टीएचडीसी इंडिया लिमिटेड
THDC INDIA LIMITED

सुरक्षा स्वास्थ्य और पर्यावरण मैनुअल

SAFETY HEALTH AND ENVIRONMENT MANUAL




टीएचडीसी इंडिया लिमिटेड
THDC INDIA LIMITED
(अनुसूची-'क' मिनी रत्न पीएसयू)
(Schedule - A Mini Ratna PSU)
CIN : U45203UR1988GOI009822

G20 भारत 2023 INDIA
वसुधैव कुटुम्बकम्
ONE EARTH • ONE FAMILY • ONE FUTURE

मुहम्मद शोएब
अपर महाप्रबंधक (सुरक्षा)
Mohammed Shueb
Additional General Manager (Safety)

प्रस्तावना

It is with immense satisfaction and pride that I present THDC India Limited's Safety, Health, and Environment (SHE) Manual. In my capacity as Additional General Manager (Safety), I am delighted to introduce this comprehensive manual, meticulously crafted to address the diverse operational facets of our organization, encompassing hydro, thermal, wind, solar, coal mines, and renewable energy sectors.

The development of this updated SHE Manual underscores our steadfast commitment to prioritizing safety, health, and environmental stewardship across all dimensions of our operations. This manual serves as a pivotal instrument to steer our workforce towards adhering to the highest standards, regulations, and protocols, thereby ensuring a secure and sustainable work environment across our wide-ranging portfolio of operational and under construction projects.

I extend my heartfelt appreciation to the National Safety Council (NSC), Uttarakhand Chapter, for their invaluable guidance and support in nurturing a safety culture within our organization. Their expertise has undoubtedly enriched the content of this manual.

Furthermore, I commend the tireless efforts of my esteemed colleagues, Mr. Rajeev Kumar Tyagi, Dy. Manager (Safety), and Mr. Ekansh Raturi, Safety Officer, whose unwavering dedication and diligence were instrumental in compiling and refining this manual. Their commitment to safety excellence has played a pivotal role in shaping the content to align with industry standards and regulatory mandates.

As we navigate the ever-evolving landscape of the energy sector, safety remains our top priority. This SHE Manual not only mirrors our current practices but also embodies our vision for continuous improvement and excellence in safety, health, and environmental performance.

I urge all employees to acquaint themselves with the guidelines delineated in this manual and seamlessly integrate them into their daily work routines. Let us collectively uphold our responsibility to safeguard one another and the environment while striving for operational excellence.

I express my gratitude for your unwavering dedication to safety and for embracing the principles outlined in this SHE Manual. Together, let us ensure that safety, health, and environmental protection remain ingrained in everything we undertake at THDC India Limited.

Mohammed Shueb
Additional General Manager (Safety)

Rishikesh, 16th April 2024

सूचना का अधिकार
RIGHT TO INFORMATION

प्रधान कार्यालय : गंगा भवन, प्रगतिपुरम, बाईपास रोड, ऋषिकेश - 249201
Corporate Office : GANGA BHAWAN, PRAGATIPURAM, BYPASS ROAD, RISHIKESH - 249201
पंजीकृत कार्यालय : भागीरथी भवन (टॉप टेरिस), भागीरथीपुरम, टिहरी गढ़वाल-249124
Regd. Office : Bhagirathi Bhawan, (Top Terrace), Bhagirathipuram, Tehri Garhwal-249 124
टेलीफैक्स- 0135-2439463, Telefax: 0135-2439463, Website Adress : www.thdc.co.in
("हिन्दी को राजभाषा बनाना, भाषा का प्रश्न नहीं अपितु देशाभिमान का प्रश्न है")


ALSTOM

राजीव विश्नोई
Rajeev Vishnoi
अध्यक्ष एवं प्रबन्ध निदेशक
Chairman & Managing Director

टीएचडीसी इंडिया लिमिटेड
THDC INDIA LIMITED
(श्रेणी-क मिनी रत्न, सरकारी उपक्रम)
(Schedule - A Mini Ratna Govt. PSU)

Ganga Bhawan, Pragatipuram, By-pass Road, Rishikesh-249201
Tel.: (0135) 2431464

Message

I am pleased to announce the issuance of the 3rd Revision of our Safety, Health, and Environment (SHE) Manual at THDCIL Power Plants & Projects. This revision marks a significant milestone in our ongoing commitment to maintaining the highest standards of safety, health, and environmental stewardship across all our operations.

By adhering to the guidelines outlined in this manual, employees can gain valuable insights to establish and maintain a safe work environment in all THDCIL work environments.

I reiterate my call to all employees to actively utilize the SHE guidelines outlined in this SHE Manual during their daily activities and to contribute with utmost dedication and zeal, towards achieving the company's mission of an accident-free corporation.

(Rajeev Kumar Vishnoi)

Rishikesh, 10th April 2024

पंजीकृत कार्यालय : भागीरथी भवन, (टॉप टेरिस), भागीरथीपुरम, टिहरी गढ़वाल–249001 (उत्तराखण्ड)
Regd. Office : Bhagirathi Bhawan, (Top Tarrace), Bhagirathipuram, Tehri Garhwal- 249 001 (Uttarakhand)
एनसीआर कार्यालय: प्लॉट नं.–20, सैक्टर–14, कौशाम्बी, गाजियाबाद (उ0प्र0), फोन: 0120–2776430

शैलेन्द्र सिंह
निदेशक (कार्मिक)
Shallinder Singh
Director (Personnel)

टीएचडीसी इंडिया लिमिटेड
(श्रेणी–क, मिनी रत्न, सरकारी उपक्रम)
THDC INDIA LIMITED
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Ganga Bhawan, Pragatipuram, By-pass Road, Rishikesh-249201
Tel.: (0135) 2432688
E-mail: sinhshallinder@thdc.co.in

Message

I am pleased to announce the release of the 3rd revision of the THDCIL Safety, Health & Environment (SHE) Manual, which comes into force with immediate effect. This revised SHE manual reflects our unwavering commitment to providing a safe and healthy work environment for all our employees.

The revised SHE manual incorporates the latest industry best practices, regulatory requirements, and lessons learned from past incidents. It aims to further enhance our safety culture by:

- Providing clear and concise guidance on safe work practices across all our operations.
- Emphasizing risk assessment and mitigation strategies to proactively identify and address potential hazards.
- Strengthening the roles and responsibilities of all employees in upholding safety standards.
- Promoting a culture of continuous improvement through regular training, communication, and feedback mechanisms.

I urge all employees to familiarize themselves with the revised SHE Manual and strictly adhere to its guidelines. Remember, safety is not just a policy; it is a core value at THDCIL. By working together and prioritizing safety in everything we do, we can create a workplace where everyone returns home safe and healthy every day.

