.

#### **4.4 Responsibilities of Electrical Safety Officers at Circle Level:**

All the Dy. CE/SE (Generation), at various Hydro projects under execution under HPSEBL shall act as Overall Safety Officers for the respective circles and they shall ensure the following:

- Ensure that each element of program is implemented within the periphery of the circle.
- Ensure that all circles and down below up to helpers supervisor in the jurisdiction comply with the program.
- Ensure that safety/health surveys are conducted in his/her circle on regular basis, frequently (Once per quarter).
- Ensure that Inter Hydro Power Houses Safety Audits Shall be carried out on regular basis , frequently ( Once per Half yearly)
- Ensure that each Division, Sub-Division (Shift & maintenance) up to supervisor, (Jr. Engineer/Forman/Helper) and other employees comply with the program.
- Ensure that PPE (Personal Protective Equipment) are made available to line staff/ employees concerned and immediately intimate to the safety committee for any shortage.
- To ensure receiving of records in specified formats and specified intervals form Divisional offices and scrutinizing of record for any non-compliance if any. If there is any non-compliance efforts must be done to immediately resolve the issue.

- Timely submission of all information in specified formats and specified intervals as received from Divisions to C.E. (P & M) along with a copy to C.E. (Generation).

#### **4.5 Responsibilities of Officers at Divisional/Resident Engineer Level:**

- To ensure that every staff/employee concerned in his/her division receives appropriate training upon initial assignment, and later on the changes in the process, procedures, equipment or assignment.
- To ensure proper implementation of all safety documents circulated by C.E (P & M) in letter and spirit.
- To ensure that PPE (Personal Protective Equipment) are made available to staff/ employees concerned.
- To ensure that each supervisor (Jr. Engineer/Foreman/Fitter/Electricians/ Helper) and authorized person in his/her Hydro Power House complies with the program in letter and spirit.
- To ensure that proper documentation in specified formats is being done by field units.
- Frequent conduct of safety and health inspection of his/ her work area.
- The RE/XEN will conduct the random checking at power house as per (**Annexure-V, VI, VII**) Field Job Audit Form/Tool Box Audit Form /Safety Audit Form.

#### **4.6 Responsibilities of Officers at Shift/Maintenance Engineer/Sub-Divisional Level:**

- Ensure that each staff/employee receives refresher training whenever required by law, changed procedures or whenever circumstances indicate the need for training.
- Frequent conduct of safety and health inspection of his/ her work area.
- The every near miss incident will be reported as per the format attached (**Annexure-III**).
- The every Accident will be reported as per the format attached (**Annexure-IV**).

The General Safety protocols attached in annexure required to be followed in field at Sub-Divisional level at all power houses. However R.E/Sr. Executive Engineer, in close coordination with A.Es shall identify the plant wise inherent hazards related to the works of the plant/project and assess the risk associated with the hazard. R/E Sr. Executive Engineer shall add the specific requirement of safety in the protocols of power house under intimation to Superintending Engineer.

#### **4.7 Safety Committee:**

For effective implementation of the Safety Practices to avoid accidents, the Safety Committee shall be formed at R.E/Divisional Level, Circle Level and Corporate level to campaign the safety of the Employee and imparting Safety Training to the employees which also includes the tools / equipment to be provided to the Shift Engineer/J.E. Maintenance/Forman/Fitter/Electrician/Helper or effective usage of tools and plants.

The responsibilities and functions of the Safety Committee shall be as follows:

1. Safety Committee shall meet once in a quarter to review the adoption of safety practice at all field work levels.
  2. Safety Committee shall ensure availability of all safety equipment/tools with the sub divisions.
  3. Safety Committee shall ensure availability of Safety Manuals in all the sections.
  4. Safety Committee shall ensure strict adherence of implementing "Work Permit" practices in the field. The respective ASE/Sr. Executive engineer/REs shall get the Work Permit formats printed and supplied to the field units with instructions to adopt.
  5. The Safety Committees shall ensure imparting Safety Training to all the authorized staff/employees.
  6. The Safety Committee shall also review whether periodical testing of safety equipment is done or not and ensure proper working condition of the safety equipment.
  7. The Safety Committee shall hold discussion with the Employees Union for adoption of uniform for the Skilled and UN Skilled staffs ensure that the uniform is made available.
- If any accident occurs then the accident investigation report will be prepared by the investigation formed by HPSEBL authority in the format attached as per (**Annexure-XI**).

#### **4.8: SAFETY ORIENTATION, TRAINING AND PROMOTION**

Adequate training /orientation shall be provided to all workers regarding safe working procedure and standard operating procedure of the work. The Resident Engineer shall arrange all such training programme including safety. The Safety Officer shall be the key person coordinator for conducting safety awareness programme for motivation and promotion of safety and for the Human resource Wing will provide all necessary facilities such as safety training hall, seating arrangements, multimedia facilities such as projector, computer, mike,

speakers, audio-visual arrangement for showing videos etc.

Each employee and workers shall undergo safety induction training program for minimum 2 days and one day respectively. For safety induction training a training module should be prepared. Induction training should also include briefing of company, existing hazards, safety rules to be followed in the company, safety policy, emergency response plan etc.

The R.E should prepare monthly / quarterly / yearly safety training calendar and submit to S.Es concerned.

Each employee and worker should undergo at least 8 hours of safety training every year and it is the responsibility of Sr. Executive Engineer to ensure that each employee and worker is undergoing at least 8 hours of safety training every year and should arrange the participants. The employees and workers should attend the scheduled safety trainings failing to which disciplinary actions will be taken by the management of HPSEBL.

The following shall be included in the orientation program: Project safety rules, general safety awareness, first aid, Electrical safety, Manual and mechanical Material handling, Ergonomics, Use of **MSDS** (Material Safety Data Sheet) and Safe handling of chemicals, Accident prevention, Near miss, SOPs, Personal protective equipment (its selection, use, maintenance and store), Emergency response plan, Housekeeping including **5 S** system (Sort-Set in Order-Shine-Standardized-Sustain), Hazard Identification and Risk Assessment (**HIRA**) and Job Safety Analysis (**JSA**), Work permit system, Defensive driving, Fire prevention and protection system, Basic firefighting, Case study sharing, Safety in machine and guarding, Accident Investigation & Analysis, Role of Safety Officers/Coordinators, Safety Audit/Inspections, Safety in Working at Heights, Office Safety, Statutory Requirement pertaining to Occupational Safety and Health, emergency procedures including shock treatment, use of personal protective equipment, safety precautions while handling electro-mechanical equipment, use of different types of firefighting equipment, response in the event of emergencies including fire, flood, landslide, earthquake etc; site specific hazards and the precautions as well as response in respect of the same. All training presentations or module should be reviewed and revised as per current scenario or updating periodically (at least once in 3years) by the safety department.

Safety promotional activities shall be organized periodically to create awareness and enthusiasm among the employees which shall include organizing safety day, safety week, safety competitions and display of posters, banners, safety calendars and displays depicting possible consequences of unsafe acts and conditions in conspicuous locations in the plant. Safety literature item shall be displayed and distributed for awareness and promotion of safety.

**NSW** (National Safety Week–4th-10thMarch): Every year each plant should celebrate National Safety Week during 4-10March. During this celebration following activities should be performed for employee and workers: safety exhibition, safety quiz competition, poster competition, essay competition, training programs, prize distribution to winners of competitions etc.

**FSW** (Fire Service Week – 14th – 20th April): Every year each plant should celebrate Fire Service Week during 14 – 20th April. During this celebration following activities should be performed for employee and workers: Fire Fighting drill/Demo, quiz competition, poster competition, Fire safety exhibition, training sessions of fire safety etc.

For promotion of safety signage, posters, slogans should be displayed at strategic location and as far as possible all promotional materials should be in pictorial form and in local language for better understanding of employees and workers.

All activities and statistics of safety trainings and promotion should be communicate to all hierarchies for information and monitoring purpose.

## **CHAPTER- 5**

### **HAZARD IDENTIFICATION, RISK ASSESSMENT AND MANAGEMENT**

The Safety Officer in close coordination with Risk officer shall identify the inherent hazard related to the works of the plant/project and assess the risk associated with the hazard. He shall assist the management in managing the risk.

For each phase of the work a Job Safety Analysis/Risk Assessment shall be developed. The analysis shall be job specific and shall include all major tasks, sequence of work. This shall include health and safety hazards related to chemical, physical, and ergonomic stress. For jobs involving the physical or use of chemicals, control measures such as engineering, administrative or PPE must be identified and included in the job safety analysis and reviewed with personnel prior to starting work. Control measure or precautionary actions include requirement of particular PPE, fall protection measures, fire protection measures, barricades, safe work practices etc. The completed Job Safety Analysis and Risk Assessment shall be submitted to the Site engineer/site in-charge/Er. In-charge for necessary risk management. The Job Safety Analysis shall be updated whenever there are significant changes in the work plan, materials used, work environment, or a new crew or subcontractor is assigned to conduct the work.

In case of imminent danger, the Shift / Maintenance Engineer / Shift / Maintenance in-charge/ Er. In-charge shall immediately prohibit site personnel from working in the affected area until the hazard has been corrected.

Material Safety Data Sheet (MSDS) for each hazardous material used in the plant/project shall be displayed near to the hazardous material in the local languages or languages spoken by majority of the employees working at the site.

## **CHAPTER-6**

### **SAFE WORK ENVIRONMENT**

#### **A. Illumination and emergency lighting:**

1. Sufficient illumination as per relevant national standards shall be arranged for maintaining safe working conditions at workplace and for passage ways, stair ways and landings, excavation site, tunneling work.
2. Emergency generators shall be provided and is readily available for service at all times to ensure adequate illumination at all work places where work is being carried out at night and dark places, in case of power failure.
3. Such emergency power supply system shall be capable of operating air compressor and ancillary systems of such compressed air system.

#### **B. Noise pollution:**

1. Noise survey shall be carried out at least once in 12 months by safety department and List the High noise level areas.

Effective engineering control and administrative measures shall be taken to reduce the high noise level Below 85 dB A (90dB A or more).

2. High noise level area shall be marked and displayed.
3. Proper earplug/earmuff shall be provided by concern department and ensure that employees and workers are using it, used at the high noise area to protect the worker from the exposure of high noise.
4. Exposure in excess of 115 dB A shall not be permitted at any case.

#### **C. Harmful gases, fumes and dust pollution:**

1. Workers shall not be allowed to enter any confined space such as chamber, tank, pit, pipe etc. where any harmful gas, fume, vapour or dust is likely to be present.
2. All necessary measures shall be taken to remove such harmful substances up to permissible limit from the confined space and shall be confirmed before entry of the worker to perform any work.
3. Effective artificial ventilation shall be provided to control the above hazard.
4. A certificate in writing shall be issued by the tester that the confined space is reasonably free from such dangerous and harmful substance and the tester shall use suitable breathing apparatus and a belt securely attached to a rope and free end of which is held by a person outside the confined space.
5. Welding, cutting, brazing or soldering shall not be allowed in any tank, vessel or any confined space which contains or has contained any explosive or inflammable substance unless adequate measures are taken to remove such harmful and dangerous substance.



#### **D. Ventilation:**

1. Artificial ventilation by mechanical means shall be arranged and provided at the workplaces where workers employed underground.
2. The amounts of fresh air supplied by mechanical means of ventilation in an hour shall be equivalent to at least six times the cubic capacity of the workroom and shall be distributed evenly throughout the workroom without dead air pockets or under draughts caused by high inlet velocities. The amount of fresh air to be provided shall be as per the relevant rules.
3. Exhaust fans, jets, ducts, hoods, etc. shall be so designed, constructed, maintained and operated as to ensure the required protection by maintaining a volume and velocity of exhaust air sufficient to gather dusts, fumes, vapour or gases from said equipment or process, and to convey them to suitable points of safe disposal, thereby preventing their dispersion in harmful quantities into the atmosphere where employees work.
4. Ventilation system shall be provided with a back-up power supply source so that it continues to operate in the event of failure of regular power supply system.
5. The maximum permissible threshold limits of exposure of chemical and toxic substances in manufacturing processes (whether hazardous or otherwise) in any Power station shall be of the value indicated in the 2<sup>nd</sup> Schedule of FA 1948.
6. Site in charge shall ensure at a construction site of that the operator of every lifting machine in is provided with a cab or cabin which is adequately ventilated.
7. The site in charge shall ensure at a construction site that all work areas in a free air tunnel are provided with ventilation system as approved by the Director General & the fresh air supplied in such tunnel is not less than 6 m<sup>3</sup> / min for each building worker employed underground in such tunnel and the free-air-flow movement inside such tunnel is not less than 9m/min.
8. The precautions shall be taken to prevent inhalation of dust, fumes, gases or vapours during any grinding, cleaning, spraying or manipulation of any material & steps shall be taken to secure & maintain adequate ventilation of every working place or confined place.
9. No person shall be allowed to enter any chamber, tank, vat, pit, pipe, flue or other confined space in Power station in which any gas, fume, vapour or dust is likely to be present to such an extent as to involve risk to persons being overcome thereby, unless it is provided with a man hole of adequate size or other effective means of egress.
10. No person shall be allowed to enter any confined space until all practicable measures have been taken to remove any gas, fume, vapour or dust, which may be present so as to bring its level within the permissible limits and to prevent any ingress of such gas, fume, vapour or dust and unless- a certificate (Work permit) in writing has been given by a experienced person, based on a test carried out by himself that the space is reasonably free from dangerous gas, fume, vapour or dust.

**SAFETY DISPLAY:** Sign Boards as attached in (**Annexure-XII**) may be used as various locations in power house to create awareness among staff regarding safety.

## **CHAPTER-7**

### **HOUSEKEEPING**

Housekeeping shall be systematic, comprehensive and consistent with the requirement of applicable Safety Rules. Workmen are frequently injured by tripping, stumbling, stepping on or bumping in to tools, material and other objects left lying around or by carelessly placed objects falling from above.

Housekeeping means “EVERYTHING SHALL HAVE DESIGNATED PLACE AND EVERYTHING SHALL BE IN ITS DESIGNATED PLACE”. Hence Housekeeping shall not be limited to only just cleaning the area. It is a combination of orderliness and cleanliness. It is a part of everyday life and plays a significant role in preventing accidents. Orderliness and cleanliness can be achieved only if;

- All things have an assigned place for storage.
- All things are kept in their assigned place
- Storage of materials are done in an orderly and neat manner
- Unwanted things are not kept around.
- Sources of uncleanness are arrested, and
- Sources contributing to uncleanness are removed and disposed off safely.

The state of cleanliness of a plant cannot be achieved by an occasional grand cleanup during an annual inspection or housekeeping drive. It requires sustained efforts and cooperation of all employees working in the plant. The active support and encouragement of the plant management is a must. A well-kept plant is indicative of a safe place to work at and indicate competent management and an efficient workforce.

Effective housekeeping results in:

- reduced handling to ease the flow of materials
- fewer tripping and slipping accidents in clutter-free and spill-free work areas
- decreased fire hazards
- lower worker exposures to hazardous dusts and vapors
- better control of tools and materials, including inventory and supplies
- better hygienic conditions leading to improved health
- more effective use of space
- reduced property damage by improving preventive maintenance
- pleasing appearance to the workplace resulting in improved morale of employees
- improved productivity

Housekeeping order is "maintained" not "achieved." Cleaning and organization must be done regularly, not just at the end of the shift. Integrating housekeeping into jobs can help ensure this is done. A good housekeeping program identifies and assigns responsibilities for the following:

- clean up during each shift
- timely disposal of waste
- removal of unused materials
- inspection to ensure cleanup is complete

## **Housekeeping Program**

### **1) Dust and Dirt Removal**

Regular cleaning of dust and dirt from work areas as well as equipment and removal of waste generated is an essential part of good housekeeping. Floors must be cleaned/mopped/vacuumed depending upon the type of area. Housekeeping of the area where any maintenance activity is carried out is essentially the duty of the crew carrying out the maintenance.

### **2) Employee Facilities**

Employee facilities need to be adequate, clean and well maintained. Lockers are necessary for storing employees' personal belongings. Washroom facilities require cleaning once or more each shift. They also need to have a good supply of soap, towels plus disinfectants, if needed. Smoking, eating or drinking in the work area should be prohibited. The eating area should be separate from the work area and should be cleaned properly each shift.