(Shallinder Singh)

Rishikesh: 12th April, 2024

भूपेन्द्र गुप्ता
निदेशक (तकनीकी)
Bhupender Gupta
Director (Technical)

टीएचडीसी इंडिया लिमिटेड
(श्रेणी–क, मिनी रत्न, सरकारी उपक्रम)
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Tel.: (0135) 2431468, Mob.: 9910027256
E-mail: dt@thdc.co.in

Message

I am pleased to announce the release of the 3rd Revision of the THDCIL Safety, Health & Environment (SHE) Manual, effective immediately. This revised SHE manual incorporates the latest best practices, regulatory requirements, and industry standards in the areas of Safety, Health, and Environment.

The revised SHE Manual, covering various aspects related to the prevention of workplace injuries and accidents, will serve as a comprehensive resource.

I encourage all employees to familiarize themselves with the revised SHE Manual and adhere to its guidelines while working at our workplace. Your dedication to safe work practices is essential in achieving our goal of zero accidents and incidents.

I also extend my gratitude to each one of you for prioritizing safety, health, and environmental concerns at our workplace and request you all to integrate safety, health, and environmental practices into your day to day life. This will significantly contribute to our collective well-being

(Bhupender Gupta)
Director (Technical)

Rishikesh, 16th April 2024

टीएचडीसी इंडिया लिमिटेड
THDC INDIA LIMITED
(अनुसूची-'क' मिनी रत्न पीएसयू)
(Schedule - A Mini Ratna PSU)
CIN : U45203UR1988GOI009822

वीरेन्द्र सिंह
मुख्य महाप्रबंधक
(ओ.एम्.एस.क्यू.ए एवं सुरक्षा)
Virendra Singh
Chief General Manager
(OMS, QA & Safety)

संदेश

THDCIL holds in deep reverence the value of the lives of its employees and human life in general. In addition to the Hydro-power generation which involves lot of construction and development activities has also kept a pace in diverse sources of power generation such as Thermal Power, Wind Turbine Generation, Solar Power generation and Coal Mine. These different power generation source have added various new statutory provisions.

Because of these new power projects of THDCIL various new legal and other statutory requirements are now have been applicable on our projects. It had become necessary for us to revise our SHE (safety, Health & Environment) Manual so that compliance of statutory provisions applicable on our projects could be ensured.

I am happy to place on records the appreciable joint efforts done by our corporate safety team along with National Safety Council in successful completion of this challenging task.

I appeal THDCIL employees at all levels will go through the SHE (safety, Health & Environment) Manual and ensure compliance of statutory provisions applicable on their all construction Projects/Plants/Sites.

(Virendra Singh)
Chief General Manager (OMS, QA & safety)

Rishikesh,16th April 2024

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राष्ट्रीय सुरक्षा परिषद . उत्तराखंड चैप्टर
कार्यालय मुख्य निरीक्षक कारखाना एवं बॉयलर, उत्तराखंड,
श्रम भवन,नैनीताल रोड, पी.ओ. भोटिया पराव, हल्द्वानी
263139 जिला : नैनीताल, उत्तराखंड

National Safety Council - Uttarakhand Chapter
Office of the Chief Inspector of Factories & Boilers,
Uttarakhand, Shram Bhawan, Nainital Road, P.O. Bhotia
Parao, Haldwani 263139, Distt. Nainital, Uttarakhand

Arvind Kumar Nagyan
Chairman, National Safety Council, Uttarakhand Chapter &
Dy. Director of Factories & Boilers, Uttarakhand Govt.

Message

I am pleased to know that THDC India Limited undergoes regular revision of their SHE Manual. THDC India Limited is making significant contributions to meet the country's growing energy needs while prioritizing safety as a long-term investment.

THDCIL is doing commendable effort in revising the Safety, Health, and Environment (SHE) Manual for the third time. I have firm belief that revised SHE Manual will prove to be a milestone to bolster the confidence of THDCIL employees and ensure enhanced safety at workplaces.

I congratulate Sr. Safety Consultant of N.S.C. Uttarakhand Chapter, Mr. S.K. Bhatnagar and team members for the untiring efforts put in by them and all those who directly or indirectly assisted in the revision of the manual.

I, appeal THDCIL employees at all levels to make best use of this manual to enhance safety knowledge, follow safe practices and contribute to achieve 'Zero Accident Goal'.

Arvind Nagyan

Arvind Kumar Nagyan

Contents

Abbreviations

BOCW Act, 1996	:	Building and Other Construction Workers' (Regulation of employment and Conditions of Service) Act, 1996.
BOCW Rules	:	Building and Other Construction Workers' (Regulation of employment and Conditions of Service) Central Rules, 1998 / Uttaranchal Rules, 2005.
CAPA	:	Corrective Action & Preventive Action
CEA Regulation, 2011	:	Central Electricity Authority (Safety Requirements for Construction, Operation and Maintenance of Electric Plants and Electric Lines) Regulations, 2011
CISF	:	Central Industrial Security Force
CPCB	:	Central Pollution Control Board
CSR	:	Corporate Social Responsibility
EPPCB	:	Environment Protection & Pollution Control Board, Uttaranchal Government
HEP	:	Hydro Electric Project.
HPP	:	Hydro Power Project
ICOLD	:	International Commission of Large Dam
I.E. Rules	:	Indian Electricity Rules, 1956.
LOTO	:	Lockout - Tagout
MSDS	:	Material Safety Data Sheet
OH&S	:	Occupational Health & Safety
PAP	:	Project Affected Persons
PPE	:	Personal Protective Equipment
PSP	:	Pumped Storage Power Plant
SHE	:	Safety, Health & Environment
SWP System	:	Safety Work Permit System
SF6 Gas	:	Sulphur Hexafluoride Gas
CSR	:	Corporate Social Responsibility

1 Introduction and Scope of SHE Manual

1. Introduction of the Company – THDCIL

THDC India Limited is under the ownership of National Thermal Power Corporation Limited, Ministry of Power, Government of India. It was incorporated in July 1988 to develop, operate and maintain the Tehri Hydro Power Complex and other Hydro Projects. THDC India Limited is a Mini Ratna Category-I Enterprise. Present CMD of the corporation is Shri Rajeev Kumar Vishnoi.

At present the company has four power plants in operation namely Tehri Dam (1000 MW), Koteshwar Dam (400 MW), 50 MW Wind project in Patan (Gujarat) and 63 MW Wind project in Dwarka (Gujarat). In addition, more than 06 projects are under various stages of construction. Tehri PSP (1000 MW) and Vishnugad-Pipalkoti HEP (444 MW) are in advance stage and are expected to commission by 2024. THDCIL has also ventured in to 50 MW solar PV power project in Kasargod Solar PV Park in Kerala, India. It is situated 50 KM from Mangalore International Airport, Karnataka and thermal power generation with its 1320 MW Thermal Power project coming up near Dussehera village which is near to Khurja, District Bulandshahr, Uttar Pradesh. The project is at advanced stage and is expected to be commissioned by 2024. The Govt. of India has re-allocated "Amelia Coal Block' THDCIL to meet out fuel requirement of 1320 MW Khurja STPP which is about 856 km from Amelia Coal Mine via rail route.