### **3) Surfaces**

Poor floor conditions are a leading cause of accidents so cleaning up spilled oil and other liquids at once is important. Allowing chips, shavings and dust to accumulate can also cause accidents. Trapping chips, shavings and dust before they reach the floor or cleaning them up regularly can prevent their accumulation. Areas that cannot be cleaned continuously, such as entrance ways, should have anti-slip flooring. Keeping floors in good order also means replacing any worn, ripped, or damaged flooring that poses a tripping hazard.

### **4) Illumination**

Adequate lighting in work area is an essential component of good housekeeping. Dirty light fixtures reduce essential light levels. Clean light fixtures can improve lighting efficiency significantly. For adequacy of illumination in work area refer recommended illumination levels in the respective State Factories Rules. One can also refer IS 3646:1992 (Part-1) – ‘Code of Practice for Interior Illumination’.

### **5) Aisles and Stairways**

Aisles should be wide enough to accommodate people and vehicles comfortably and safely. Aisles pace allows for the movement of people, products and materials. Keeping aisles and stair ways clear is important. They should not be used for temporary "overflow" or "bottleneck" storage. Stairways and aisles also require adequate lighting.

### **6) Spill Control**

The best way to control spills is to stop them before they happen. Trays shall be placed below drums/ cans containing liquid. Regularly cleaning and maintaining machines and equipment is one way. When spills do occur, it is important to clean them up immediately. Absorbent materials are useful for wiping up greasy, oily or other liquid spills.

### **7) Tools and Equipment**

Housekeeping of tools is very important, whether in the tool room, on the rack, in the yard, or on the bench. Tools require suitable fixtures with marked locations to provide orderly arrangement, both in the tool room and near the work bench. Tools should be returned promptly to the tool room after use to reduce the chance of being misplaced or lost. Workers should regularly inspect, clean and repair all tools and take any damaged or worn tools out of service.

## **8) Fire Fighting and First Aid Equipment**

Firefighting equipment, first aid boxes and rescue items should be stored at prominent locations and the area should be marked. Access to the above should be free and other materials should not be stored near these so as to prevent it from being reached easily. A regular schedule needs to be maintained for the cleaning, testing and replenishment of the emergency items.

## **9) Waste Disposal**

The regular collection, grading and sorting of scrap contribute to good housekeeping practices. It also makes it possible to separate materials that can be recycled from those going to waste disposal facilities. Allowing material to build upon the floor wastes time and energy since additional time is required for cleaning it up. Placing scrap containers near where the waste is produced encourages orderly waste disposal and makes collection easier. All waste receptacles should be clearly labeled.

## **10) Storage**

Good organization of stored materials is essential for overcoming materials to rage problems whether on a temporary or permanent basis. There will also be fewer strain injuries if the amount of handling is reduced, especially if less manual materials handling is required. The location of the stockpiles should not interfere with work but they should still be readily available when required. Stored materials should not obstruct aisles, stairs, exits, fire equipment, emergency eye wash fountains, emergency showers, or first aid stations. All storage areas should be clearly marked.

## **Housekeeping Committee & Housekeeping Competition**

A house keeping committee shall be appointed by the Resident Engineer/Executive Engineer of each unit consisting of departmental heads to conduct a house keeping visit of all plant areas. The team should prepare and use a suitable checklist for these visits. The frequency of these visits shall be at least once a month. The checklist should be such that observations can be converted to quantitative evaluation points.

A House keeping competition shall be conducted between areas of work / workshops on a yearly basis and a rolling trophy shall be instituted for the best maintained work area. Monthly points as Housekeeping Competition. The process shall be transparent and monthly points obtained by each work area may be displayed on the noticeboards to instill a sense of healthy competition among employees.

To ensure good housekeeping, the following safety precautions shall be observed in construction/O&M activity as applicable:

1. Every work place shall be kept clean and free from effluvia arising from any drain, privy or other nuisance.
2. Loose materials which are not required for use shall not be placed or left so as dangerously obstruct workplaces and passageways.
3. All projecting nails shall be removed or bent over to prevent injury.
4. Equipment, tools and small objects shall not be left lying unattended where they could cause an accident either by falling or causing a person to trip.
5. Scrap, waste and rubbish shall not be allowed to accumulate at the site.
6. Works places and passage ways that are slippery owing to oil or other causes shall be cleaned up or strewn with sand, ash or suitable means.
7. Portable equipment shall be returned after use to its designated storage place.
8. Walks, aisles, stair ways, fire escapes and all other passageways shall be kept clear of all obstructions.
9. Tools and materials shall not be placed where they may cause tripping or stumbling hazards or where they may fall and strike anyone below.
10. Puddles of oil and water create a slipping hazard. Spillage of oil or lubricant on the floor shall be immediately wiped out and strewn with sand, ash or the like. Slippery floor shall be marked with caution sign. Effective means of drainage shall be provided and maintained where a floor is liable to become wet

due to manufacturing process or during maintenance of machineries.

11. Nails in boards, such as those removed from scaffolds, forms and packing boxes, constitute a hazard and shall be removed. The boards shall be carefully stacked or stored.
12. Dirty and oily waste rags shall be disposed off as soon as practicable to avoid fire hazard.
13. All path ways shall be conspicuously marked.
14. All floor areas, pathways shall be even & free from pot holes, pits & humps.
15. Broken light bulbs, glass, metal scrap and other sharp objects shall be dumped in places, provided specially for them.
16. Discarded fluorescent and other gas filled tubes shall be disposed off safely.
17. Accumulations of dirt and refuse shall be removed daily by sweeping or by any other effective method from the floors and benches of workrooms and from staircases and passages, and disposed of in a suitable manner.
18. The floor of every work room shall be cleaned at least once in every week by washing, using disinfectant, where necessary, or by some other effective method.
19. Effective means of drainage shall be provided and maintained where a floor is liable to become wet due to manufacturing processor during maintenance of machineries.
20. Spillage of oil or lubricant on the floor shall be immediately wiped out and strewn with sand, ash or the like.
21. Slippery floor shall be marked with caution sign.
22. Equipment, tools and small objects shall not be left lying unattended or unsecured from where they could fall or cause a person to trip.
23. All doors and window frames and other wooden or metallic frame work and shutters shall be kept painted or varnished and the painting or varnishing shall be carried out at least once in every period of five years;
24. All floors, steps, stairs, passages and gangways shall be of sound construction and properly maintained and shall be kept free from obstructions and substances likely to cause persons to slip, and where it is necessary to ensure safety, steps, stairs, passages and gang ways shall be provided with substantial and rails.

## **CHAPTER-8**

### **PREVENTION OF SLIPS, TRIPS AND FALLS**

Slips, trips and falls are common causes of injuries at workplaces which can result in head injuries, back injuries, cuts lacerations, sprained muscles or even death. Most of these incidents can be prevented with general precautions and safety measures.

Slips happen where there is too little friction or traction between the footwear and the walking surface. Common causes of slips are wet or oily surfaces, smooth surfaces, inappropriate or wet footwear, leaks or spills, loose or unanchored rugs or mats, etc.

Trips happen when a person's foot inadvertently hits an object causing loss of balance and resulting in fall. Common causes of trips are obstructed view, poor lighting, uneven walking surfaces, threshold sand steps ( particularly a single step ), blind corners, obstacles on the walkway such as trailing cables, tools, trolleys, packing materials, drawn-out shelves, wrinkled/curled/loose carpeting, etc.

Fall occurs when one is too much off-balance. Common causes of falls are unprotected floor openings, working platforms and passages at height, unstable work platforms, improper use of ladder or scaffolding, unguarded edges of floors and landing of stairways, fragile roofs, unstable posture, etc. A fall can be at the same level or from a height to a lower level.

General precaution for prevention of slips trips and falls:

1. Clean and mop up water and other spills immediately and display a "Caution Wet Floor" sign.
2. Modify work practices that cause spills.
3. Remove obstacles from walk way sandal ways keep it free of clutter.
4. Avoid leaving objects on floor.
5. Provide adequate lighting in the work area.
6. Use high visibility fluorescent paint or tape to mark changes in floor levels.
7. Consider providing non-skid floors.
8. Look for and report broken/loose tiles, worn out floor coverings and loose or frayed carpets and mats.
9. Ensure carpets are anchored or secured to avoid curled edges.
10. Position equipment so as to avoid trailing cables crossing pedestrian routes. Use securely fixed cable covers, if necessary.
11. Barricade floor openings.
12. Ensure stair sand work platforms at height have protective railing sand toe boards.
13. Use safety belt while working at height.
14. Ensure that ladders are sturdy, in good repair and during usage they are stable and secure.
15. Face the ladder while ascending or descending it.
16. Follow the three point contact principle. At any given time, two feet and one hand or two hands and one foot must be in contact with ladder.
17. Avoid carrying tools, materials, etc. in the hand while climbing a ladder. Use tool bag or belt.
18. Never over reach while working at an elevated level.
19. Never uses make shift devices like a chair in place of a stool, or using a ladder as plat form.
20. Minimize carrying loads on stairs.
21. Wear non-skid footwear. Ensure footwear is free from grease, oil, mud, etc.
22. Be careful of wet shoes on a dry floor since they can be just as sleeper as a wet floor.

## **CHAPTER-9**

### **EMERGENCY PREPAREDNESS PLAN**

A major emergency can be defined as an accident/ incident that have potential to cause serious injuries or loss of life. It may cause extensive damage of property, serious disruption both in production and working of Power station and may adversely affect the environment. The following factors may cause major emergency: Plant failure, fire, bomb blast, collapse of structure, vehicle crash, sabotage, earthquake, natural calamities.

- Emergency Management System shall be formulated for each Power Generating Station for quickly and effectively dealing with probable emergencies with the following.

#### **Objectives:**

- To improve state of preparedness to meet any emergency.
- To protect plant personnel inside and public outside the plant.
- To reduce response time in organizing the assistance.
- To identify major resources, manpower, material & equipment needed to make the plan Operational.
- To bring the situation under control and thereafter to normalcy in minimum time.

#### **On-site Emergency Management Plan**

1. The Resident Engineer/Executive Engineer of each Power Station shall prepare and keep up to date On-site Emergency Management Plan to deal with all probable emergencies which can occur at the premises such as:

- Major Fire in Cable Gallery,
- Major Fire in Transformer Yard,
- Flooding of Power Houses,
- Landslides,
- Earth quake
- Terrorist activities etc.

2. The plan shall also include the procedures for responding to emergencies created due to crisis and disasters in accordance with the plans prepared by appropriate authorities.

3. The On-Site Emergency Management Plan shall Include the names of the persons who are responsible for safety on the site and the names of those who are authorized to take action in accordance with the plan during emergency.

4. The Resident Engineer/Executive Engineer shall ensure that the emergency plan is. updated on account of any modification made in the industrial activity and that every person on the site who is likely to be affected by the plan is informed of its relevant provisions.

5. The On-Site Emergency Management Plan shall be prepared:

- In the case of start of any activity in the field relating to new Hydro Power station, within 60 days of commencement of construction activity.
- In the case of an existing Power station, within 30 days.

6. The Resident Engineer/Executive Engineer shall ensure that the mock drill is conducted every six months as per onsite

Emergency plan. On-Site Emergency Management Plan shall also include the following:

- Name and address of the Chief Safety Officer.
- Alarm System and method of Reporting/declaring emergency.
- Emergency Response Procedure including response to Off- Site Emergency Management plan and Crisis & Disaster Management Plan.
- Details of the key personnel of the emergency team and their responsibilities.

- Outside organization (local administration, police, hospitals, organization located nearby) involve in assisting during emergency with their role and contact numbers.
- Risk assessment information giving possible nature of incidents/ events giving rise to emergency conditions, risk analysis and impact assessment.

Details about the site:

- Locations where emergency can arise
- Emergency control room/Alternate Emergency Control Room
- Demarcation of safe assembly zone relevant to each type of emergency condition

7. Internal and external communication Plan during emergency

8. Details of firefighting and other facilities available to  
Deal with emergency conditions

9. Details of emergency equipment available in the Unit,

10. Details of First Aid and Hospital services available and its adequacy

11. Mutual Aid arrangements, with nearby organizations,

12. Post emergency activities:

- Collection of records
- Conducting enquiries and concluding preventive measures
- Making insurance claims
- Preparations of enquiry report and suggestion scheme
- Implementation of enquiry report recommendations
- Rehabilitation affected persons within plant
- To re-start the plant

## **EMERGENCY ESCAPE ROUTES**

Emergencies can develop very rapidly. Make sure that you are equipped to move the employees to a total or relative place of safety without delay. The following will be helpful:

### **Design permanent exit routes**

- Ensure that the number of exit routes is adequate based on the number of employees, the size of the Building, its occupancy, and the arrangement of the workplace.
- Separate an exit route from other workplace areas with materials that have the proper fire resistance-rating for the number of stories the route connects.
- Ensure that exit routes meet width and height requirements. The width of exit routes must be sufficient to accommodate the maximum permitted occupant load of each floor served by the exit route.
- Ensure that doors used access exit routes have side hinges and swing in the direction of travel (depending on occupancy and hazard areas).
- Design exit routes that lead to an outside area with enough space for all occupants.
  - An outdoor exit route is permitted but may have additional site-specific requirements.
  - Maintain the fire-retardant properties of paints and solutions that are used in exit routes.



- Ensure that required exit routes and fire protections are available and maintained, especially during repairs and alterations.
- Ensure that employee alarm systems are installed, and in operable condition.
- Direct employees through exit routes using clearly visible signs. These signs must meet the required letter height and illumination specifications.
- Arrange exit routes so that employees are not exposed to the dangers of high hazard areas.
- Exit routes must be free and unobstructed. Prevent obstructions, such as decorations, furnishings, locked doorways, and dead-ends within exit routes,
- Plan escape routes and make sure they remain available and unobstructed.
- Display signs for people unfamiliar with escape routes.
- Light all escape routes sufficiently for people to use them safely in an emergency.
- Make sure emergency lighting complies with the requirements. Use an independent power source, e.g. a generator, in case the mains electricity supply fails.
- If using floodlighting, lighting towers etc. as temporary lighting make sure it does not shine in people's faces along the escape route, making it more difficult for them.
- Plan how, where necessary, you will evacuate people to a place of relative safety from where they can proceed to a place of total safety,
- All doors and gates leading to final exits, as well as site exits themselves, should be available for immediate use at all times.

**Check that they are:**

- unlocked if security is an issue they may lock but keep the key with safe access for use in emergency.
- Doors should open outwards in the direction of escape:

**Assembly Point:**

There should be predefined assembly points, safe from the emergency hazards, where in case of emergency the employees gather for roll call.

## **CHAPTER-10**

### **OCCUPATIONAL HEALTH & MEDICAL FACILITIES**

#### **A. First-aid facilities:**

First aid refers to the emergency treatment given to a person suffering from an accident or sudden illness, until a doctor attends. First-aid box shall be maintained with medicines and other equipment as prescribed by the factories rules of the respective state.

There shall be at least one first aid box. There should be at least 2 first aiders available in each shift for each first aid box and there shall be in charge of first aid box and he should do inspection of first aid boxes every week to see whether it is in replenished condition or not and he should coordinate with OHC to ensure that first aid box is always in replenished condition.

The list of first aiders along with their names, designation, and contact nos. shall be displayed near each first aid boxes and at other strategic locations.

Each first aid box should be provided with first aid register book and first aid in charge should fill the internal incident report and departmental in charge should forward to the investigation team. First aid Box record should be maintained by Shift Engineer roster as per **(Annexure-VIII)**.

#### **B. Display of instructions for resuscitation of persons suffering from electric shock:**

Instructions, in English or Hindi and the local language of the District and where Hindi is the local language, in English and Hindi for the resuscitation of persons suffering from electric shock, shall be affixed by the owner/Resident Engineer/Executive Engineer in a conspicuous place in every generating station, enclosed sub-station, enclosed switching station, mines and every Power station as defined in clause (m) of section 2 of the Power station act, 1948 (63 of 1948). The owner of every generating station, enclosed sub-station, enclosed switching station and every Power station or other premises to which these regulations apply, shall ensure that all designated persons employed by him are acquainted with and are competent to apply the instructions.

#### **C. Artificial respirator:**

In every manned generating station, sub-station or switching station, an artificial respirator shall be provided and kept in good working condition.

#### **D. Training:**

First aid medical training shall be provided to all employees and Cardiac Pulmonary Resuscitation (CPR) training shall be provided to the employees those who are engaged in electrical work. Refresher training should be provided to first aiders periodically through authorized agency.