THDCIL signed MOU with Government of Rajasthan to develop 10,000 MW solar parks in the state. THDCIL is also entrusted to develop 1200 MW Kalia-II and 1750 MW Demwe (Lower) HEP in Lohit basin of Arunachal Pradesh.

THDCIL is ISO 9001: 2015 (Quality Management System), ISO: 14001 - 2015 (Environmental Management System) and ISO 45001 – 2018 (Occupational, Health & Safety Management System) Certified Company.

Vision, Mission and Values of THDCIL

Vision

A word class energy entity with commitment to environment and social values.

Mission

- To plan, develop and operate energy resources efficiently.
- To adopt state of the art technologies.
- To achieve performance excellence by fostering work ethos of learning and innovation.
- To build sustainable value-based relationship with stakeholders through mutual trust.
- To Undertaker rehabilitation and resettlement of project affected persons with human face.

Values

- Zeal to excel and zest for change.
- Integrity and fairness in all matters.
- Respect for dignity and potential of individuals.
- Ensure speed of response.

- Strict adherence to commitments.
- Foster learning, creativity and teamwork.
- Loyalty and pride in CPSE.

2. Scope

Safety, Health and Environment (SHE) is of paramount importance for the THDCIL Management. THDCIL Projects are designed and developed by adopting latest technologies in such a way so as to produce minimum adverse effect on the environment, making efficient use of energy and resources.

The SHE Manual is prepared with an objective to enhance safety awareness among THDCIL employees and to update their knowledge;

(a) In Occupational Safety & Health (OS&H) related latest legal and other requirements associated with the activities, products and services of company;

(b) In various National and International Safety Standards applicable to THDCIL activities, products and services; and

(c) To develop safe operating and maintenance procedures for uniform implementation in THDCIL projects.

The scope of SHE Manual is to cover all the above three elements.

It should be noted that, this safety manual does not in any sense supersede or nullify the provisions prescribed by law, which in any case should be strictly observed. SHE Manual is complimentary to the statutory obligations and should be followed in conjunction with operating instructions of equipment manufacturers' manuals, standard codes and other standing orders.

Efforts have been made to facilitate plant personnel in maintaining high safety standards in their respective areas and to eliminate the possibility of physical injuries, damage to property and the environment by ensuring compliance of the provisions made in this manual.

Note: In this document the following verbal forms are used;

i) The use of 'shall' indicates a mandatory requirement.

ii) The use of 'should' indicates recommendation;

iii) The use of 'may' indicates a permission;

iv) The use of 'can' indicates a possibility or a capability.

2 Safety Logo of THDC India Limited

2.1 Purpose

THDC India Limited Safety Logo is a visual representation of company's safety brand because it is often the primary means by which interested party form an image about company commitment towards safety and health of employees and other interested parties.

2.2 THDCIL Safety Logo

Safety Logo of THDCIL is a green equilateral triangle containing THDCIL logo inside.


SAFETY PARK

3 Definitions

3.0 The terms used in SHE Manual shall be interpreted in the most commonly accepted sense consistent with any industry including electrical industries.

3.1 Acceptable Risk

Risk that has been reduced to a level that can be tolerated by the organization having regard to its legal obligations and its own OH&S Policy.

3.2 Accident

Accident is an unplanned/undesired event giving rise to death, ill health, injury, damage or other loss to personnel or property.

(a) **Reportable Accident or Loss Time Injury** (Sec. 88 of Factories Act, 1948)

Where in an accident causes death, or which causes any bodily injury by reason of which the person injured is prevented from working for a period of forty-eight hours or more immediately following the accident, or which is of such nature as may be prescribed in this behalf.

(b) **Reportable accidents** (Rule-8 of CEA Regulations, 2011)

The cases of outage of an electrical plant or an electric line of 50 MW and above rating and 132 Kv and above for electric lines due to any accident related to any equipment e.g. fire, explosion of pressure piping or pressure vessel, implosion, emission of hazardous chemicals, collapse of transmission tower, flooding of power house area, shall be reported to the Authority within 24 hours, whether or not any death or disablement is caused to any person.

(c) **Dangerous Occurrences**

As per the Schedule under Rule-110 of the State Factories Rules, the following occurrences whether or not they are attended by personal injury or disablement are called dangerous occurrences;

- Bursting of a plant used for containing or supplying steam under pressure greater than atmospheric pressure.
- Collapse or failure of a crane, derrick, winch hoist or other appliances used in raising or lowering persons or goods, or any part thereof, on the overturning of a crane.
- Explosion, fire, bursting out, leakage or escape of any molten metal, or hot liquid or gas causing bodily injury to any person or damage to any room or place in which persons are employed, or fire in rooms of cotton pressing factories when a cotton opener is in use.
- Explosion of a receiver or container used for the storage at a pressure greater than atmospheric pressure of any gas or gases (including air) or any liquid or solid resulting from the compression of gas.
- Collapse or subsidence of any floor, gallery, roof, bridge, tunnel, chimney, wall, building or any other structure.

3.3 Occupational Health and Safety Audit

The following provisions of 'Internal Audit' and 'External Audit' shall be applicable;

3.3.1 Internal Safety Audit

1. In accordance with IS 14489:1998 clause 4.1.2 Audit Frequency, the Internal Safety Audit is recommended to be conducted at least once annually.
2. The Internal Safety Audit will be conducted by Corporate Safety
3. The Safety audit team will consist of following members:
   - A Safety audit members from the THDCIL, Corporate Office
   - An Safety audit members from any Project/Plant of THDCIL
   - The secretary member from the concerned project/plant where the audit will take place along with all record/documents the concerned contractor and his entire team should also provide their support for the Internal Safety Audit.
   - As per Regulation-6 of the Central Electricity Authority (Safety Requirements for Construction, Operation and Maintenance of Electrical Plants and Electric Lines) (Amendment) Regulations, 2022, 'Internal Safety Audits' shall be carried out by the owner of the plant.

3.3.2 External Safety Audit

1. According to IS 14489:1998 clause 4.1.2 Audit Frequency, the External Safety Audit is recommended to be scheduled once every two years.
2. Considering the importance of Safety, the Corporate Safety Department Rishikesh can conduct External Safety Audit once a year on all the Projects and Plants of THDCIL.

   As per Regulation-7 of the Central Electricity Authority (Safety Requirements for Construction, Operation and Maintenance of Electrical Plants and Electric Lines) (Amendment) Regulations, 2022, 'External Safety Audit'/ 'Safety checks' of generating stations shall be periodically carried out as per the Regulation 12, reproduced below;

   Regulation-12 of CEA Regulation 2022

   (1) Safety audit of generating stations shall be periodically carried out every two years by an accredited third party and the audit report shall be sent to the Authority.

   (2) Authority through a designated officer may verify such reports by physical site inspections as and when required.

   (3) Safety checks shall be site specific and shall include the minimum safety checks as identified in Schedule IV annexed to these Regulations.