#### **E. First Aid (Situation and Procedures)**

First-aid is the immediate care given to the victim of an accident or sudden illness before the arrival of a qualified expert. The purpose of First-aid is to preserve life, assist recovery, prevent aggravation and minimize complications.

##### **1. ARTIFICIAL RESPIRATION**

- Mouth to Mouth: This is appropriate and effective technique for emergency artificial respiration.
- Keep the head slightly backward and open the jaw.
- Seal the casualty's nose to prevent escape of air by pinching with thumb and index finger.
- Take a deep breath, open your mouth widely, place it over the victim's mouth and make a tight seal.
- Quickly blow the full breath into the mouth of victim.
- Remove your mouth from the victim and allow him to exhale passively.
- Repeat the procedure 12 to 15 times per minute, till medical aid is arranged.
- Arrange immediate medical aid.

##### **2. CAUTIONARY NOTE**

- Do not give mouth to mouth resuscitation during CPR in the presence of toxins such as cyanide, hydrogen sulphide, corrosives and organo-phosphates. Ventilate the casualty by using a face mask or bag/valve/mask assembly.
- Avoid mouth to mouth resuscitation if there is possibility of transmission of infection between the victim and the rescuer, such as HIV, Hepatitis-B, Tuberculosis, and Shigellosis, Meningococcal meningitis, Herpes simplex virus and Salmonella. Use an inter positional airway device which must function

effectively in both its resuscitation and protective roles, and be immediately available at all times.

### **3. CONTROL OF BLEEDING**

- a. Apply direct pressure by thumb or finger.
- b. Apply dressing—gauze pad and bandage.
- c. Apply in direct pressure on pressure points.
- d. Apply tourniquet.
- e. Remove the injured to the hospital.

### **4.FRACTURES**

- a. Signs of Fracture: Pain, Tenderness, Swelling, Loss of Power, Deformity
- b. Do not move the injured unless the life is endangered from other causes.
- c. Deal with the hemorrhage and breathing difficulties. Immobilize the fracture by using suitable splints.
- d. Immobilization should include one joint above and one joint below the fracture.
- e. Remove the injured to the hospital.

### **5. BURNS**

- a. Pour running cold water on the affected part.
- b. Do not apply ointment or oils or any other substance.
- c. Cover the wound with sterilized cloth.
- d. Give artificial respiration, if needed.
- e. Prevent shock.
- f. Arrange immediate medical aid.

### **6.SHOCK**

- a. Lay the patient on his back.
- b. Stop bleeding, if any.
- c. Relieve pain by supporting the injured part.
- d. Keep the patient comfortable.
- e. Do not cause sweating.
- f. Fluids may be given by mouth in small amounts, if the patient is conscious.
- g. Reassure the patient.
- h. Arrange immediate medical aid.

### **7. WOUNDS**

- a. Stop the bleeding, if any.
- b. Avoid touching the wounds.
- c. Cover the wound with sterilized cloth.
- d. Arrange immediate medical aid.

### **8. EYE INJURIES**

- a. Removal of foreign body should not be attempted.
- b. Do not apply oil or ointment.
- c. Apply sterile pad and loose bandage.
- d. Send the patient to the hospital.

### **9. ABDOMINAL WOUNDS**

- a. No time should be lost in sending the patient to the hospital.
- b. Keep the patient flat on his back.
- c. Give nothing by mouth.
- d. Maintain warmth.
- e. If intestines protrude from the wound, do not attempt to touch or replace them.
- f. Apply sterile dressing and binder on the wound.
- g. Provide immediate transportation to the hospital.

### **10. BACKBONE FRACTURE**

- a. Fracture of backbone may lead to paralysis of limbs. Hence, victim should be handled with great care.

- b. Transport on a rigid frame, which may be improvised by using available board.
- c. The rigid frame is to be placed on a stretcher for transportation.
- d. Immediate hospitalization is needed.

**11. HEAT STROKE**

- a. Make the patient lie down.
- b. Remove all clothing's except the underwear.
- c. Keep the patient under the fan.
- d. Pour cold water on the body repeatedly.
- e. Wash the head thoroughly with cold water and dry it with towel.
- f. Record body temperature falls upto 38°C stop pouring water.
- g. Give plenty of cold water with a pinch of common salt in each glass of water to drink.
- h. Send the patient to the hospital.

**12. BLEEDING NOSE**

- a. Make the patient sit on a Chair with head downward.
- b. Pinch the nose with fingers and thumb.
- c. Apply ice or cold compression.
- d. Do not plug the nostrils.
- e. Do not put water or any medicine through the nostrils.
- f. Send for medical aid immediately.

**13. FOREIGN BODY IN THE NOSE**

- a. Do not try to remove the solid object.
- b. Ask the patient to breathe through mouth.
- c. Send the patient to the hospital.

**14. BLEEDING EAR**

- a. Lay the patient with the head slightly raised.
- b. Incline the head to the affected side and apply a dry dressing over the ear with loose bandage.
- c. Do not plug the ear.
- d. Apply pressure in front of the ear.
- e. Send for medical aid immediately.

**15. FOREIGN BODY IN THE EAR**

- a. Solid—Do not try to remove, scratch or probe it.
- b. Insects—Put a few drops of water in the ear and turn the head so that affected ear points upwards.
- c. Keep the head in that position for 5 minutes, then turn the head downwards so that the water flows out.
- d. Arrange immediate medical aid.

**16. SNAKE BITE**

- a. Reassure the patient
- b. Do not allow the person to run or walk
- c. Apply a ligature above the wound (in between the heart and the wound) if the bite is in the leg or hand.
- d. Wash the wound with potassium permanganate solution or with soap and water.
- e. Allow free bleeding.
- f. Never suck the blood from the wound.
- g. Treat for shock.
- h. Arrange immediate hospitalization, by transporting the patient in a lying down position.

**17. INSECT BITE**

- a. The sting bite should be pulled out.
- b. Apply cold compression.
- c. Apply vinegar diluted with water.
- d. Soda-bicarbonate paste should be applied at the site.
- e. Prevent shock.

- f. Send for medical aid immediately.

#### **18. CHEMICAL BURNS OF THE EYES**

- a. Immediate washing of the eye with clean water atleast for fifteen minute or longer.
- b. Apply sterile dressing over the eye.
- c. Neutralizing agents or ointments should not be used.
- d. Send the patient to the hospital.

#### **19.SUFFOCATION**

- a. Remove the patient from the source.
- b. Clean the airways.
- c. Restore breathing by artificial respiration.
- d. Send the patient to the hospital.

#### **20.ELECTRIC SHOCK/ INJURIES**

- a. Do not touch the casualty while he is still in contact with electricity.
- b. Switch off the current at once.
- c. Do not attempt first aid until the contacts have been broken.
- d. Make the air passage clear and clean.
- e. Restore breathing Artificial respiration and external cardiac massage, if needed.
- f. Call for immediate medical aid.
- g. Send the patient to the hospital.

#### **21.UNCONSCIOUSNESS**

- a. Make the patient lie down on his belly with head turned to one side.
- b. Check breathing and pulse.
- c. Loosen tight clothings.
- d. Clean the air-way.
- e. Give artificial respiration and external Cardiac Massage, if needed.
- f. Transport the patient to the hospital.

#### **22.POISONING**

- a. Find the nature of the poison
- b. Give universal antidote mixture as given below to drink:
  - i. Charcoal powder- 2 tablespoons
  - ii. Coffee powder -2 tablespoons
  - iii. Chalk powder -1 tablespoon
- c. Add it to a glass of warm water and mix well.
- d. Send the patient immediately to the hospital

## **CHAPTER-11**

### **COMMUNICATION SYSTEM, SAFETY & PERSONAL PROTECTIVE EQUIPMENT**

#### **11.1 COMMUNICATION SYSTEM**

Communication is a key component to control an emergency in a work site. The Walky Talky, Telephone, Cellphone, Intercom etc. may be provided in the work site. Further, telephone, fax, V-set, internet communication may be provided in the plant.

#### **11.2: LOCATION OF SAFETY EQUIPMENT AND EMERGENCY FACILITIES IN THE PLANT**

All safety equipment, personal protective equipment, gas mask and emergency facilities such as first aid box, stretcher, artificial respiration system, and ambu -bag etc. shall be kept at a conspicuous location in sufficient quantity near the work area. Defective equipment shall be discarded immediately.

#### **11.3: PERSONAL PROTECTIVE EQUIPMENT**

##### **A. General:**

Hazard exists in every workplace in many different forms: sharp edges, falling objects, flying sparks, chemicals, noise and a myriad of other potentially dangerous situations. Many hazards cannot be removed at source; hence, use of PPE/PPC plays an important role to work as a shield against hazards and protects the precious life of workers on the site. Every industrial/construction worker, supervisor and field engineer shall wear appropriate personal protective equipment and protective clothing which shall be adequately provided by the management. All PPE except shoe, disposable ear plug and disposable dust mask shall be for common use. High visible safety vest shall be provided to the site personal in all construction areas.

##### **B. Quality:**

Personal protective equipment (PPE) shall be suitable for use and conform to the national (BIS) standard. Where national standard is not available, international standard (CE, EN, ANSI etc.) shall be considered.

## **CHAPTER-12**

### **FIRE PREVENTION, PROTECTION& FIRE FIGHTING**

#### **12.1 General**

“It is easy to prevent a fire, difficult to fight one”. A fire safety program should therefore aim at preventing a fire before it starts. Equipment and system should be available to control fire at the initial stage of a fire, in case one gets initiated. Suitable fire detection and alarm system, availability of first aid firefighting system and trained and alert man power are the essential requirements for this.

Adequate firefighting facilities such as firefighting equipment (portable & mobile fire extinguishers, sand buckets, water tender, fire hydrant with high velocity water spray system, emulsifier, automatic CO2 release system), detection, warning and alarm system (smoke & heat detector with control panel, audible alarm and manual call point) with sufficient trained manpower shall be provided for prevention, protection and effective control of fire. Water & sand buckets and portable fire extinguishers are to be provided at appropriate places in the work site for use during fire emergencies. Fire incident report will be prepare and submitted by concerned Shift Engineer as per **(Annexure-IX)**.

#### **12.2 Portable Fire Extinguishers**

Portable Fire Extinguishers of Dry Chemical type, Mechanical Foam, Carbon Dioxide and Sand Buckets are placed strategically in the plant for its easy availability. There are extinguishers of the above three types at HPSEBL plants. The checklist to be followed for inspection and maintenance is given in the (Annexure XI).

Fire extinguishing equipment could be in the form of water and sand buckets, portable fire extinguisher, small bore hose-reels and hydrant system. Water, sand buckets and portable fire extinguishers are to be provided at appropriate places in the Construction/Operation/Maintenance Site for use during fire emergencies.

Fires in electrical equipment are to be treated as either Class ‘A’ or Class ‘B’ fires depending on the ingredients of the electrical equipment, but the water type and mechanical foam should not be used unless the electrical supply to the equipment is isolated. Other types suitable for Class ‘A’ or ‘B’ fires can be used on the electrical Equipment on fire even if supply is not switched off.

The type of fire extinguishers suitable for various types of fires as given below;

<b>Class of Fire</b>	<b>Type of Fire</b>	<b>Suitable type of Extinguisher</b>
Class ‘A’	Fires due to combustible materials such as wood, paper, rubber etc.	Water Buckets; Water type/ABC Powder type Extinguisher
Class ‘B’	Fires inflammable liquids like oil, petroleum products, solvents, grease, paints, etc.	Sand Buckets; Mechanical Foam/Carbon dioxide, Dry Powder/ABC Powder type Extinguisher
Class ‘C’	Fires arising out of gaseous substances	Carbon dioxide/Dry Powder/ABC Powder type Extinguishers.
Class ‘D’	Fires arising from reactive chemicals, metals, etc. (These chemicals/materials are not generally used during Operation/Maintenance stage of any plant)	Sand Buckets; Special type of Dry Powder Extinguishers.

**Note:-**In case of Electrical Fire after De- Energization and isolation of electrical circuit, Fire is to be treated as A or B or C Class as per material used and accordingly ABC Type, Foam Type or CO2 Type Extinguisher can be used. Accordingly, guideline may be issued by the respective Plant/Project Safety Officer.

### **12.3 Placement of Fire Extinguishers:**

- One 2 kg. Dry powder or CO<sub>2</sub> extinguisher within 15 m of electrical equipment (Transformer, Motor, other equipment).
- The fire extinguishers should be located in such a way that a person in a workplace has to travel not more than 15 mt or each the nearest extinguisher.
- The extinguishers should be in conspicuous places and readily accessible for immediate use.
- Generally, these are to be placed near exits, staircase, landing routes of escape etc.
- Access should not be blocked by materials or otherwise.
- The extinguishers or buckets should be placed at convenient height, such that their bottom is 75cm above floor level.

### **12.4 Fire Hydrant system**

A fully operational wet hydrant system should be maintained. The piping system and delivery points should consist of Fire Hydrant stand pipes with single/ double discharge points depending upon the area. The hydrant system should be maintained as per IS13039:1991.

### **12.5 Water Supply**

Sufficient quantity of water as required for independent power houses should be stored in static tanks distributed around the Construction/Operation/Maintenance Site with due regard to potential fire risk.(As per factories rules)

### **12.6 Fire Detection & Alarm System**

A Fire Detection & Alarm System should be installed in the plant, consisting of Smoke Detectors and Manual Call Points. Inspection and test procedure for smoke detectors should be as per IS 2189:1999. Record of such inspection and tests shall be kept for verification.

### **12.7 Fire Emergency Plan:-**

A written fire emergency plan should be developed for each Unit and should at least include the following:

- Response to fire alarms and fire systems supervisory alarms.
- Evacuation of personnel not directly involved in the firefighting activities from the fire area.
- Coordination with the security forces to admit public fire department and control personnel movement.
- Periodic fire drills should be carried out at least quarterly.
- Responsibilities of various agencies such as Shift Charge engineer, safety officer, Fire crew, Security etc. during fire emergencies should be clearly mentioned.



## **12.8 Guide lines for Fire Emergencies: -**

- If anybody notice fire or see/smell smoke, immediately follow these procedures:
- Inform the Shift Engineer/ In charge immediately.
- The Shift Engineer/In charge should inform the Safety Officer/Asst. Safety Officer/Plant security.
- The Shift Engineer/In charge should immediately activate the Building alarm.
- Shutdown equipment/cut off electric supply in the immediate area if possible.
- Use a portable fire extinguisher & try to control the fire, if you have received appropriate training.
- Isolate the area by closing windows and doors and evacuate people from the building, if you can do so safely.
- Employees should not to waste their time in collecting personal/official items. Leave the area of the fire immediately and meet in the designated assembly points.

### **12.10 Fire Squad**

A 'Fire Squad' is a select group of employees belonging to the operation and maintenance wing of the plant who are basically technical employees familiar with the plant and its systems. In the absence of a Fire Brigade it is required to train such a small group of persons who are able to identify the source of fire, isolate the system and use the available firefighting systems to control/ fight fire till a trained fire brigade reaches the plant with their equipment and manpower to fight the fire. The availability of a fully trained fire squad is required at each plant when a Fire brigade is not available with the plant / nearest Municipal fire brigade is not within 5 km from the plant.

At least 10% of the plant employees should be trained by a professional agency to serve as a Fire squad. These employees should also consist of personnel who come in round the clock shift duty, so that in an emergency during evening or night hours trained Fire Squad is available at plant site to control and extinguish the fire. The duration of training for the fire squad should be at least one week (5days) with the oral and practical sessions.

Fire Extinguisher record will be maintained by Concerned A.E maintenance as per **(Annexure-X)**.

## **CHAPTER-13**

### **Maintenance Check List for Fire Extinguishers (as per IS 2190: 2010)**

#### **13.1 Fire Extinguisher-Foam Type (Mechanical)**

- a) Open the extinguisher, check the liquid level. Pour liquid in separate clean receptacle to see if there is any sediment at the bottom of the cylinder: Reject the charge if there is sufficient sludge formation.
- b) Examine the extinguisher externally and internally for any corrosion or damage. Damaged and corroded extinguisher should be replaced.
- c) Examine the gas cartridge of mass. If there is loss of more than 10 percent of original mass, replace it with fully charge done.
- d) Examine the foam generating nozzle, strainer, vent holes, internal discharge tube ceiling washer, etc. Replace them, if not in good condition.
- e) Check the operating mechanism for free movement and piercing mechanism for proper working.