3.3.3. Safety Audit provision as per Manufacture, Storage and Import of Hazardous Chemical (Amendment) Rules, 1994

As per Rule-10 of the Manufacture, Storage and Import of Hazardous Chemical (Amendment) Rules, 1994, the occupier of hazardous industries plants shall carry out an independent safety audit of the respective industrial activities with the help of an expert, not associated with such industrial activities.

The occupier shall forward a copy of the auditor's report along with his comments to the concerned Authority within 30 days after the completion of such Audit.

The occupier shall update the safety audit report once a year by conducting a fresh safety audit and forward a copy of it with his comments thereon within 30 days to the concerned Authority.

3.4 Authorised person

A person, who is properly authorised to perform specific duties under certain conditions or who is carrying out order from competent authority and as defined under Rule 3 of I.E. (Indian Electricity) Rules of 1956.

3.5 Building worker

Building worker means a person who is employed to do any skilled, semi-skilled or unskilled, manual, supervisory, technical or clerical work for hire or reward, whether the terms of employment be expressed or implied, in connection with any building or other construction work but does not include any such person-

1. Who is employed mainly in a managerial or administrative capacity; or
2. Who, being employed in a supervisory capacity, draws wages at the prevailing rates as per rules or exercises, either by the nature of the duties attached to the office or by reason of the powers vested in him, functions mainly of a managerial nature.

3.6 Confined Space

An area which is enclosed, have limited means of egress or escape and not designed or intended for continuous human occupancy which makes it dangerous. Hazards in a confined space often include suffocation by un-breathable gases which may be present but not visible, submersion in liquids or electrocution. For example; storage tanks, process vessels, bins, boilers, ventilation ducts, sewers, underground utility vaults, tunnels, pipelines etc.

3.7 Competent Person

Competent person means a person or an institution recognised as such by the Chief Inspector-cum-Facilitator/ Central Govt. / Chief Controller - Explosives for the purposes of carrying out tests, examinations and inspections required to be done in in an establishment having regard to—

(i) the qualifications and experience of the person and facilities available at his disposal; or

(ii) the qualifications and experience of the persons employed in such institution and facilities available therein.

Provided that in case of mines the competent person includes such other person who is authorised by the manager referred to in section 67 to superviseor perform any work, or to supervise the operation of machinery, plant or equipment and is responsible for such duties assigned to him and also includes a shot firer or blaster;

OR

Who is adequately experienced and well conversant in safe manufacture, storage, transportation, handling as the case may be of explosive.

3.8 Continual Improvement

The organization shall continually improve the suitability, adequacy and effectiveness of the OH&S management system, by:

a) Enhancing OH&S performance;

b) Promoting a culture that supports an OH&S management system;

c) Promoting the participation of workers in implementing actions for the continual improvement of the OH&S management system;

d) Communicating the relevant results of continual improvement to workers, and, where they exist, workers' representatives;

e) Maintaining and retaining documented information as evidence of continual improvement.

3.9 Corrective Action

The actions taken to eliminating hazards; substituting with less hazardous materials; redesigning or modifying equipment or tools; developing procedures; improving the competence of affected workers; changing the frequency of use; using personal protective equipment is called corrective action.

3.10 Current

Current is the rate at which "Charge" is flowing.

3.11 Contractor

(a) *As per Occupational Safety, Health and Working Conditions Code and Central Rules, 2020*

"Contractor", in relation to an establishment, means a person, who—

(i) Undertakes to produce a given result for the establishment, other than a mere supply of goods or articles of manufacture to such establishment, through contract labour; or

(ii) Supplies contract labour for any work of the establishment as mere human resource, and includes a sub-contractor;

(b) *As per ISO 45001 - 2018*

"Contractor" external organization providing services to the organization in accordance with agreed specifications, terms and conditions. Services may include construction activities, among others.

3.12 Compressed Air

Compressed air means air mechanically raised to a pressure higher than atmospheric pressure at sea level.

3.13 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 current carrying parts, when these parts are not alive.

3.14 Danger

Danger means danger of accident or of injury or to health.

3.15 Demolition Work

Demolition work means the work incidental to or connected with the total or partial dismantling or razing of a building or a structure other than a building and includes the removing or dismantling of machines or other equipment.

3.16 Designated Person

As per Rule-3 of the CEA Regulations, 2010; person(s) designated to operate and carry out the work on electrical lines and apparatus:-

(1) A supplier or a consumer, or the owner, agent or manager of mine, or the agent of any company operating in an oil field or power plant or the owner of a drilled well in an oil field or a contractor who has entered into a contract with a supplier or a. consumer to carry out duties incidental to the generation, transformation, transmission, conversion, distribution or use of electricity shall designate persons for the purpose to operate and carry out the work on electrical lines and apparatus.

(2) The supplier or consumer, or the owner, agent or manager of a mine, or the agent of any company operating in an oil-field or the owner of a drilled well in an oil field or a contractor referred to on sub-regulation (1) shall maintain a register wherein the names of the designated persons and the purpose for which they are engaged, shall be entered

(3) No person shall be designated under sub-regulation (l) unless, -

(i) he possesses a certificate of competency or electrical work permit, issued by the Appropriate Government

(ii) his name is entered in the register referred to in sub regulation(2).

3.17 Document

The information and its supporting medium. The medium can be paper, magnetic, electronic or optical computer disc, photograph or master sample, or a combination thereof.

3.18 Earth

'Earth' means a conducting mass of earth or of any conductor in direct electrical connection therewith.

3.19 Earthed

'Earthed' means connected to earth in such a manner as it will ensure immediate discharge of electrical energy without danger at all times.

3.20 Emergency

An emergency is an urgent, unexpected, and usually dangerous situation that poses an immediate risk to health, life, property, or environment and requires immediate action. Most emergencies require urgent intervention to prevent a worsening of the situation, although in some situations, mitigation may not be possible and agencies may only be able to offer palliative care for the aftermath.

3.21 Excavation

Excavation means the removal of earth, rock or other material, in connection with construction and demolition work.

3.22 Guardrail

Guardrail means a horizontal rail secured to uprights and erected along the exposed sides of scaffolds, floor openings, runways and gangways to prevent persons from falling.

3.23 Hazard

The source, situation, or act with a potential for harm in terms of human injury or ill health, or a combination of these.

3.24 Hazard Identification

The process of recognizing that a hazard exists and defining its characteristics.

3.25 Hot Work

Open flames - Welding, grinding, cutting, hot tapping, brazing, bundle pulling, power brushing, hacking by using jack hammer, soldering, vehicles entering into the operating units, using of mobile equipment inside the operating unit / refinery, battery operated tools, speed cutter or any activities that can producing spark (visually).

3.26 Ill Health

Identifiable, adverse physical or mental condition arising from and/or made worse by a work activity and/or work-related situation.

3.27 Incident

Work-related event(s) in which an injury or ill health (regardless of severity) or fatality occurred, or could have occurred

Note-1: *An accident is an incident which has given rise to injury, ill health or fatality.*

Note-2: *An incident where no injury, ill health, or fatality occurs may also be referred to as a "near-miss", "near-hit", "close call" or "dangerous occurrence"*

3.28 Isolation

A means of physically separating confined space from an energy source by the use of blinds, and breaking of lines.

3.29 Live

'Live' means electrically charged.

3.30 Nonconformity

Non-fulfilment of a requirement

Note: *A nonconformity can be any deviation from:*

- Relevant work standards, practices, procedures, legal requirements, etc.
- OH&S management system requirements.

3.31 Occupational Health and Safety (OH&S)

Conditions and factors that affect, or could affect, the health and safety of employees or other workers (including temporary workers and contractor personnel), visitors, or any other person in the workplace.

Note: *Organizations can be subject to legal requirements for the health and safety of persons beyond the immediate workplace or who are exposed to the workplace activities.*

3.32 Owner *(Regulation-2(c); CEA Regulations, 2011 & Rule-37: Coal Mines Regulation-2017)*

Owner when used in relation to a mine. Means any person who is the immediate proprietor or lessee or occupier of the mine or any part thereof and in the case of and in the case of mine the business whereof is being carried on by liquidator or receiver, such liquidator or receiver but does not include a person who merely receives a royalty rent or fine from the mine, subject to any lease grant or licence for the working thereof, or is merely the owner of the soil and not interested in the minerals of the mine; but (any contractor or sub- lessee for the working of a mine or any part thereof shall be subject to this act in like manner as if he were an owner, but not so as to exempt the owner from any liability.

- Duties and Responsibilities of the owner of mines is defined under Rule-37 of Coal Mines Regulations-2017.

3.33 Occupier *(Section-2(n); Factories Act, 1948 & Regulation-2(ci); CEA Regulations, 2011)*

Occupier of a factory means the person who has ultimate control over the affairs of the factory: Provided that—

i) In the case of a firm or other association of individuals, any one of the individual partners or members thereof;

ii) In the case of a company, any one of the directors, except any independent director within the meaning of sub-section (6) of section 149 of the Companies Act, 2013;

iii) In the case of a factory owned or controlled by the Central Government or any State Government, or any local authority, the person or persons appointed to manage the affairs of the factory by the Central Government, the State Government or the local authority or such other authority as may be prescribed by the Central Government, shall be deemed to be the occupier.

iv) Duties and responsibilities of occupier is defined in Section-7A of Factories Act, 1948.

3.34 OH&S Management System

OH&S Management System part of an organization's management system used to develop and implement its OH&S policy and manage its OH&S risks.

3.35 OH&S Objective

OH&S goal, in terms of OH&S performance, that an organization sets itself to achieve

Note-1: Objectives should be quantified wherever practicable.

Note-2: Requires that OH&S objectives are consistent with the OH&S policy.

3.36 OH&S Performance

Measurable results of an organization's management of its OH&S risks.

3.37 OH&S Policy

Overall intentions and direction of an organization related to its OH&S performance as formally expressed by top management.

3.38 Outrigger

Outrigger means a structure projecting beyond the facade of a building with the inner end being anchored and includes a cantilever and other support.

3.39 Putlog

Putlog means a horizontal member on which the board, plank, or decking of a working platform are laid.

3.40 Preventive Action

Action to eliminate the cause of a potential nonconformity or other undesirable potential situation. There can be more than one cause for a potential nonconformity. Preventive action is taken to prevent occurrence whereas corrective action is taken to prevent recurrence.

3.41 Procedure

Specified way to carry out an activity or a process. Procedures can be documented or not.

3.42 Protective Devices

'Protective Devices' means PPEs (Personal Protective Equipment) such as rubber gloves, rubber gauntlets, rubber boots or other insulating devices, which are especially designed for the protection of workmen.

3.43 Purging

Displacement of hazardous contaminants by the use of Water, Nitrogen, Steam or other inert gases.

3.44 Risk

Combination of the likelihood of an occurrence of a hazardous event or exposure(s) and the severity of injury or ill health that can be caused by the event or exposure(s).

3.45 Risk Assessment

Process of evaluating the risk(s) arising from a hazard(s), taking into account the adequacy of any existing controls, and deciding whether or not the risk(s) is acceptable.

3.46 Safe Working Load

Safe working load in relation to an article of lifting gear or lifting appliances means the load which is the maximum load that may be imposed on such article or appliance with safety in the normal working conditions as assessed and certified by a competent person.

3.47 Suspended Scaffold

Suspended scaffold means a scaffold suspended by means of ropes or chins and capable of being raised or lowered but does not include a boatswain's chair or similar appliance.

3.48 Toe board

Toe board means a member fastened above a working platform, access landing, access way, wheelbarrow run, ramp or other platform to prevent building workers and material falling there from.

3.49 Unauthorised person

A person, who is not permitted to work on electrical apparatus except under the personal supervision of an authorised person.

3.50 Vehicle

Vehicle means a vehicle propelled or driven by mechanical or electrical power and includes a trailer, traction engine, tractor, road-building machine and transport equipment

3.51 Voltage

Voltage is the difference in 'charge' between two points. It is the amount of potential energy between two points on a circuit. One point has more charge than another. This difference of 'charge' between the two points is called voltage.

Low Voltage

Where the normal voltage is not greater than 250 Volts.

Medium Voltage

Where the normal voltage exceeds 250 Volts but is not greater than 650 Volts.

High Voltage

Where the normal voltage exceeds 650 Volts but is not greater than 33,000 Volts.

Extra High Voltage

Where the voltage exceeds 33000 Volts.

3.52 Worker

(a) **Worker** *(Occupational Safety, Health and Working Conditions Code, 2020)*

"worker" means any person employed in any establishment to do any manual, unskilled, skilled, technical, operational, clerical or supervisory work for hire or reward, whether the terms of employment be express or implied, and includes working journalists and sales promotion employees, but does not include any such person—

(i) Who is subject to the Air Force Act, 1950, or the Army Act, 1950, or the Navy Act, 1957; or

(ii) Who is employed in the police service or as an officer or other employee of a prison; or

(iii) Who is employed mainly in a managerial or administrative capacity; or

(iv) Who is employed in a supervisory capacity drawing wage exceeding eighteen thousand rupees per month or an amount as may be notified by the Central Government from time to time

(b) **Worker** *(ISO 45001 – 2018)*

Person performing work or work-related activities that are under the control of the organization.

Note 1:

Persons perform work or work-related activities under various arrangements, paid or unpaid, such as regularly or temporarily, intermittently or seasonally, casually or on a part-time basis.

Note 2:

Workers include top management, managerial and non-managerial persons.

Note 3:

The work or work-related activities performed under the control of the organization may be performed by workers employed by the organization, workers of external providers, contractors, individuals, agency workers, and by other persons to the extent the organization shares control over their work- or work-related activities, according to the context of the organization

3.53 Workplace

Any physical location in which work related activities are performed under the control of the organization.