#### **13.2 Fire Extinguisher- Dry Powder Type (Gas Cartridge)**

All dry powder extinguishers should be inspected and maintained in accordance with the following. The dry powder extinguisher should be opened in a dry room and for a minimum possible time to avoid effect to atmospheric moisture on powder.

- a) Dry powder extinguisher, where discharge control is fitted on the nozzle, should be operated before opening
- b) Weigh the extinguisher to check the correct mass of powder filled in it which should be marked on the body of extinguisher
- c) Open the extinguisher and remove gas cartridge and see that sealing disc is intact. Weigh and compare its mass with full mass of cartridge marked on it. In case, loss of mass is more than 10 percent, it should be replaced by new cartridge.
- d) Check the operating mechanism, discharge control for fire movement and closing. Examine nozzle, hose, vent holes, piercing mechanism of cap cartridge holder, grease and wipe clean.
- e) Empty the dry powder in a dry container and examine for caking, lumps and foreign matter, in which case replace it with new dry powder charge.

#### **13.3 Fire Extinguisher, Carbon Dioxide Type**

13.3.1 Examine extinguisher body externally. Damaged or corroded extinguisher should be replaced.

13.3.2 Weigh the extinguisher, compare mass against the mass marked on it for fully, charged extinguisher. It should be sent for refilling if the loss is more than 10 percent of mass. Clean and polish externally.

13.3.3 Examine hose, horn and assembly and clean. In case of trolley mounted extinguisher, examine the wheel carriage for free movement

#### **13.4 Refilling Schedule for Fire Extinguishers and Operational Test**

Extinguishers to be refilled/operated for performance test in annually cyclic manner.

Once in Two Years

13.4.1 Portable fire extinguisher, water type-stored pressure.

13.4.2 Portable fire extinguisher, mechanical foam-stored pressure.

Once in Three Years'

BC and ABC powder extinguisher

Once in Five Years

- a) Portable fire extinguisher, mechanical foam type
- b) Fire extinguisher, carbon dioxide type.

### 13.5 Hydraulic Pressure Testing of Fire Extinguishers

Every extinguisher installed in premises shall be hydraulically pressure tested as per the schedule given below. There shall not be any leakage or visible distortion. Extinguisher which fails in this requirement shall be replaced.

Sr no.	Type of extinguisher	Test pressure Kg/cm <sup>2</sup>	Pressure maintained For min.	Test interval year
1	Water type(gas cartridge)	35	2.5	3
2	Water type(stored pressure)	35	2.5	3
3	Water type(gas cartridge)	35	2.5	3
4	Mechanical foam type	35	2.5	3
5	Dry powder(stored pressure)	35	2.5	3
6	Carbon dioxide	35	2.5	3

The CO<sub>2</sub> type and clean agent type fire extinguishers shall be pressure tested every time when the cylinders are sent to recharging.

### 13.6 Inspection and Maintenance of Fire Hydrant System (IS13039:1991)

Each hydrant provided in the area should be inspected as often as possible. However for industrial establishments, such inspections for each hydrant should be carried out at intervals not exceeding once every week.

The following action should be taken during the monthly/weekly inspections:

- a) The valve spindles should be checked for signs of excessive wear including leakage in the gland.
- b) The valve should be opened slightly to see that water is flowing freely and there is no obstruction.
- c) The paint work of the hydrants, pit covers, indicator plates, etc., should be checked.
- d) Brass parts should be cleaned and polished.
- e) All cut off (isolating) valves should be operated and oiled, once a month.
- f) Isolating (cutoff) valves should be thoroughly overhauled annually to remove sludge and other foreign matter collected in valve seating.
- g) As part from the monthly/weekly inspections, the performance of the hydrants should be thoroughly checked during the firefighting operations and regular drills and practices.
- h) The practices should be so arranged that the maximum number of hydrants in different areas is operated in rotation.
- i) Testing of pressure and output in different areas covered by the hydrant system should be carried, at least every quarter.
- j) Hydrant mains should be tested with the pump delivering at its maximum pressure with all the hydrants outlet closed and thereafter, with at least three adjacent hydrants opened to see that the hydrant yield the minimum output of 125 liters per minute at a minimum pressure of 5.25 kgf/cm<sup>2</sup> or higher, if needed.

### 13.7 Inspection & Test of Fire Detection and Alarm System as per IS2189

The following check-list and test sequence should be carried out Quarterly by the User

- a) Batteries and their connections should be examined and tested to ensure that they are in good serviceable condition.
- b) Where applicable, secondary batteries should be examined to ensure that the specific gravity of electrolyte in each cell is correct.

- c) The alarm function of control and indicating equipment should be checked by the operation of a trigger device in each zone.
- d) The visual inspection should also confirm that a clear space of at least 750 mm radius is preserved in all directions below every detector,

### **Annual Inspection Tests**

The following check and test sequence should be carried out:

- a) The instruction and test routines detailed above
- b) Operation of at least 20 percent of the detectors in an installation should be checked each year and the selection should be done in such a way that all the detectors in an installation shall have been checked once in every 5 years
- c) Each detector should be checked for correct operation using specified test equipment and method.
- d) Visual inspection should be made to confirm that all cable fitting and equipment are secure, undamaged and adequately protected.

### **13.8 Fire Safety in Cable galleries / vaults (as per IS12459:1988)**

The entire cable run should be protected by automatic fire alarm system. The following types of detectors may be used depending upon the circumstances:

- a) Smoke Detectors (IS11360-1985)
- b) Heat detectors linear type, and
- c) Heat detectors (IS: 2175-1988).

Long cable runs should be compartmented and each compartment should be considered as a separate zone for installation of detectors (IS2189:1988).

The linear detectors may be used for each cable or for bunch of cables.

### **13.9 Fire Extinguishing System**

In addition to the fire detection and alarm system an automatic fixed fire extinguishing installation should also be provided for long cable runs as in case of heavy industries, electricity generating stations, etc. The automatic fixed fire extinguishing Installation employ any of the following extinguishing media, according to the operational requirements.

- 13.9.1 Water,
- 13.9.2 Carbon dioxide (IS:6382-1984)
- 13.9.3 Clean agent, and
- 13.9.4 High expansion foam.

### **13.10 Miscellaneous**

1. Self-contained breathing unit should be installed in substations, cable basements and cable tunnels, where ventilation has not been provided.
  2. Cable tunnel floor should have a slope leading to a sump for collecting see page and other water including that used for firefighting and should be provided with sump pump.
- Entry of personnel into cable tunnels and galleries should be strictly controlled through work Permit system. No one should use these premises for rest and carrying eatables.

- 3.No welding or naked fire should be allowed inside the cable gallery.
- 4.All cotton waste sand waste paper should be disposed in self closing metallic containers.
- 5.Identify all the activities/location where there is a potential for fire and explosion.
- 6.Do not keep any flammable material near the potential hazardous area and electrical points.
- 7.Ensure that no body smokes inside the identified fire prone areas.
- 8.Ensure that the electrical earthing is in place.
- 9.Follow safe electrical practices while handling electrical equipment, machinery and lines. Use Rubber mats, Electrical Grade Gloves, Shoes wherever required.
10. Do not allow any spillage or leakage in working Area; in case any spillage is noticed, immediately wipe off with cloth. Throw the cloth in the designated bin.
11. Make sure that non-compatible materials are not kept together, especially chemicals. Also, good electrical practices to be in place e.g. no naked wires etc.
12. Ensure availability of adequate number(s) of appropriate type Fire Extinguishers in the fire prone places.
13. Keep yourself informed about the type and class of fire and appropriate extinguisher to be used.
14. Participate actively in the periodic Mock Drills to ensure emergency preparedness.

Adequate firefighting facilities such as firefighting equipment ( portable & mobile fire extinguishers, sand buckets, water tender, fire hydrant with high velocity water spray system, emulsifier, automatic CO<sub>2</sub> release system), detection, warning and alarm system (smoke & heat detector with control panel, audible alarm and manual call point) with sufficient trained manpower shall be provided for prevention, protection and effective control of fire. Water & sand buckets and portable fire extinguishers are to be provided at appropriate places in the work site for use during fire emergencies.

### **13.11 Training for operating the equipment**

In every shift, there should be persons trained in the operation and effective use of the equipment. There are no particular norms on the number of trained persons to be available. The Shift Supervisor, Sub-Contractor's Supervisor, and some building workers should be trained in the operation. The Contractor may maintain a register of training with names & designations of the persons trained, date of training, name of the trainer, duration of training and the aspects covered in the training (such as demonstration/ operation, hands-on trials by participants, films shown. topics covered, etc.). Great value is attached to refresher training.

### **13.12 Inspection & Maintenance of Extinguishing Equipment**

The Rules requires--  
Proper maintenance

Regular inspection at intervals of not less than once a year by responsible person and maintaining the record of inspection.

The record of inspection should be maintained in a Register as per the format given in the Indian Standard IS 2190: 1992 Selection, installation and maintenance of first-aid fire extinguishers - Code of Practice.

Sl. No.	Type	Capacity	Year of Manufacture	Make	Location	Monthly Inspection Dates	Annual Inspection dates	Pressure Tested on	Date of Discharge	Refilled on	Due for Refilling	Remarks
1.												
2.												
3.												
4.												
5.												
6.												

Document for verification: Register of Fire Extinguishers.

In addition, the following details should be painted on the body of each equipment and imprinted on a metal tag attached to the extinguisher.

Sl. No./ distinguishing number of extinguishers

Date of last refilling

Date of last inspection

The Inspector may verify at random, whether the above details are available on the extinguishers.

Although it is not mandatory, but still it is recommended that firefighting facilities may be considered as required under the relevant IS.

The Fire Fighting Extinguishers may also be inspected and maintained as per provisions contained in IS.

## **CHAPTER-14**

### **CONTROL OF NOISE**

- 1.Ensure the availability of PPE like earmuffs/earplugs and insist to use the same.
- 2.Ensure the display of awareness Boards to insist on usage of PPE at work locations that are noise prone zones.
- 3.Check the condition of doors of all the enclosures, gaskets, sealing under normal conditions ensure the doors to be closed. Under abnormal conditions of noise check the equipment for leaks of oil, vacuum conditions etc.
- 4.Inform maintenance staff for attending abnormalities.
- 5.Ensure the periodic checking of PPE for their effectiveness/healthiness.
- 6.If a PPE is found defective, replace the same.

Never open the acoustic doors of the Diesel Generator Sets while it is running.

## **CHAPTER-15**

### **SAFETY IN WASTE DISPOSAL**

Waste management or disposal is the process required to manage waste from its inception to its final disposal. This includes amongst other things, collection, transport, treatment and disposal of waste together with monitoring and regulation. It also encompasses the legal and regulatory frame work that relates to waste management including recycling.

#### **A. General:**

Waste such as jute and clothes used for cleaning of machinery, damaged gasket and rubber seal, fused bulb etc. shall be disposed suitably so that no pollution of air, water and soil can take place. The following measures shall be taken to control of pollution:

1. Segregation in to Bio-degradable and Non-Biodegradable waste.
2. Temporary collection of waste on site. Disposal of waste at identified/authorized location.
3. Dumping of non-biodegradable waste in designated dumping area on a shaving concrete floor. After sufficient accumulation, the waste shall be disposed off through suitable agency.
4. Biodegradable waste shall be collected from different areas and dumped in designated area away from human habitation.
5. Display board to be installed to educate the employees to avoid wastage of goods. Awareness among the employees shall be imparted during work place inspection.

#### **B. Hazardous waste:**

Hazardous waste means any waste which causes danger to health or environment, whether alone or when in contact with other waste. The key objectives of hazardous waste management are to minimize the hazardous waste in terms of quantity, to dispose off as close to the source and reduce the Trans boundary movement.

##### **a) Provisions:**

1. Every hazardous waste handling/generating unit is responsible for collection, reception, treatment, storage and disposal of hazardous Waste.
2. Mandatory authorization from the State Pollution Control Board is to be sought for collection, treatment, storage and disposal of hazardous Waste.
3. Import and export of hazardous waste is not permitted for dumping and disposal.
4. Import and export of hazardous waste is permitted as raw materials for recycling and reuse subject to the compliance of procedure prescribed involving the grant permission from MoEF for such import and export of hazardous waste.

##### **b) Common pre-requisites for obtaining authorization for storage under Hazardous waste (management & handling) Rules:**

1. Display of updated data outside the main Power station gate in two boards of size, 6 feet x 4 feet, both in English and Hindi and the local language.
2. Storage facility shall have appropriate containment system.
3. The container/enclosure holding hazardous waste shall be marked (Hazardous Waste) in red colour in English/in Hindi and shall bear the prescribed label.
4. The Resident Engineer/Executive Engineer must take precautions to prevent any accidental ignition or reaction of ignitable or reactive waste.
5. The containment system shall be leak proof and able to drain/remove liquids.
6. Units that store hazardous waste shall do so in such a manner that it does not in any way contaminate the environment or the ground water due to air/rain/seepage/leakage etc.

#### **C. Disposal of hazardous waste:**



1. Segregate the Hazardous waste from general waste such as Oily cloth/ oily soaked cotton waste, empty chemical containers, empty paint containers, e-waste from electronic data processing, oil filters, oil bearing strainer, oil bearing contaminated residue from centrifuge, oil bearing cartridge filter, contaminate collector from electronic liquid cleaner.
2. Ensure that there is no spillage of waste during handling; use Personal Protective Equipment as may be required.
3. Collect hazardous waste in drums during maintenance activities or as required.
4. Collect used or spent such as oil, Lubricants, Waste coolant, strainer cleaning waste water from centrifuge, metallic cartridge cleaning waste water in drums during maintenance activities or as required.
5. Ensure that there is no spillage of oil during handling.
6. Collect the oil in designated Leak Proof MS/ Fiber Drums only.
7. Ensure that the drums are not damaged/leaking. Label the containers as per the Hazardous Wastes (Management, Handling & Trans-boundary Movement) Rules.
8. Send hazardous waste to the Scrap yard for proper storage and maintain record in Form 3 of the Hazardous Wastes (Management, Handling & Trans-boundary Movement) Rules.
9. Load them in and keep in designated area only.
10. Ensure to keep the waste oil drums in concreted storage areas only.
11. Follow the Hazardous Wastes Authorization conditions as received from state Pollution Control Board.

## **CHAPTER-16**

### **COMPRESSOR AND COMPRESSED AIRLINES**

1. Ensure that there is no oil leakage from the compressors.
2. In case of oil leakage, arrest it immediately & keeps the oil in a tray for reuse.
3. Check and maintain oil level as per the marking provided at the machine.
4. Put old/used spares, waste cloths in the designated bin.
5. Use earplugs/muffs in the compressor area, when it is in operation.
6. Check and arrest any air leakage from valves, flanges, pressure gauges etc., check for any pinholes and drop in desired air pressure. In case any deviation is found, get it corrected immediately.
7. Maintain pressure as per process requirement.
8. Display the safe working pressure (range) in the compressor and also mark the same suitably in the pressure gauge.
9. Drain moisture from the Air reservoir once in a day.
10. Do preventive/scheduled maintenance as per Manufacturer's recommendation and statutory testing (as applicable).

## **CHAPTER-17**

### **AIR CONDITIONING AND VENTILATION SYSTEM**

#### **A. General:**

1. Check compressor for any leakage of oil & Refrigerant (R122/R134A)
2. Check discharge and suction line pressure to observe any abnormality.
3. Check all pumps of AC & Ventilation systems for any abnormality.
4. Check all pipelines of AC & Ventilation system for any abnormal behaviors.
5. Logging of all temperatures of AC & V system to monitor healthiness of system.
6. Check the heat exchangers for any choking.
7. Ensure that thermal insulation provided on pipes is in good conditions.
8. Change of duty cycle of compressors.
9. Check functioning of all temperature controllers.
10. Note down the readings of all pressure gauges provided in the systems for any abnormal behavior.