3.54 Work Permit

Work permit is a written document used to identify a specific task, show the assessment of hazards related to the task, specifies the method used to eliminate or control hazards related to the task, and identifies those accountable for preparing and performing the task.

3.55 Work Permit Issuing Authority

A person who is responsible and accountable for preparing the equipment or an area to work before issuing work permit.

3.56 Work Permit Receiving Authority

The person, who receives the work permit from the Issuing Authority and is accountable and responsible for all following permit stipulations outlined by the permit issuing authority. This person, usually from contractor, must read and understand the permit before accepting.

3.57 Demolition

Demolition is the science and engineering in safely and efficiently tearing down of buildings and other artificial structures.

3.58 Emergency Preparedness and Response

- *Schedule-III, Regulation-9(2) of CEA Regulations-2011;*
- *Rule-36 of BOCW Rules-1998;*
- *Rule-37(3) & 104 of Coal Mines Regulations-2017;*
- *Section-41B(4) of the Factories Act, 1948; and .*
- *Rule-13 of the Manufacturing, Storage and Import of Hazardous Chemical Rules, 1989.*

Emergency preparedness plans can include natural, technical and man-made events that occur inside and outside normal working hours.

The organization shall establish, implement and maintain a process needed to prepare for and respond to potential emergency situations, including:

a) Establishing a planned response to emergency situations, including the provision of first aid;

b) Providing training for the planned response;

c) Periodically testing and exercising the planned response capability;

d) Evaluating performance and, as necessary, revising the planned response, including after testing and, in particular, after the occurrence of emergency situations;

e) Communicating and providing relevant information to all workers on their duties and responsibilities;

f) Communicating relevant information to contractors, visitors, emergency response services, government authorities and, as appropriate, the local community;

g) Taking into account the needs and capabilities of all relevant interested parties and ensuring their involvement, as appropriate, in the development of the planned response. The organization shall maintain and retain documented information on the process and on the plans for responding to potential emergency situations.

3.59 Lockout / Tag out (LOTO)

LOTO System is a safety procedure used to ensure that dangerous equipment is properly shut off and not able to be started up again prior to the completion of maintenance or repair work. It requires that hazardous energy sources be «isolated and rendered inoperative» before work is started on the equipment in question. The isolated power sources are then locked and a tag is placed on the lock identifying the worker and reason the LOTO is placed on it. The worker then holds the key for the lock, ensuring that only they can remove the lock and start the equipment. This prevents accidental start-up of equipment while it is in a hazardous state or while a worker is in direct contact with it.

3.60 Employer *(Section-2(I); BOCW Act, 1996 and Section-2(u); Code 2020)*

"Employer" *(Section-2(I); BOCW Act, 1996)* in relation to an establishment, means the owner thereof, and includes-

(i) In relation to a building or other construction carried on by or on behalf of a local authority or other establishment, directly without any contractor, the chief executive officer of that authority or the establishment.

(ii) In relation to a building or other construction carried on by or through a contractor, or by the employment of building workers supplied by a contractor, the contractor.

"Employer" *(Section-2(u); Code 2020)* means a person who employs, whether directly or through any person, or on his behalf, or on behalf of any person, one or more employees in his establishment and where the establishment is carried on by any Department of the Central Government or the State Government, the authority specified, by the head of such Department, in this behalf or where no authority, is so specified, the head of the Department and in relation to an establishment carried on by a local authority, the Chief Executive of that authority, and includes;

(i) in relation to an establishment which is a factory, the occupier of the factory;

(ii) in relation to mine, the owner of the mine, agent or manager referred to in section 67;

(iii) in relation to any other establishment, the person who, or the authority which has ultimate control over the affairs of the establishment and where said affairs are entrusted to a manager or managing director, such manager or managing director;

(iv) contractor; and

(v) legal representative of a deceased employer.

Responsibilities of employer is defined under Section-44 of BOCW Act, 1996.

3.61 Manager of Mines *(Regulation- 27; Coal Mines Regulation-23017)*

"Manager" includes Mine Superintendent who is appointed by the owner or agent of a mine under Section 17 of the Act and as such, responsible for the control, management, supervision and direction of a mine.

4 Occupational Health & Safety Policy

4. Statutory provision

The OH&S policy is a set of principles stated as commitments in which top management outlines the long-term direction of the organization to support and continually improve its OH&S performance. The OH&S policy provides an overall sense of direction, as well as a framework for the organization to set its objectives and take actions to achieve the intended outcomes of the OH&S management system. Declaration of OH&S Policy by the occupier / owner / Employer of THDCIL is compliance of the following statutory requirement;

- Section 7-A(3) And 41-B(2) of the Factories Act, 1948 and rules made thereunder;
- Rule-4(a) of CEA Regulations, 2011;
- Clause 5.2 of ISO: 45001-2018; and
- Rule-39 of the BOCW Central Rules, 1998.

4.1 Responsibility of occupier

This will be the responsibility of the Occupier /Owner /Employer of THDCIL Power Plants / Projects to declare a written statement on Occupational Health & Safety Policy of workers and all those who are working for and on behalf of the organization. The policy should be reviewed as and when required.

The OH&S Policy should be prominently displayed in regional language and English languages at conspicuous places across the plant / project. The policy should be communicated to all and made available to interested parties on demand.

OH&S Policy should include minimum following statements:

- Prevention of injury and ill health by providing safe workplace
- Training and competence of employees
- Continual improvement in OH&S performance
- Compliance with OH&S related applicable legal and other requirements
- Compliance with other requirements to which the organization subscribes
- Role and responsibility of contractors
- Framework for setting and reviewing OH&S objectives.
- Intention of taking into account the health and safety performance of individuals at different levels while considering their career advancement.

Note:

(i) The OH&S Policy should be consistent with the vision of the organization, and

(ii) It should be realistic, neither overstating the nature of the risks the organization faces, nor trivializing them.

(iii) The OH&S Policy should be communicated to all persons working under the control of THDCIL in order to assist them to understand:

- What the top management is committed to OH&S;
- What employees are individually required to do to demonstrate compliance of OH&S Policy; and
- Their role, responsibilities and accountability in compliance of Company's OH&S Policy statement.

(iv) The OH&S Policy can be linked with other policy documents of the THDCIL and should be consistent with the THDCIL's overall business policies and with its policies for other management disciplines e.g. quality management or environmental management.

4.2 Funds and facility

The occupier of power plant / project shall allocate separate expenditure head for the expenses to be incurred on OH&S Promotional and Educational activities. The OH&S Performance of THDCIL shall be included in the 'Annual Report' of THDCIL.

4.3 Role, and responsibility of HODs in compliance of OH&S Policy statements

It shall be the responsibility of HODs for compliance of OH&S Policy statements (Both Corporate OH&S Policy and Project OH&S Policy) and also for the compliance of OH&S related legal and other requirements applicable to his/her areas.

For effective implementation of the OH&S Policy, the Head of executing Department / Engineer In-charge shall integrate following OH&S issues in their managerial decisions, especially,

- At tendering and design stage;
- In the selection and procurement of machinery, equipment and materials; and
- In the selection of contractor and placement of personnel;

The Department Heads shall ensure that;

1. Workers including contract workers are trained and re-trained in safety in proper use of PPE (Personal Protective Equipment) to perform the assigned jobs safely.
2. Contract workers are physically fit and suitable to the job requirement.
3. Contractors / Sub-contractors ensure compliance of OH&S related all applicable legal and other requirements to which the THDCIL subscribes.
4. Contractors shall made available good qualities PPE suitable for personal protection against the hazard he/she is likely to be exposed while performing the job. Under exceptional circumstances or during exigency of work, the same shall be provided by THDCIL on returnable basis to or at the cost of contractor to ensure safety of workers.
5. Work under contract shall be supervised by a competent person of the contract awarding department who is knowledgeable about the job being done and potential hazards associated with the work and their prevention.
6. Contractor and his engineer / supervisor understands THDCIL Work Permit System and shall take all practicable measures for compliance of safety conditions mentioned in the permit and also any other additional safety measures which are required to be taken as per the job requirement to enhance safety of persons.

7. Contractor immediately report an accident including 'Near-miss Incident' and/or dangerous occurrence to Head of Executing Department / Engineer In-charge and Safety Department. He completes all legal formalities for reporting of accident to the authorities on the prescribed format and within prescribed time period as per rules.
8. The contractor shall submit a monthly statement of Near-miss Incidents, First-aid Injuries, Loss Time Injuries, Fatal Accidents / Occupational Disease / Dangerous Occurrence to the HOD – Safety of the project on 1st day of next month.
9. Submit 'Action Taken Report' of 'Internal / External Safety Inspections and Safety Audits conducted by the principle employer of the contract awarding organization to Head of Safety of the project / plant.
10. Contractor assists in accident investigations conducted by THDCIL and/or Government organization(s).
11. The contractor shall appoint qualified Safety Officer wherever applicable otherwise contractor shall appoint or nominate nodal safety co-ordinator for every construction sites who is knowledgeable about the potential hazards associated with the job to be done and reports to the Site In-charge / Site Engineer. He shall be responsible to arrange Safety Work Permit for the jobs where SWP is applicable and ensure availability of PPE and their use by the workers.

4.4 Responsibility of Head of Safety Department

The head of Safety Department shall ensure that OH&S Policy is prepared in both regional language and English language and get it signed by the occupier. The policy should be;

- Displayed OH&S Policy at conspicuous places in the plant;
- Communicated to the workers including contract workers, apprentices, transport workers, suppliers, stakeholders and made available to interested parties on demand;
- Ensure implementation of OH&S Policy statements; and
- Update OH&S Policy as and when required.

Annexure

Corporate SHE Policy duly signed by Chairman and Managing Director in Hindi and English

Normative References

- *The Building and other Construction Workers (Regulation of Employment and Conditions of Service) Rules, 1998*
- *Central Electricity Authority (Safety Requirements for Construction, Operation and Maintenance of Electrical Plants and Electric Lines) Regulations, 2011*
- *Factories Act, 1948 and rules made thereunder*
- *ISO 45001 – 2018:Occupational health and safety management systems*
- *Occupational Safety, Health and Working Conditions Code and Rules, 2020*

टीएचडीसी इंडिया लिमिटेड
ऋषिकेश
कॉरपोरेट व्यवसायिक स्वास्थ्य एवं सुरक्षा नीति

हम अपने कर्मचारियों के साथ–साथ ठेकेदारों, उनके उप ठेकेदारों और परामर्शदाताओं के कर्मचारियों के स्वास्थ्य एवं सुरक्षा के लिए प्रतिबद्ध हैं।

हम प्रतिबद्ध हैं कि :–

- लागू कानूनी आवश्यकताओं, कानूनों, विनियमों और सर्वोत्तम प्रथाओं का पालन करेंगें।
- व्यवसायिक स्वास्थ्य एवं सुरक्षा के मद्देनजर खतरों एवम् जोखिम को समाप्त करेंगें।
- श्रमिकों तथा उनके प्रतिनिधियों की भागीदारी एवम् उनके परामर्श को सुनिश्चित करेगें।

हम एक सुरक्षित एवम् सामाजिक रूप से जिम्मेदार तरीके से अपने व्यवसाय का संचालन करेगें।

हम,

- ❖ कर्मचारियों में स्वास्थ्य एवं सुरक्षा जागरूकता बढ़ाने वाली संस्कृति का समर्थन करेंगे।
- ❖ व्यवसायिक स्वास्थ्य एवं सुरक्षा प्रबन्धन प्रणाली को अपनाने, लागू करने और उसमें निरन्तर सुधार करने का प्रयास करेंगे।
- ❖ स्वस्थ और सुरक्षित कार्य वातावरण प्रदान करने के लिए अनिवार्य आवश्यकताओं की पूर्ति करेंगे।
- ❖ कर्मचारियों में व्यवसायिक स्वास्थ्य एवं सुरक्षा प्रबन्धन प्रणाली के प्रति जागरूकता बढ़ायेंगे।
- ❖ कर्मचारियों और प्रासंगिक हितधारकों को स्वास्थ्य एवं सुरक्षा पहलुओं पर प्रशिक्षित करेंगे।
- ❖ व्यवसायिक स्वास्थ्य एवं सुरक्षा के क्षेत्र में उत्कृष्टता प्राप्त करने हेतु तत्पर रहेंगे।

(राजीव कुमार विश्नोई)
अध्यक्ष एवं प्रबन्ध निदेशक

दिनांक:-16-08-2022

THDC INDIA LIMITED

CORPORATE OCCUPATIONAL HEALTH AND SAFETY POLICY

We are committed to ensure health and safety of our employees as well as employees of contractors, sub-contractors and consultants.

We are committeed to:-

- Fulfill applicable legal requirements, laws, regulations and best practices.
- Eliminate hazards and reduce OH&S risks.
- Consultations and participation of workers and workers' representative.

We shall conduct our business in a safe and socially responsible manner.