#### **B. Energy conservation:**

1. Put off the lighting during daytime – use daylight to the extent possible.
2. Ensure that all temperature controllers are working satisfactorily.
3. Use Air Conditioners only when required and ensure to carry out periodic maintenance.
4. Switch on and off all building lights timely.
5. Ensure that all power factor correcting panels are working satisfactorily.
6. Switch off all fans / AC's / Coolers / Heaters when not required or moving out of the cabin / work area.
7. Ensure to switch off the control panels of the machines when it is not use.
8. Keep your Computer Monitors in energy saving mode; do not keep the printers / accessories in “ON” condition.
9. Regularly clean the reflectors in the lighting fittings.
10. Use the water pumps judiciously.
11. Switch ‘OFF’ all lights of non-essential areas.
12. Do's for Energy Conservation as follows:
  - (i) SWITCH OFF light when it is bright.
  - (ii) Use wire of proper size in house wiring to reduce loss of energy.
  - (iii) Use ISI standard electrical fittings and fixtures.
  - (iv) Keep lamps and fixtures free from dust and dirt.
  - (v) SWITCH OFF the stabilizer when appliance is not in use.
  - (vi) Clean Air-conditioner, Desert Cooler pads and Refrigerator radiator periodically.
  - (vii) Use stairs more.
  - (viii) SWITCH OFF lights and fans while leaving the room.
  - (ix) Use LED lights instead of bulbs.
  - (x) Lubricate motor and motor drives regularly to reduce friction.
  - (xi) Motors shall be kept clean to help them cool properly.
  - (xii) A motor shall be placed as close to the load as possible.
  - (xiii) Match motors to your requirement. Oversized motors waste energy. Use motors of high efficiency.
  - (xiv) Use shunt capacitors across motor terminals to reduce KVA charges and also avoid damage to motors.
  - (xv) Tighten belt and pulley at regular intervals to reduce loss of energy due to ‘Slip’.
  - (xvi) Replace worn out bearings immediately and ensure timely repairs.
  - (xvii) Make greater use of daylight.

## **CHAPTER-18**

### **SAFETY FEATURES AND SAFE USE OF LIFTS**

Failure of lift is very common with greater use of lifts. Injuries sustained in lift accidents are often severe and even fatal because many lift accidents involve the fall of victim from great heights.

Hazards associated with lifts: Exposed lift shafts, improper leveling of the lift car with the floor level, improper functioning of electronic eyes – the mechanism used to control the closing of lift door, sudden drop of the lift car, exposed parts carrying electrical current.

#### **A. Safety features to be provided in the lift:**

1. Lifts should be inspected by competent person at least in 6 months as per the factories Act 1948 and its records should be maintained and lifts should be maintained as per the section 28 of the factories Act 1948. It is the responsibility of head of concern department to get it tested by the competent person.
2. Every hoist way & lift way shall be sufficiently protected by an enclosure fitted with gates & the hoist and lift & every such enclosure shall be constructed as to prevent any person or thing from being trapped between any part of lift & hoist & any fixed structure & moving part.
3. Every gate shall be fitted with inter-locking /other efficient device to secure that the gate cannot be opened except the cage is at the landing & cage can't be moved unless the gate is closed.
4. Segregation of electric supply lines-To safeguard the users, the electrical supply lines are to be segregated voltage wise. Car shall be taken that whichever part of a lift comes in contact with users has minimum possible supply voltage.
5. Over speed governor- To bring the lift car to rest by operating the safety gear in the event of over speeding in the descending direction exceeding a pre-determined limit. Safety gear is attached to the car bottom frame to stop and hold the lift car on guide rails in the event of free fall or over speeding in descending direction.
6. Interlocks to landing and car door- To open lift landing and car door only when the lift car is in the landing zone.
7. Down final limit-To avoid the lift to over travel in the downward direction below ground floor and hit on the buffers in the pit.
8. Up final limit-To avoid the lift to over travel in the upward direction beyond the top floor and hit on the ceiling of the machine room.
9. Emergency stop switch-To stops the lift instantly during emergency anywhere during ride.
10. Emergency alarm-To obtains assistance in case of emergency.
11. Pit switch-To avoid the operation of the lift by any means when persons have entered in the pit for any maintenance work and are safely guarded from the lift to come down.

#### **B. Safe use of lifts:**

1. Do not panic in case of the elevator getting trapped between floors. Press emergency alarm button.
2. Do not jump out of the elevator before it comes to the floor level.
3. Do not jump in side elevator when elevator is in motion.
4. Do not try to force open/close power operated doors.
5. Do not overload the elevator than the rated load.
6. Do not open the manual doors when elevator is in motion.
7. Do not rest on the door panel.
8. Do not allow seepage or water accumulation in the elevator pit, shaft and machine room.
9. Passenger elevator shall not be used for transfer of heavy and bulky articles.
10. Operate the button gently and only when required.
11. Keep the machine room neat and tidy.
12. Keep the machine room key easily accessible.
13. Display the service provider's contact number in the elevator cabin and at ground floor.
14. Don't use lift in case emergency such as fire, earthquake etc. Use staircases.

## **CHAPTER-19**

### **PREVENTION OF UNAUTHORIZED ENTRY AND PERMIT TO WORK SYSTEM**

Unauthorized entry at hazardous or dangerous operations /activities /areas shall be prevented by having a proper safety system, regulating entry through gate pass and permit to work system.

**19.1 Permit to Work:** It is a written statement containing information and instructions pertaining to hazards that are to be avoided in a particular operation. It indicates that all hazards have been considered in advance and that foreseeable appropriate pre cautionary measures have been taken. People responsible to execute a job defined in the permit are to review them from the point of compliance. A permit is a written consent of the issuing authority that guarantees proper and safe conditions where personnel can work safely by complying with the instructions on the permit. It also indicates that the people executing the job have reviewed the permit and accept responsibility of adhering to the instructions and limitations stipulated. Thus, a permit finally becomes a document of consent by both parties, i.e., the Receiver (Maintenance personal) /issuing authority and job executor.

**19.2 Issuer of permit:** Designated person authorized to issue work permit. The issuer shall be shift in charge as per the requirement of site.

**19.3 Receiver:** Designated person authorized to receive work permit. The receiver shall be engineer of that maintenance department (O&M plant).

#### **19.4 Electro mechanical Work Permit System:**

Work on electromechanical installations, equipment and apparatus is considered to be very hazardous. Therefore, it is of utmost importance that sufficient safety precautions are taken before carrying out any work on electrical circuits, lines, mechanical components, hydraulic systems and equipment. Hence, to exercise greater control over such work and to ensure that adequate precautionary measures are taken before commencement of work, a Work Permit system shall be developed. This permit is issued to carry out work on electrical equipment, installation after completely de-energizing the equipment from electrical energy & providing effective grounding and work on Mechanical /Hydraulic systems after depressurizing the system.

The permit shall clearly indicate–The equipment / installation under work, the person who is handling the work, duration of work, type of work that is to be carried out, points/ means of isolation indicating each point of isolation, grounds provided to the equipment, additional precautions required if any to be indicated on the permit. The permit shall be signed by the issuing authority & also by the executing authority. All work shall be carried out under the supervision of a competent supervisor. If more than one department is working on the same equipment/apparatus, a permit to work shall be issued to the person in-charge of each department. No construction, repair or maintenance work in the proximity of high or EHV system / equipment (electrical or mechanical) where technical knowledge or experience is required to avoid danger, shall be carried out unless a permit to work on the prescribed form has been issued by the shift in-charge to an authorized person. The person issuing a permit to work shall ensure that the system/equipment is made perfectly safe for working. In the case of electrical system/equipment, the isolation shall be complete, the metal parts adequately earthed and danger notices attached at suitable places in the case of mechanical equipment, the isolation shall be complete and conditions rendered safe and danger notices applied at suitable places.

Work permit shall be made in duplicate. Original copy of the permit is handed over to person in-charge of the work. The carbon/duplicate copy shall be retained by the shift in-charge. **Permit books are important records and shall be compiled safely.** All pages shall be kept safely. No page shall be detached or used for any other purpose. If a page is inadvertently detached, it shall be recorded and duly signed in the book by the person concerned. The issue of permit to work, nature of repair carried out, transfers, if any, cancellation of permit are to be noted in the Log Book maintained by the permit issuing department. The Person in-charge shall be responsible for identifying the isolated and de-energized circuit. After completion of the works, removal of men/material (tools and tackles), and the person in-charge of the works shall inform the person issuing the permit regarding completion of work and shall surrender the original work permit for cancellation

of it.

Carryover of work over to next shift: if the work is carried out the next shift the same work will remain in force however the shift Engineer in whose shift the permit has been issued will put a note in the Shift Engineer diary in respect of PTW issued. It will be the duty of next Shift Engineer to check the diary and make him/her self-informed about the PTW. This will continue till the cancellation of PTW. Format of permit to work (PTW) is attached in (**Annexure-I**).

The audit on monthly basis of Permit to Work forms will be done by RE/Executive Engineer as per (**Annexure-II**) attached.

#### **19.5 General Instructions for Work permit system:**

- a) The work permit shall be filled up carefully and accurately in clear handwriting ensuring that complete information is provided in all sections / sub sections and none of column is left blank. Sketches should be provided wherever possible to avoid miscommunication.
- b) Appropriate safe guards and required personnel protective equipment shall be determined by a careful analysis of the potential hazards and the operations to be performed prior to starting the work.
- c) For renewal of work clearance, the issuer shall ensure that the conditions are satisfied Power station for the work to continue. If the conditions have changed, it may be necessary to issue a new permit or amend the existing permit.
- d) Document of permit must be available at work site at all times.
- e) On completion of the work, the permit must be closed and kept as record.
- f) Powered/ pressurized equipment must be stopped and locked out before maintenance or repairs are performed unless the equipment is designed or fitted with safeguards to protect personnel during maintenance /repair. Lockout /tag-out procedures will include locking out electrical, mechanical and stored energy as appropriate.
- g) Issuer or safety department may add other relevant instructions based on their operating and maintenance practices.

## **CHAPTER-20**

### **GUARDING OF ROTATING PARTS OF MECHANICAL EQUIPMENTS AND HYDRAULIC WORKS**

1. Every moving part of a prime mover and every fly-wheel connected to a prime mover, whether the prime mover or fly wheel is in the engine house or not, the headrace and tailrace of every water wheel and water turbine, any part of a stock-bar which projects beyond the headstock of a lathe, every part of an electric generator, a motor or rotary converter, every part of transmission machinery and every dangerous part of any other machinery shall be securely fenced by safeguards of substantial construction which shall be constantly maintained and kept in position while the part of the machinery are in motion or in use.
2. No part of any machinery which is in motion shall be examined, lubricated, adjusted or repaired except by a person skilled for such job.
3. Machine parts shall be cleaned when such rotating machine is stop.
4. When a machine is stopped for servicing or repairs, adequate measures shall be taken to ensure that such machine does not restart inadvertently.
5. An effective guard must:
  - (i) Prevent contact. The safeguard must prevent hands, arms, or any part of a worker's body or clothing from making contact with dangerous moving parts.
  - (ii) Be secured & well- constructed. Workers shall not be able to easily remove or tamper with the safeguard. They must be firmly secured to the machine. Guards shall be made of durable material that will withstand the conditions of normal use. They may be constructed of sheet metal, screen, wire cloth, bars, plastic, or any other material that is substantial enough to withstand whatever impact it may receive and to endure prolonged use.
  - (iii) Protect from falling objects/contain the hazard. The safeguard shall ensure that no objects can fall in to moving parts.
  - (iv) Create no new hazards. A safeguard defeat sits own purpose if it creates a hazard of its own such as a shear point, a jagged edge, or an unfinished surface which can cause a laceration or creates a pinch point between the guard and moving machine parts. The edges of guards, for instance, shall be rolled or bolted in such a way that they eliminate sharp edges.
  - (v) Create no interference. Any safeguard which impedes a worker from performing the job quickly and comfortably might soon be overridden or disregarded. Proper safeguarding can actually enhance efficiency since it can relieve the worker's apprehensions about injury.
  - (vi) Allow safe lubrication. If possible, one shall be able to lubricate the machine without removing the safe guards.

## **CHAPTER-21**

### **HANDLING OF OIL AND GREASE**

1. All electrical safety measures shall be followed strictly to prevent spark in oil storage & handling area.
2. Smoking shall be strictly prohibited in oil storage & handling area.
3. Open flamed lighting arrangement shall not be allowed in oil storage & handling area.
4. Flame proof lighting arrangement shall be provided in oil storage & handling area.
5. Oil containers shall be stored in upright position unless otherwise specifically mentioned and on a cemented floor with collection pit.
6. Oil storage area shall be away from other establishment and securely protected.
7. Caution sign board shall be displayed at oil storage area with caption “NO SMOKING”, “NO OPEN FLAMMED LIGHT”, “FLAMMABLE LIQUID” etc.
8. Never heat a container that has stored oil without first ensuring that it is free of residual oil and oil vapour.
9. To extinguish a small fire, foam, dry powder or CO2 extinguisher or earth/sand can be used. DO NOT USE WATER ON AN OIL FIRE AS IT WILL CAUSE THE FIRE TO SPREAD.
10. Avoid prolonged or repeated exposure of skin to contact with oil and avoid splashing it into the eyes, swallowing it, or inhaling the vapour in a confined space. In the event of contact with skin, wash with large volumes of water; for contact with the eyes, bathe them with clean water for ten minutes and seek medical attention if irritation persists.
11. Materials contaminated with oil shall not be carried, or left in pockets, and any clothing that is heavily contaminated shall be changed as soon as practicable.
12. Do not deliberately drink or inhale petroleum products but if this shall happen accidentally, seek urgent medical attention.
13. Availability & use of appropriate pumps / transfer equipment for the transfer of spilled oil shall be ensured.
14. Separate jerry cans for intermediate storage of oil, if replaced, shall be used. These cans shall be kept in trays with proper identification and pumps shall be used to draw out required quantity of oil into handy container. Ensure the containers are having lid to avoid spillage during handling.
15. Rejected oil from equipment shall be collected to avoid spillage using proper device (funnel, tray, and containers). Collected oil shall be transferred to site at identified locations. The filled drums shall be returned to store for further disposal action. Ensure that the waste oil collected is sold to authorized recycles (By Central Pollution Control Board) and records to be maintained as per Hazardous Waste (Management, Handling and Trans-boundary Movement) Rules.
16. The fresh left-over oil shall be kept/poured back into the respective containers kept in the maintenance section/sub store-using funnel to avoid spillage.
17. Placement of oil drums, cans in tray shall be so ensured to facilitate collection of spilled over oils is easy.
18. In case of any spillage of oil, wipe with waste cotton/ jute & throw it in the designated bin.
19. In the event of a spillage or leakage, do not smoke in the vicinity and do not try to disperse the oil with water; under no circumstances shall a petroleum product be allowed to enter a drain or water course.
20. Keep the records of the oil issued/returned.
21. Oil products shall be stored in a soundly constructed tank, designed specifically for the purpose, and shall be sited away from any source of heat or potential ignition.

#### **PREVENTION OF OIL LEAKAGE, SPILLAGE**

1. Centrifuging of all the oils.



2. Annual checks of the oil by reputed firm.
3. Check OPU manifold blocks for oil leakage through couplings.
4. Check all the bearing housings of abnormal oil level & leakage of oil.
5. Check oil leakage from turbine & MIV Servomotors; change the seals to avoid leakage.
6. Check oil leakage from bearing housing oil cooler.
7. Check oil level of LGB housing from oil level gauge.
8. Check oil leakage from transformers.
9. Check leakage of oil from chiller compressor.
10. Control oil spills during manual handling, topping up, manual transfer/pumping.
11. Check oil drums/containers for leaks.
12. In case of any leaks/spills, transfer re-usable oil in another container, soak the rest spill/leak with sawdust/jute/cloth and throw in designated bin.

## CHAPTER-22

### **HANDLING AND STORAGE OF CYLINDERS CONTAINING FLAMMABLE GASES AND LIQUIDS**

Flammable Gases and flammable liquids play a vital role in the construction, installation, erection and operation and maintenance of plant. Their improper use may result in loss of life by fire and explosion. Gases for cutting, welding, etc. and flammable liquids like petrol, diesel, kerosene and various hydrocarbons and chemicals like sulphuric acid, hydrochloric acid and nitric acid, and chemical compounds like calcium carbide, acetone, air-entraining agents, epoxy, paints, polishes, varnishes etc., are also used in the plant. It is essential to take necessary precautions in storage, transportation, handling and use of these gases and hazardous substances. Flammable liquids vaporize and form flammable mixtures when kept in open containers, when leaks or spills occur or when they are heated. The degree of danger is determined by the flash point of the liquid, concentration of the vapour in the air (whether the vapour-air mixture is in the flammable range or not) and possibility of a source of ignition at or above a temperature sufficient to cause the mixture to burst in to flame. In the handling and use of flammable liquids, exposure of large liquid surfaces to air shall be prevented. Liquids themselves do not burn or explode, but the vapour-air mixtures, formed when they evaporate are explosive. Therefore, handling and storing of these liquid in closed containers and avoiding exposure of low flash point liquids in use are of fundamental importance. The presence of vapours or fumes of dangerous gases shall be detected by the instruments in accordance with the relevant Indian Standards.

#### **A. Safety aspects in storage, handling and use of such gases:**

##### **a) Storage:**

Compressed gases are usually contained in cylinders of different shapes and sizes. Gas cylinders are painted in different colours according to the contained gases to make the identification easier. Following safety measures shall be observed in the storage of cylinders:

1. Gas cylinders stores shall be well-ventilated and empty cylinders shall be stacked away from full cylinders.
2. Empty cylinders shall be segregated from the filled ones and care shall be taken that all the valves are tightly shut. 'Full 'or' Empty' notices shall be displayed on each relevant stack.
3. When stacking the cylinders vertically, it shall be ensured that they are properly secured by suitable brackets or stands so that they do not fall.
4. If cylinders are stacked horizontally, proper blocks shall be used at each end of stack to prevent their rolling. Large size cylinders shall be placed at the bottom. One vertical stack shall not contain more than four cylinders.
5. It shall always be ensured that the cylinders are protected from corrosive conditions.
6. It shall be ensured that cylinders do not come in contact with electrical apparatus or live wire.
7. Cylinders shall not be directly placed on wet soil. Proper drainage shall be used.
8. Cylinders shall be stored away from sources of heat.
9. Cylinders shall not be exposed to direct rays of the sun. Tarpaulin or any other cover shall not be used in direct contact with cylinders, as a protection against the sun.
10. Under no circumstances shall a cylinder used for storing one type of gas be used for storing another type. This is of paramount importance with such gases as oxygen on one hand and hydrogen or acetylene on the other. Mixing up of such gases would produce serious explosion risk.
11. Ensure that there is no other inflammable material stored near the Compressed Gas Cylinders.
12. Ensure that nobody smokes and carries the match box in compressed gas storage area.
13. The storage room or shed shall be of fire resistant construction.
14. The gas cylinder is painted with appropriate identification colours specified in IS: 4379 for industrial

cylinders & IS: 3933 for medical cylinders. Display boards of colour coding of gas cylinders.

15. Do not change the colour of this cylinder.
16. This cylinder should not be filled with any gas other than the one it now contains.
17. No flammable material should be stored in the close vicinity of this cylinder or in the same room in which it is kept.
18. No oil or similar lubricant should be used on the valves or other fittings of this cylinder.
19. Please look for the next date of test, which is marked on a metal ring inserted between the valve & the neck of the cylinder, & if this date is over, do not accept the cylinder for use.
20. The storage room or shed shall be of fire resistant construction.
21. Cylinders containing flammable gases & toxic gases shall be kept separated from each other & from cylinders containing other types of gases by an adequate distance or by a suitable partition wall.
22. Cylinders shall not be stored under conditions, which will cause them to corrode.
23. Cylinders shall not be stored along with any combustible material.
24. In premises for filling & storing flammable gases in cylinders all electric meters, distribution boards, switches, fuses, plugs & sockets, electric fittings, fixed lamps, portable hand lamps & motors, shall be of flame proof construction conforming to IS:2148 or such other specification as approved by the Chief Controller & shall be effectively earthed.
25. Before accepting the gas cylinder from vendor check whether they are tested as per the gas cylinder rules.

**b) Handling:**

Following safety measures shall be observed in handling of cylinders:

1. Oil and grease ignite violently in presence of oxygen and may even lead to explosion in case oxygen is under pressure. Oxygen cylinders shall be kept away from oil-soaked debris, rags, etc.
2. It shall be ensured that grit, oil dirt of any sort does not enter regulator assemblies.
3. Only the standard key shall be used for opening the valves and the key shall be free from any oil or grease. Leverage of keys or spanners shall not be increased and no attempt shall be made to get gas from cylinders with broken valves thereby rendering the cylinder useless.
4. Cylinder shall not be used as rollers, work supports or jacks.
5. Trolleys & cradles of adequate strength shall, as far as possible, be used when moving the cylinders.
6. The cylinders shall be handled carefully & not be allowed to fall upon one another or otherwise subjected to any undue shock.
7. Sliding, dropping or playing with cylinders is prohibited.
8. Open flames, lights, mobile phones, lighting of fires, welding and smoking shall be prohibited in close proximity to any cylinder containing flammable gases except those while in use for welding, cutting or heating.
9. Display no smoking.

## CHAPTER-23

### **FREQUENCY & TYPE OF TESTS FOR LIFTING AND OTHER EQUIPMENT**

**A. Examination of Hoists and Lifts:** Under Section 28 of the Factories Act, 1948.

1. Every hoist and lift shall be:
  - (i) Of good mechanical construction, sound material and adequate strength.
  - (ii) properly maintain, and shall be thoroughly examined by a competent person at least once in every period of six months, and a register shall be kept containing the prescribed particulars of every such examination.

**B. Examination of Lifting Machines and Lifting Tackles:** Under Section 29 of The Factories Act, 1948

1. All lifting appliances including all parts and gears thereof, whether fixed or movable are tested and examined by a competent person before being taken in to use for the first time or after it has undergone any alterations or repairs liable to affect its strength or stability.
2. All lifting appliances are thoroughly examined by a competent person once at least in every twelve months and where the competent person making such examination forms the opinion that the lifting appliance cannot continue to function safely, he shall forthwith give notice in writing of his opinion to the owner of the lifting appliance.
3. A register containing the details of all lifting equipment mentioning their capacity, year of make, specifications, their identification number, testing date, last date of examination and the next due date of examination must be maintained.

**C. Examination of Pressure Vessels:** under subsection (2) of section 31 of Power station Act, 1948,

1. It is mandatory that the identification number, safe working pressure, test pressure, last testing date and the next due testing date are painted/ written on the pressure vessel.
2. All pressure vessels need to be externally examined once in six months, internally examined once in a year and hydro tested for safe working pressure once in a period of four years. If internal examination is not possible then the hydraulic pressure testing shall be done once in a period of two years.
3. The working of the safety valve is to be checked at regular frequency and records be maintained in the log books. The records of these testing and examination are to be maintained for future reference.

## **CHAPTER-24**

### **SAFETY OF STRUCTURES AND BUILDING**

1. Now all, chimney or other structure or part of a structure shall be left unguarded in such a condition that it may fall, collapse or weaken due to wind pressure or vibration.
2. Structural frame work & formwork, scaffolding etc. shall be safe & stable so as to ensure safety of the employees working on such sites.
3. Material used for construction, design, soil conditions, wind direction and weather are responsible for the overall safety of the structure. Due to design fault or change in earth crust where the structure is standing is responsible for the collapse of the structure.
4. Due to ageing post construction maintenance has to be carried out. This has to be done by regularly conducting structural audits from competent persons from time to time.
5. Material and equipment used for construction shall conform to the Indian standards.
6. Necessary fire safety measures shall be provided at construction site.
7. Following care shall be taken while excavation is carried out near a structure or building:
  - (i) Where there is any doubt as to the stability of any structure/building adjoining the workplace or other areas to be excavated or where tunneling work is to be carried out, the project engineer shall arrange for measures like underpinning, sheet piling, shoring, bracing or other similar means to support such structure and to prevent injury to any worker working adjacent to such structure or damage to property or equipment adjacent to such structure.
  - (ii) Where any worker engaged in excavation is exposed to hazard of falling or sliding material or article from any bank or side of such excavation which is more than 1.5 metres above his footing, such worker shall be protected by adequate piling and bracing against such bank or side.
  - (iii) The excavation and its vicinity shall be checked by a responsible person after every rain, storm or other occurrences carrying hazards and in case a hazard is noticed at such checking, adequate protection against slides and cave-into prevent such hazard shall be provided.
  - (iv) Temporary sheet piling installed for the construction of a retaining wall after excavation shall not be removed, except on the advice of the responsible person after an inspection carried out by such responsible person.
  - (v) Where banks of an excavation are undercut, adequate shoring shall be provided to support the material or article over hanging such bank.

## **CHAPTER-25**

### **PREVENTION FROM DROWNING**

1. When there is a risk of drowning, suitable rescue equipment shall be provided and kept in an efficient state for ready use.
2. Measures shall be taken to arrange for the prompt rescue of worker from the danger of drowning.
3. Where there is a special risk of fall from the edge of adjacent land or from a structure adjacent to or above the water or from floating stage on water, secure fencing shall be provided near the edge of such land, structure or floating stage, as the case may be, to prevent such fall, and such fencing may be removed or allowed to remain un-erected for the time and to the extent necessary for the access of workers to such work or the movement of material for such work.
4. Employees working over or near water, where the danger of drowning exists, shall be provided with approved life jacket or buoyant work vests.
5. Ring buoys with at least 90 feet of line shall be provided and readily available for emergency rescue operations.
6. At least one life savings kits shall be immediately available at locations where employees are working over or adjacent to water.
7. Training is to be imparted regularly to all the employees for rendering CPR (Cardio Pulmonary Resuscitation) and appropriate use of life saving equipment.

## CHAPTER-26

### **SAFETY AGAINST EARTHQUAKES / GEOLOGICAL SURPRISES, FLOODING AND FLASH FLOODING**

#### **A. Earthquake:**

In the event of an earthquake, it is important not to create panic and deal effectively with the situation by taking or adopting following general precautions:

1. Secure easily toppled items so that they do not fall over.
2. Do not place heavy, pointed or hard objects on high shelves loosely in the workplace.
3. Fire is the most destructive result of an earthquake. If an earthquake occurs at workplace, extinguish all sources of fire. Turn off the all-electric lights and appliances, and locate emergency supplies. Disconnect all electrical appliances.
4. Put on shoes to protect your feet from broken glass, etc. and secure an escape.
5. Areas that have many pillars are free of heavy objects that may be apt to fall, and the areas beneath strong furniture, etc. are relatively safe.
6. In the case of a two-story building this floor is often safer as the ground floor may be destroyed.
7. Wear a helmet or quilted hood that will protect the head. Place a cloth (preferably wet) across the nose and mouth to prevent smoke or dust inhalation.
8. Do not use elevators. Use only emergency staircase.
9. Watch out for glass, signs, or other falling objects.
10. Eventually, leave the work place and take refuge in a safe area.
11. Even though the first large shock has ceased, aftershocks may continue for a considerable time. Therefore, do not attempt to return to work place right away. It is important to know what the actual situation is in order to avoid further disaster.
12. Protect yourself, drop to the floor, and take cover under a sturdy desk or table and hold on to it so that it doesn't move away from you. Wait there until the shaking stops.
13. Stay away from glass windows, heavy furniture & anything that could fall, such as lighting fixtures or other similar items.
14. If you are on the upper floor of the building, don't jump from window or balcony.
15. Do not try & run out of a building, you may be hit by falling debris. Stay inside till the shaking stops & check if it is safe to go outside.

#### **B. Flood**

In the event of a flood, general precautions that need to be followed include:

1. Keep on hand a battery-operated flash light while tunneling operations.
2. Have a prior knowledge of the evacuation routes.
3. Stay away from drains and ditches.
4. Do not enter into the flood water.
5. Immediately report to the maintenance staff regarding broken gas, electrical and water supply lines.
6. Do not handle electrical equipment in wet areas.
7. Submerged gas control valves, circuit breakers, and fuses pose explosion and fire hazards, and shall be replaced as the water subsides.

## **CHAPTER-27**

### **SAFETY IN REPAIR AND MAINTENANCE OF STEEP ROOF**

1. All practicable measures shall be provided to protect the workers against sliding when carrying out work on steep roofs.
2. Roofing bracket shall be secured in its place by nailing pointed metal projections attached to the underside of such bracket and securely driven into a steep roof on which it is used or secured by a rope passed over the ridge pole and tie of such roof.
3. All crawling boards used for work on steep roofs shall be of adequate strength, made of sound material and of the type approved for the purpose of their use as per national standard.
4. Crawling boards shall be kept in good repairs and inspected by a responsible person before being taken into use.
5. Crawling boards shall be secured to a steep roof on which it is used by ridge hooks or other effective means.
6. A firmly fastened life line of adequate strength shall be strung beside each crawling board throughout its length while using such crawling boards.



## CHAPTER-28

### **SAFETY IN OPERATION OF DIESEL GENERATOR (DG) SET**

1. Correct any abnormal condition.
2. Ensure that there is no oil leakage. In case of oil leakage, arrest it immediately & keep the oil in a tray for reuse.
3. Check the cooling water temperature & ensure that it is maintained below 90°C.
4. Ensure that the coolant is added as per required ratio in the system. Used coolant to be collected in a container and left for natural evaporation; the left over to be mixed with used oil for onward disposal.
5. Ensure that lube oil temperature is maintained below 105°C.
6. Avoid spillage of oil & diesel on the floor. In case of spillage wipe the floor with cloth and put the cloth in the waste bin for onward disposal.
7. Put used filters in the designated bins.
8. Check all electrical connections for tightness to prevent any sparking.
9. Maintain optimum loading (80%) on DG Set for efficient output, whenever the DG Set is in continuous operation. Do not overload.
10. Whenever the DG Set is not in regular use, carryout checks by operating for a few minutes daily.
11. Ensure ear thing is in place and isolation is working properly.
12. Ensure that no emission is taking place at ground level and no gas leakage is there from the silencer.
13. Ensure that you are using earplug/muff while working near operating DG Set(s).
14. Arrangement for First-Aid to be kept ready.
15. Firefighting arrangements to be regularly checked for their effectiveness.
16. Ensure that lube oil is changed at desired intervals; collect the used oil and dispose as per the requirements of the Hazardous Wastes (Management, Handling and Trans-boundary) Rules.
17. Do preventive maintenance as per Schedule and maintain records. Ensure that the external agency responsible for the same is carrying out all desired checks at quarterly frequency.
18. Do not smoke in side DG Room and also never store inflammable materials near the DG Sets.

## CHAPTER-29

### **COLOUR CODING OF PIPELINE**

1. In order to proper identification of the contents of the pipelines, the system of colour coding is introduced as per IS: 2379; 1990.
2. This colour coding system consists of a ground colour and colour bands superimposed on it. Display colour coding boards at conspicuous places to educate people working on or around the pipelines. Flow directions shall also be provided on the pipelines to indicate material flow direction inside the pipeline.
3. The ground colour identifies the basic nature of the fluid carried and also distinguishes one fluid from another.
4. Ground colour shall be applied throughout the entire length for un insulated pipes, for insulated pipes, on the metal cladding or on the pipes of material such as non-ferrous metals, austenitic stainless steel, plastic, etc, ground colour coating of minimum 2 m length or of adequate length, not to be mistaken as colour band, shall be applied.
5. Colour bands are superimposed on the ground colour to distinguish: a) One kind or condition of a fluid from another kind or condition of the same fluid, or b) One fluid from another but belonging to the same group, for example carbon-monoxide from coke oven gas or diesel fuel from furnace fuel.
6. Appropriate quality of paints conforming to relevant Indian Standards, shall be used for colour marking. It is recommended that the paints used shall produce a glossy finish.
7. Procedures for application of colour code and colour band in the pipeline are detailed in the standard.
8. The ground colour as prescribed in the standard for application in the pipeline is mentioned below:

S.No.	Substance	Colour
1	Hot Water	Sea green
2	Cold Water	Dark Blue
3	Pressurized Oil	Brown
4	Non-Pressurized Oil	Yellow
5	Air	Sky blue
6	Fire Frightening Lines	Red
7	Other liquids/gases which do not need identification	Black

9. The standard also detailed about colour coding as applicable to pipeline for general services, industrial gases, hydro carbons & naphtha and medical gases.
10. The colour of the pipeline never be changed as the same may create unsafe condition in the plant.

## CHAPTER-30

### **GENERAL SAFETY GUIDELINES FOR VARIOUS VALVES**

1. **Follow all safety guidelines of safety.**
2. Check mode of operation of valves i.e. motor operated, pneumatically operated, hydraulically operated, manually operated etc.
3. Check the position of valves i.e. close/open/in-between and confirm with remote and local feedback/check back. If the positions are not matching inform respective maintenance department.
4. After or during the operation of any valves if any abnormality like gland leak etc. is observed then restores the original position of valve or keep the valve in position where the abnormal behavior is minimized and inform respective maintenance department.
5. Check the housing of the area in the vicinity of valve to be operated, if not proper then inform respective maintenance department, or Min Control Room.
6. Check the type of valve i.e. isolating or control etc.
7. Confirm the valve is easy to operate.
8. Gate valves are always to be operated in full open or full close condition.
9. Avoid frequent operation of high-pressure valves as far as possible to avoid any gland leak.
10. **For Motor Operated Valve:**
  - Confirm from working party or Main Control Room whether valve operation is to be done electrically or manually.
  - For electrical operation check the direction of operation by giving an impulse command if possible and if direction is OK then operate it fully.
  - If manual operation is to be done then first confirm that motor breaker is off and then valve can be operated in the similar way as that of manual valve.
11. **For Manual Operated Valve:**
  - Arrange right size of spanner as per size and location of valve and also arrange hand gloves and other safety accessories as per specific requirement of the valve to be operated.
  - Fix the spanner in such a way so that enough space is available for spanner movement and also confirm that spanner grip is proper and there is no slipping or sliding of spanner. This can be confirmed by applying force initially. Change the spanner if required. Gradually start operating the valve (close/open as per requirement).
12. **For Pneumatically Operated Valve:**
  - Check instrument air supply isolating valve is open and thus air is available for valve operation.
  - Reset pneumatic air lock, if any and check the direction of valve by giving small command from remote or local and then valve can be further operated from remote or local as per requirement.
  - If valve operation is not possible pneumatically then it can be done manually in the same as given for manual operating valve by isolating its instrument air supply.
13. **For Hydraulically Operated Valve:**
  - Check hydraulic circuit is properly lined up and enough hydraulic pressure is available for valve operation.
  - Check for any leakage during or after the operation of valve in hydraulic circuit.

## Chapter-31

### **SAFETY IN PAINTING WORKS**

Over exposure to a substance means too much has been breathed in, swallowed or absorbed through the skin. The possible effects of overexposure to paint and the chemicals it contains vary according to the type of paint.

#### **A. Precautionary measures while painting:**

1. Any machinery/ equipment shall be cleaned only after getting the necessary clearance from the concerned department.
2. Standard colour code of machinery /pipe lines etc. shall never be changed without proper Permission of the concerned department.
3. A painter must always be provided with a Helper/ Asst. when painting at heights.
4. A supervisor must always be present at site whenever painting at heights is being done.
5. While painting at heights in addition to having safety belt, painter shall engage one hand in holding the paint brush and the other hand to catch support for him. Paint –box shall never be carried in the hand while painting at heights.
6. Before commencing painting of structure etc. near crane walkways, the crane operators in that area shall be informed if the painting job to be undertaken and red flags shall be displayed on both ends of the rail tracks.
7. Safety belts must always be worn when painting at heights. It is desirable to have safety nets tied below the area of work as additional protection in case of a fall.
8. While painting at heights, if any crane comes just under the spot, stop painting and just sit or stand there till the crane moves away.
9. Great care shall be taken to see that the crane bus-bars are not contacted either by the scaffoldings, slings or other hanging materials. Any job in the bus-bar area is to be done only after getting power shutdown.
10. While painting overheads, plain goggles shall be worn to prevent paint from falling in eyes.
11. Make sure the correct types of fire extinguishers are available at the work site.
12. No worker shall be employed below the age of 18 and women on the work of painting with products containing lead in any form. Whenever men are employed on the work of lead painting, the following precautions shall be taken:
  - (i) No paint containing lead or lead products shall be used except in the form of paste or ready-made paint.
  - (ii) Suitable face masks shall be supplied for use by them when paint is applied in the form of spray on a surface having lead paint dry rubbed and scrapped.
  - (iii) Coveralls shall be supplied to the workmen and adequate facilities shall be provided to enable the working painters to wash after cessation of work. As an additional protective measure, use BARRIER CREAMS on hands face and neck. Check to make use the correct barrier cream for the chemicals being used.

#### **B. Dos and Don'ts before painting:**

1. Post “No Smoking” and “No Welding” signs.
2. Remove portable lamps and heaters from the area.
3. Make sure painting is done away from naked flames, sparks, non-explosion proof motors or any other source of ignition.
4. Check the ventilation system to make sure it is on and working correctly.
5. Electrically ground all spraying equipment.
6. Make sure approved respirator, eye goggles and any other protective equipment required for the job are worn.
7. DON'T Smoke.
8. DON'T take more paint out of the store room than use in one day.

## **Chapter-32**

### **SAFETY WHILE WORKING AT HEIGHT**

#### **General Measures to Prevent Fall of Persons**

After consideration of general site conditions as they affect safety, it is a logical step to examine now general measures which should "be taken on any site to prevent certain categories of accidents which occur with frequency on all sites.

#### **The first category is "fall of persons"**

A fall is really the result of an accident rather than an accident itself, but there is a convenience in regarding it as an accident. It identifies the nature of an occurrence against which certain general precautionary measures can be suggested.

#### **There are two main categories of falls: fall from one level to another; and fall on the same level**

Together these constitute more than 25 per cent of the total number of accidents occurring on civil & engineering sites and include a high proportion of the more serious injuries. This is perhaps not surprising in view of the vast amount of movement which takes place on a site and the elevated positions in which men frequently have to work. It does however give emphasis to the need for taking active measures to prevent falls.

Falls are caused mainly by persons slipping, tripping, stepping out or otherwise moving into space or they may be a consequence of the failure of a means of support. Other influencing factors can be wet, slippery or uneven surfaces, loose articles on a floor, the wearing of unsuitable footwear, lack of protection at sides and edges of elevated sites, plant or equipment, insufficient handhold or foothold, insecure supports and bad lighting. There are obviously many factors which have to be considered and possible hazards removed before there can be any substantial reduction in the number of falls of persons.

When falls from one level to another and falls on the level are compared, the total numbers of accidents do not vary widely.

#### **Suggested general preventive measures.**

The following suggestions are intended only to indicate the kinds of measures which should be taken to prevent the types of falls of persons which are known to occur.

#### **1. Fall of persons from one level to another General preventive measures**

##### **Falls from structures:**

These include falls from structural work in course of erection, sides of structures, through openings in floors and walls, and falls through fragile materials.

Remedial measures should include the provision of proper staging or scaffolding, where any part of any structure from or on which any person has to work does not give proper security, either "by not providing proper handhold and foothold or "because its bearing capacity is doubtful. The staging or scaffolding provided should be properly constructed and maintained.

The sides and edges of any existing structure, including wall openings, on which it is otherwise safe to work, should be protected to prevent falls.

Openings in floors should be carefully covered and the coverings suitably marked to indicate their purpose.

##### **Fall from Scaffolds, Ganagways and Runways:**

All scaffolding should be constructed to prevent collapse of the whole or any part. Its erection therefore should be undertaken by a competent person and there should be sufficient equipment of the right kind available. Platforms of scaffolds should be of adequate width, kept free of unnecessary obstructions and

tripping risks, guarded where necessary at the sides and edges and frequently inspected, especially in wet or frosty weather.

### **Falls from Mobile Plant:**

Falls from all kinds of moving plant, including transport vehicles and operational equipment are frequent. They occur to drivers getting on to or off of their machines, and to employees servicing, loading or unloading machines. Others injured include persons riding in unsafe positions. Remedial measures include:

- provide and keep all steps or other means of access on to vehicles in good repair and free of mud or grease;
- Workers should not be allowed to ride on such plant, unless there is safe accommodation. There should be a prohibition of riding on tow bars, steps, running boards and dumper skids.

### **Falls at Lifting Machines:**

The falls referred to here are those in which people are raised or lowered by standing on crane hooks or other unsuitable gear operated by power. This kind of practice should be prohibited.

### **Falls into Water:**

These are falls from positions alongside or above water which may result in drowning. Two things must be taken into account; the prevention of the fall and the prevention of drowning:

- prevent the fall in the first place by protecting the sides or edges of the place of work;
- If a fall does occur prevent the falling person from falling into water, by using safety "belts and lines, safety nets and sheets as appropriate;
- provide immediately available means of rescue in case of a fall into water. In bridge work over water this should include provisions for a craft equipped with rescue equipment and available for instant use;
- Persons working over or near water should be provided with a suitable buoyant work vest or life preserver.

## **2. Fall of persons from one level to another General preventive measures:**

In considering means of preventing falls on the same level it might be helpful look at optimum conditions first and then see what should be done, to make the site as safe as possible when optimum standards cannot be obtained. It can be said that where the underfoot conditions are not of the best, falls will occur. The best possible underfoot surface is one which is firm, dry, even, level and free of obstacles or loose materials over which person can fall or trip. The surface of any workplace on which people have to stand or move while they are focusing their attention on the job should have the above qualities. The same high standards cannot be expected over the whole of a site and therefore enough roads, paths and gangways with suitable surface should be provided.

It should be recognized that workers at some time or other may be required to go to some part of a site where the underfoot conditions are not perfect. It would be most helpful if the whole site surface were kept as level and firm as possible and free of any litter.

The need for good lighting and tidiness has already been emphasized.

Many falls on the same level are associated with the moving or carrying of materials either by hand or in barrows or similar devices. If any load is carried it should be well within the carrying capacity of the individual concerned. Loads should not impede visibility.

The use of unsuitable footwear with soles which are smooth or badly worn is to be avoided. At all times, workpeople should exercise care and never take short cuts across terrain which may be dangerous.

## Chapter-33

### MOCK DRILL RELATING TO DISASTER

#### **Need of Mock Drill**

- Many of Plans in India remain on paper;
- It is an exercise to know-how much concerned persons
- How much active are concerned persons;

#### **What One Should Know**

- What hazards are there which may cause Disaster (Emergency);
- How and why they can cause disaster;
- What facilities/systems are provided in the Unit to mitigate it;
- What provisions are made in the system in the plant in this regard;
- Who is responsible for specific control activities;
- What provision in the Plan has been made, if the concerned individual (Responsible Person) is not available;
- What are possibilities of failure- what is corrective action in such case;
- What are alternate arrangements to control the effect of emergency;
- What will be severity in case of failure;

#### **How Should Be Mock Drill Conducted**

The Mock Drill shall be conducted for following activities:

##### **1. Major Fire:**

This will cover all major fires including effects thereof. E.g. if Fire occurs in transformer the oil spread over covers big part of power station and the gases generated due to oil fire can cause suffocation to the persons working there along with burning of other parts of power station.

##### **2. Explosion:**

Possibility of explosion is during construction of tunnel where explosive gases may erupt during tunneling. In operational power station possibilities of explosion are in high pressure OPU, transformer, etc.

##### **3. Flooding:**

Flooding is possible due to excess water accumulated in power house that came from either HRT or water coming from main access tunnel through river or rain water. Very Important issue in disaster management plan of flooding is evacuation of persons affected and their rehabilitation.

##### **4. Earth Quake:**

Earthquake is a natural phenomenon and has been very often occurring in hilly areas of Himachal Pradesh. Very important issue in disaster management plan of earthquake is evacuation of persons affected and their rehabilitation.

##### **5. Failure of Backup Power:**

Failure of backup power although is not a direct disaster but its failure may cause/ increase the possibilities of disastrous effects e.g. if a fire occurs in turbine/ generator, in case of failure of backup power the fire

extinguishing media may not reach the fire.

#### **6. Multiple Electrocutions:**

To save the persons from electrocution the facility of trained doctors/ other medical staff to provide artificial respiration is a must. Further their evacuation to the hospital may help revival of their lives.

#### **7. Vehicle accident causing multiple fatalities:**

In case of such disasters the assistance of local government officials like police, fire, etc. is required and all HPSEBL personals must know on which telephone number they should seek assistance.

#### **8. Drowning of river transport:**

Proper communication arrangements must be provided in the boats and sufficient guards must be available for boat users for saving their lives.

#### **9. Bomb threat and terrorist activities:**

Procedure for bomb disposal must be available with local authorities.

*Detailed procedure relating to all above shall be covered under disaster management plan of each project.*

#### **Knowledge of Mock Drill**

- It should be known to HOP in Power Station/Project and administrative and police head of the district.
- Like-Mock Drill relates to very severe issues which is for effects to outsiders also District Authorities/State Administration should be informed;
- In case it relates to plant only- it must be known to Head of Unit and 2-3 others holding top posts;
- Others should not be informed in any case;

#### **Methodology for Mock Drill**

- Few independent observers should be selected- but they should not be pre-informed about the simulated incidence;
- They must be told about the system- which need to be undertaken during such instances:
- They should be told of their role as observer:

#### **Report of Observations**

Each Observer should record his observations (Deficiency and strength) on what has been observed by him in Mock Drill viz-a-viz what was supposed to be done as per the Plane e.g.:

- Whether the employees, who joined the Mock Drill, had adequate knowledge about their role and responsibilities:
- Whether the Team Members and other employees, who Participated in the Mock Drill reacted/behaved in the manner, they were expected to;
- What time had been taken by emergency teams/systems to reach and take actions as required;
- What action had been taken by different Team Members:



- Had the employees gathered at Assembly points:
- What deficiencies in implementation of systems recorded:
- They should use the enclosed format for summing up their observations:

#### **Responsibility for Conduct of Mock Drill:**

It is responsibility of HOP (or his authorized representative) to conduct mock drill with minimum frequency as mentioned in applicable statutes or as mentioned in the respective DMP

#### **Post Mock Drill Meeting**

- Immediately at the end of Mock Drill, Meeting of concerned Team Leaders/ Members shall be called;
- The Observers shall place their report in the Meeting;
- The Unit Head shall decide about the action to be taken if the deficiencies are recorded along with the time bound action plan;
- In Subsequent Meetings, compliance of this action plan shall be reviewed;

#### **FORMAT FOR OBSERVATIONS OF MOCK DRILL AND ACTION PLAN**

1. Name of the Power utility/ Generating Station:
2. Date/time of Mock Drill:
3. Location site of Mock Drill:
4. Observers:
5. Scenario:
6. Objective:
7. Chronological Order of Events Logged:
8. Observations on Effectiveness of Mock Drill/ Demonstration:
9. Recommendation and Suggestions on the Observation:

# Chapter-34

## **CONFINED SPACE AND HYDROMECHANICAL EQUIPMENTS**

### **1. Safety**

General safety assessment for activities necessary to inspect a gate structure and related equipment should be considered as a part of pre- inspection planning. A safety and hazard analysis, tag-out or lockout procedures, OSHA procedures for confined space entry, fall protection, waterway safety, rope access, and special considerations for the presence of hazardous materials should be considered as a part of pre-inspection planning. Pre and Post Job Debriefs are required to cover all safety issues related to these inspections. Specific safety issues pertaining to gate inspection are addressed and are follows.

#### **i) Personnel safety**

The following sections describe some of the steps inspection personnel may take to ensure safe working conditions when inspecting gate structures. A safety hazard analysis and detailed assessment should be conducted to list safety issues and safety concerns, and then address all of these potential safety issues and concerns. Many of the topics are critical to personnel safety and this text should not be relied on as a sole source. The use of an on-site expert to provide advice on safety issues is important.

There are numerous regulations governing workplace safety. The Occupational Health and Safety Administration (OSHA) is the primary authority governing workplace safety and health requirements. The health and safety administrative authority for the particular inspection site and specific regulations that may govern the inspection activities should also be identified.

Each inspector and support personnel is ultimately responsible for their own personal safety including having proper personal protective equipment, appropriate clothing, and awareness of safety conditions.

#### **ii) Safety hazards analysis**

A safety hazards analysis should include a review of the potential safety hazards at a site and all documentation related to a gate, safety manual, safety orders, and emergency plans. A checklist should be prepared specifically for the inspection that provides key information to all inspection personnel. Hazard analysis establishes guidelines to ensure the safety of all inspection personnel.

#### **Hazard analysis should include the following emergency data:**

- List of facility contacts for reporting accidents.
- Contacts for local hospitals and emergency services such as ambulances, paramedics, local fire departments, and rescue teams.
- Review the safety manual that pertains to the gate inspection activities. Note specific requirements for lock-out/tag-out procedures, confined space entry permits, and entry into de-watered structures with flooding hazards.
- Review of the site working conditions and potential safety hazards. The safety specialist may have insights to specific job hazards at the site.
- All equipment and facilities including electrical breakers, disconnect switches, motor controls, operating systems, cranes, hoists, or any other equipment that poses a threat to the safety of personnel (should it operate during the inspection) must have clearance/safety tags placed before starting any inspection activities.
- Personnel entrances should be marked to help ensure everyone on-site is aware of an ongoing inspection and the need to coordinate equipment operation.
- The owner's established clearance procedures should be reviewed. It is preferable that inspectors also place their own locks on isolation points where local policy allows.
- Emergency call codes/horn warning for project (e.g., seven long blasts = evacuate)
- Identify safe staging or assembly area in the event of an emergency
- Rescue plan.

#### **Additional hazards to consider are:**

- When climbing on or inside a penstock or sloping tunnel to reach a gate, personnel should wear approved safety harnesses together with a secured safety line.
- Ensure that adequate lighting is provided for inspection activities. If battery lighting is selected, sufficient backup lamps should be included to allow safe egress. If alternating current lighting is used, it should be protected by a ground-fault-circuit-interrupter. All electrical extension cords and apparatus used in a wet environment should be protected by a GFCI or an assured grounding program. Low voltage lighting should be considered in this environment.
- Wet or icy floors or inverters are unavoidable in many instances. Surfaces inside penstocks, tunnels, or gate structures may be very slippery. Wear appropriate boots and/or waders and proceed cautiously. Always work in teams.
- Use caution when inspecting equipment with a high-pressure leak. Complete a visual inspection from a distance. The leak may be indicative of an impending failure.
- OSHA confined space requirements should be followed. In a confined space where CO<sub>x</sub>, H<sub>2</sub>S may be present, it is advisable (and may be required) to use gas analyzer meter to detect these gases.
- When entering upstream of a sluice (gate inside a sluice tunnel) good safety practice would include placing a wooden timber in the gate guide that would prevent accidental closure of the sluice gate with personnel upstream of the gate.
- If hazardous materials are present that pose a health or safety threat, review Material Safety Data Sheets (MSDS) for the facility. Determine if there are lead-based coatings on the gates or associated equipment. Determine if there is asbestos present in gaskets or insulation. Should the inspection require removal of asbestos insulation or piping or equipment gaskets, approved personnel will be required to abate the material.
- Wildlife (snakes, rodents, insects [including bees and wasps], spiders, etc.) and their excrements, which could be disease carrying.
- For more complicated inspections, a job hazard analysis (JHA) may be required this type of analysis will include a step by step process to be used during an inspection, along with safety hazard and mitigation plans for that activity.

### **iii) Pre and Post Job Debrief**

A Pre-Job Debrief meeting should be performed each day before starting the inspection to review the inspection plan, cover safety issues, review the schedule, and review individual responsibilities. In some cases, safety issues may become apparent during the actual work. Depending on the issue, the work may need to be suspended and only resumed once a safety issue is remedied. This debrief should include a review of the dewatering and safety plan. A Post Job Debrief should also be held at the end of the day to review safety issues or other problems that developed during the inspection.

### **vi) Confined space**

If there is a potential for "engulfing" inspection personnel in a penstock, or a tunnel, the space will likely require treatment required confined space" as per OSHA.

### **v) Lock-out/Tag-out procedure**

The Occupational Safety and Health Administration (OSHA) require all employers to have a lock-out/ tag-out procedure in place to protect personnel during maintenance or service of machines or equipment.

### **vi) Fall protection requirements**

If inspection points expose personnel to falls of six feet or more, fall protection preplanning should be performed. Where inspections require working along unguarded heights, body harnesses and lanyards should be used. Scaffolding and ladders should be used where possible. The presence of sloping and wet surfaces should also be considered.

### **vii) Industrial rope access requirements**

Any climbing or repelling necessary to access difficult to reach gates (i.e., radial gates) should be undertaken by personnel specifically trained in industrial rope access climbing techniques to provide close-up access to

the gates. Organizations that are currently addressing these issues include the "Society of Professional Rope Access Techniques" (SPRAT, [www.sprat.org](http://www.sprat.org)) and Industrial Rope Access Trade Association (IRATA, [www.irata.org](http://www.irata.org)), which can be contacted for further information.

**Permit to Work**

Book No-----

S.No. -----

PTW No. -----

Name of the Electric Safety Officer-----

You are allowed to work on the following Equipment

Name of the Equipment/-----

Station Name:

Voltage Level

PTW Issued To(Name)	PTW Issued By(Name)

DESCRIPTION		REMARKS		
Nature of work that will be carried out on the above Equipment				
Above Equipment /is isolated at the following location(s)				
Above Equipment/Line is connected to earth at the following locations				
Safety tags have been posted at the following locations				
Note 1: All other equipment/parts are live and dangerous				
Authorized person issuing PTW		Designation	Sign	
Authorized person receiving PTW		Designation	Sign	
If PTW has been issued on the above Equipment to more than one person, indicate the other PTW Nos. Also				
Time:-----AM/PM Date:-----				
Transfer of Ownership of PTW				
PTW held by		Name	Sign	
This PTW is transferred to	Name	Sign	Time	Date

I hereby declare that all men under my charge has been withdraw and warned that it is no longer safe to work on the Equipment specified on this PTW and those tools, temporary earth and other connections are already removed, leaving that portion of the equipment ready for taking into service .

Name	Designation	Signature	Date	Time

I hereby declare this PTW cancelled.

Name	Designation	Signature	Date	Time

Extension of above PTW needed: Yes/No if Yes, give reason below				
Reason for Extension:				
New Validity of the PTW	From Date	From Time	To Date	To Time
Authorized person requesting the extension of PTW	Name		Sign	
Authorized person approving the extension of PTW	Name		Sign	

Authorized person issuing the extension of PTW	Name	Sign
Time:-----AM/PM		
Date:-----		

All Isolated point mentioned is ensured & checked from all concerns.

Safety Zone is created by PTW owner. Yes/No

Personnel Protective Equipment is available. Yes/No

(Helmet, Safety Belt, Rubber, Gloves, Shoes) Yes/No

Safety tags are installed at various locations. Yes/No

All safety measures including Earthing of Lines and uses of proper tools and tackles are to be used and the PTW owner will getting the work done must ensure before taking up the work on the Equipment.

### General:

PTW - Permit to Work

PTW can be issued/received only by individuals Authorized by the HPSEBL.

The apparatus mentioned herein must not be again made live until this PTW has been signed and re- turned by the authorized person who has received the PTW. In cases where more than one crew of personnel are working on the same apparatus, it must not be again made live until similar PTWs have been signed and returned by all the authorized person (s) who have received the PTW.

Portable grounding to be done at the place of work after checking the presence of Power by Power Tester and the same to be removed after completion of the work.

Person receiving the PTW is to ensure that the Equipment is Dead, Isolated and Earthed properly at two locations before commencing work.

This form after being signed for the work must be retained by the authorized person in charge of the work until the work is completed.

## Permit to Work Audit

Report No:

Date:

Location\_\_\_\_\_

Date\_\_\_\_\_

1. Name of AE/JE\_\_\_\_\_
2. Emp No.:\_\_\_\_\_
3. Department\_\_\_\_\_
4. Permit Book No:\_\_\_\_\_
5. Observations:\_\_\_\_\_

- a) No permit book with him
- b) Permit book incomplete
- c) Permit book not properly filled
- d) Poor condition of permit book

6. Remarks:

Electric safety Officer

**Near Miss Incident Record**

S. No.	Place & Location	Date	Time	Type	Root Cause Analysis	Responsibility	Target Date



**Form for Reporting Electrical Accidents**

1.	Date and time of accident	
2.	Place of accident (Village/Town/Tehsil/District and state)	
3.	System and voltage of supply(Whether EHV/HV/LV line, Sub-station/generation station/consumer's installation/service mains/other installations)	
4.	Designation of the Officer in- Charge of the generating company/licensee in whose jurisdiction the accident occurred.	
5.	Name of the owner/user of energy in whose premises the accident occurred	

## 6. Detail of Victim:

## ( C ) Human

Sr. No.	Name of the Victim(s)	Father's name	Sex of the victim	Full Postal address	Approx. age	Fatal/Non-fatal

## ( D ) Animal

Sr. No.	Description of animal(s)	Numbers	Name of the owner(s)	Address of the owner(s)	Fatal/Non-fatal

## 7. In case of the victims(s) is / are employee(s) of supplier:

- i. Designation of such person(s):
- ii. Brief description of the job undertaken, if any:
- iii. Whether such person/ person was/ were allowed to work on the job

## 8. In case the victim(s) is/are employees(s) of a licensed contractor

- i. Did the victim(s) possess any electrical workmen's permit(s) supervisor's certificate of competency?  
If yes give number and date of issue and the name of issuing authority.
- ii. Name and designation of the person who assigned the duties of the victims(s).

## 9. In case of accident in the system of the generating company/Licensee, was the permit to work (PTW) taken?

## 10.

- a. Describe fully the nature and extent of injuries, e.g. Fatal/ disablement (permanent or Temporary) or any portion of the body or burns or other injuries.
- b. In case of fatal accident, was the post mortem performed?

## 11. Detailed causes leading to the accident (to be given in a Separate sheet annexed to this form).

## 12. Action taken regarding first aid, medical attendance etc., immediately after the occurrence of the accident (give details).

## 13. Whether District Magistrate and police- station concerned have been notified the accident (if so,

give details).

14. Steps taken to preserve the evidence in connection with the accident to the extent possible.
15. Name and designation(s) of the person(s) assisting, supervising the person(s) killed or injured .
16. What safety equipment were given to and used by the person(s) who met with this accident (e.g. rubber gloves, rubber mats, safety belts and ladders etc.)'?
17. Whether isolating switches and other sectionalizing devices were employed to deaden the sections for working on the same? whether working section was earthed at the site of work?
18. Whether the work on the live lines was undertaken by authorized person(s)? If so, the name and the designation of such person(s) may be given.
19. Whether artificial resuscitation treatment was given to the person(s) who met with the electrical accident? If yes, how long was it continued before its abandonment?
20. Name and designation of the persons present at and witnessed the accident.
21. Any other information/ remarks.

Signature\_\_\_\_\_

Place:

Name:

Time:

Designation:

Date:

Address of the person reporting

### **Application for Pre-Arranged Shutdowns**

1.	Name of the Applicant
2.	Designation and Address
3.	Section of line or feeder or equipment on which shut down is required
4.	Time, Date and duration of shutdown
5.	Purpose of shut Down
6.	Whether concurrence of competent authority obtained or not
7.	Nearest contact telephone No.

Applicant	Designation	Date	Signature

Recommending Officer (HPSEBL)  
Signature\_\_\_\_\_

Name:

Designation

Officer-in-charge of Power House (HPSEBL)  
Signature\_\_\_\_\_

Name:

Designation

Note:

1. The applicant shall not be below the rank of a Junior Engineer.
2. The application duly approved by Officer in-charge of Power House will be forwarded to the concerned operator on duty for shutdown and this form will be retained by him as a record.

**Field Job Audit Form**

Report No: \_\_\_\_\_

Date: \_\_\_\_\_

Location: \_\_\_\_\_

Month/Year: \_\_\_\_\_

1. Name of Shift A.E./Shift J.E./Supervisor on site \_\_\_\_\_
2. Nature of job \_\_\_\_\_
3. PTW No: \_\_\_\_\_ Date: \_\_\_\_\_ Time: \_\_\_\_\_
4. Name of Electrician/ Lineman/Fitter: \_\_\_\_\_
5. Any unsafe condition: \_\_\_\_\_

Sr. No.	Unsafe condition	Remarks
1	No message in log Sheet	
2	No Proper PTW obtained	
3	No proper supervision at Site	
4	No using safety equipment like helmet/hand gloves/fuse puller/safety shoes	
5	Using improper tools	
6	Shortage of tools	
7	No danger board on switch gear control	
8	No safety zone is created	
9	Equipment/Line not properly earthed	
10	Chain not used on OH job	
11	Bad site condition	

6. Any other remarks: \_\_\_\_\_

Electric Safety Officer

**Tool Box Audit Form**

Report No:  
Date:

Date\_\_\_\_\_

1. Name of Electrician/ Lineman/Fitter:\_\_\_\_\_
2. Emp. No.\_\_\_\_\_
3. Department\_\_\_\_\_
4. Observations:

Sr. No.	Observation	Remarks
1	Conditions of tools and its insulation	
2	No proper tools	
3	Shortage of tools	
4	Condition of tool box	
5	Conditions & availability of personnel Protective Equipment like Helmet/Hand Gloves/Fuse Puller/Safety Shoes etc.	

5. Any other remarks:

Electric Safety Officer

**Safety Audit Form**

Report No:

Date:

Location: \_\_\_\_\_

Month/Year: \_\_\_\_\_

S.NO.	DESCRIPTION	REMARKS
1	TRANSFORMER	
	A) Earthing	
	B) Stenciling	
	C) Oil leakage	
2	H.T./L.T. SWITCHGEAR	
	A) Earthing	
	B) Stenciling	
	C) Oil leakage	
	D) Rubber Mat	
3	BATTERY ROOM	
	A) Exhaust Fan	
	B) No Smoking Board	
4	RUBBER MAT	
5	LIGHTING FIXTURES	
6	DANGER BOARD	
7	ARTIFICIAL RESPIRATION CHART	
8	FIRE EXTINGUISHERS	
9	FIRE BUCKET	
10	FIRST AID BOX	

REMARKS: Any unsafe condition noticed.

Electric Safety Officer

**First Aid Box Record**

<b>First Aid Box Maintenance Register</b>						
S. No.	Name of Medicines	Date Of Expiry	Quantity	Consumed by & Date	Balance	Remarks

## Fire Incident Report

NAME OF POWER HOUSE \_\_\_\_\_

Address of premises where fire occurred:

Date of Fire incident:

Time at which Fire occurred:

Time at which Fire Discovered:

Fire Discovered by:

Person in-charge at the time of Fire:

Property involved in Fire:

Location/region of Fire:

Time at which Firefighting action started by HPSEBL Staff:

Time at which Fire extinguished:

By what means fire was extinguished:

Was outside Aid required? Give brief details  
Of time they were informed, time they reported,  
Nature of assistance rendered:

Cause of Fire:

List of equipment damaged by Fire:

Equipment data

- i. Sr. No. :
- ii. Equipment No.:
- iii. Manufacturer :
- iv. Type :
- v. Rating :
- vi. Type of insulation :
- vii. Any other information :

What fire protection arrangement the building or equipment had?

List of extinguishing equipment found Defective or unsuitable on fire:



Estimated Loss: -

- i. Equipment :
- ii. Store:
- iii. Building :
- iv. Production/revenue:
- v. Miscellaneous:
- vi. Total:

Was there any casualty?

If yes, then state name of and address of casualty/ Causalities, extent of loss & action taken in this Regard:

Loss of property of other (other than HPSEBL) :

Estimated length of time the equipment will be out of service:

Any other relevant information of interest:

Brief report including remarks recommendations

& Remedial measures to avoid reoccurrence of Fire:

POWER HOUSE-in-Charge

Electric Safety Officer

Signature:

Signature:

Name:

Name:

Designation:

Designation

**Fire Extinguisher Record**

<b>Sr. No.</b>	<b>Type Of Fire Extinguisher &amp; date of Manufacturing</b>	<b>Cylinder No.</b>	<b>Capacity</b>	<b>Class</b>	<b>Make</b>	<b>Date of Refilling</b>	<b>Date of Maintenance</b>	<b>Remarks</b>

Power House In Charge:

Signature:

Name:

Designation:

**Accident Investigation Report (Accident Committee)**

<b>Sr. No.</b>	<b>Particular</b>	<b>Remarks</b>
1	Date of Accident	
2	Location	
3	Type	
4	Category	
5	Witness Name	
6	CE(Gen)/SE(Gen)	
7	Sr. Xen (Gen)/A.E., Gen	
8	CE(Gen)/SE(Gen)	
9	Sr. Xen (Gen) / A.E. Gen.	
10	Description of Accident (Sequential Detail)	
11	Analysis of Root Causes	
12	Corrective & Preventive Action	
13	Responsibility Centre	
14	Target Date	

**Name**

**Designation**

**Signature**

**Display Sign Board 27 No's Attached.**