We shall :-

S upport a culture that raises employees' health and safety awareness;

A dopt and implement Occupational Health and Safety Management System and strive for continual improvement;

F ulfill necessary requirements to provide healthy and safe working environment;

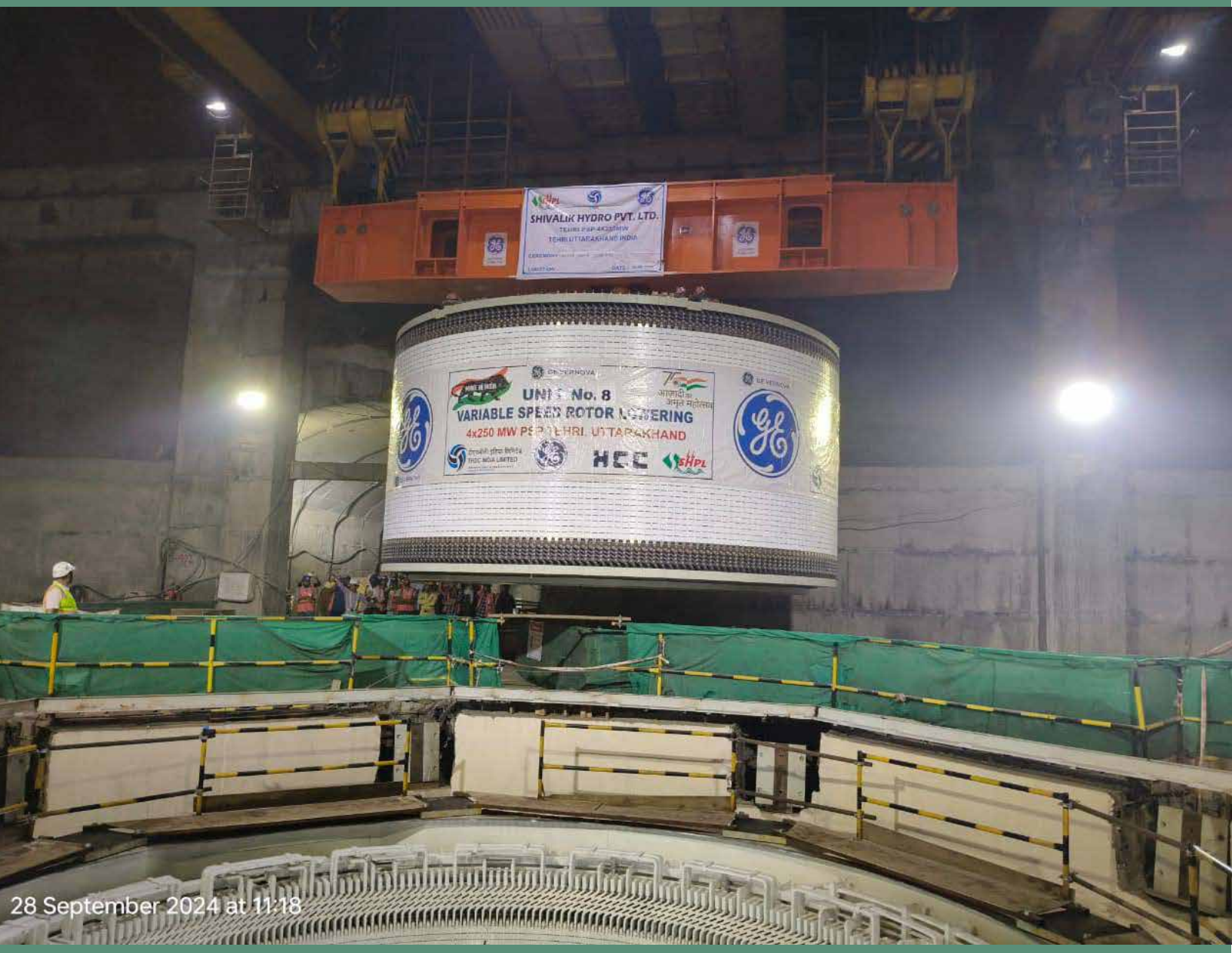
E nhance awareness and concern toward Occupational Health and Safety Management Systems amongst employees;

T rain employees and relevant stakeholders on health and safety aspects;

Y earn to achieve excellence in Occupational Health and Safety.

(RAJEEV KUMAR VISHNOI)
Chairman & Managing Director

Dated 16-08-2022


SHIVALIK HYDRO PVT. LTD.
UNIT No. 8
VARIABLE SPEED ROTOR LOWERING
4x250 MW PSP TEHRI, UTTARAKHAND
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5 OH&S Related Applicable Legal & Other Requirements

5 Role and Responsibility

- **Immediate Responsibility**

  Immediate responsibility for compliance, reviews (at least once in six months) and maintaining records of OH&S related applicable legal and other requirement concerning to Department shall be of the MR - ISO 45001-2018 and Head of Executing Department.

- **Ultimate Responsibility**

  Ultimate responsibility to ensure compliance of all OH&S related applicable legal and other requirements shall be of the Occupier / Owner / Employer / Manager of Mines.

5.1 Introduction

Occupational Health and Safety (OH&S) legislations and regulations are the driving force behind OH&S Management System in THDCIL. In addition to ensure compliance of legal responsibilities, the THDC management continually strives to improve and enhance safety performance to achieve the target of 'Accident Free Power Plants'.

OH&S related legal and other requirements to which THDC subscribes listed below for reference and compliance by concerned HODs in their plants / projects. It should be noted that, this safety manual does not in any sense supersede or nullify the provisions prescribed by law, which in any case should be observed strictly. Safety manual is complimentary to the statutory obligations and should be followed in conjunction with operating instructions, equipment manufacturers' manuals, standard codes and other standing orders.

5.2 For ready reference, list of acts and rules applicable on THDCIL plants /projects is

Mainly following OH&S related acts and rules are applicable on THDCIL Plants / Projects;

1 Ambient Air Quality Standard (Revised), 2009
4 Air (Prevention & Control of Pollution) Act, 1981
5 Air (Prevention & Control of Pollution) Rules, 1982
6 Bio-Medical Waste (Management and Handling) Rules, 1998
7 Boiler Act 1923 (Amendment) Act 2007
8 Building and Other Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996 and Central Rules, 1998
9 Central Electricity Authority (Measures Relating to Safety and Electric Supply) Regulations, 2010
10 Central Electricity Authority (Safety Requirements for Construction, Operation and Maintenance of Electrical Plants and Electric Lines) Regulations, 2011
11 Central Motor Vehicle Rules, 1989
12 Coal Mines Regulations, 2017
13 Dam Safety Act, 2021

14 Disaster Management Act, 2005
15 Dock Workers (Safety, Health & Welfare) Act, 1986
16 Dock Workers (Safety, Health & Welfare) Regulations, 1990
17 Energy Conservation Act, 2001
18 Environment (Protection) Act, 1986
19 Environment (Protection) Rules, 1986
20 Explosive Act, 1884
21 Explosive Rules, 2008
22 E-waste (Management & Handling) Rules, 2011
23 Factories Act, 1948
24 Gas Cylinder Rules, 2016
25 Gujarat Factories Rules, 1963
26 Gujarat State Lift and Escalator Act, 2000
27 Gujarat State Lift and Escalator Rules, 2001
28 Hazardous & Other Wastes (Mgt. & Transboundary) Rules, 2016
29 Indian Electricity Act, 2003
30 Inter-State Migrant Workmen (Regulation of Employment & Conditions of Service) Act, 1979
31 IS: 14489 – 2018: Occupational Health and Safety Audit — Code of Practice
32 ISO 45001 – 2018: Occupational health and safety management systems
33 Kerala Factories Rules, 1957
34 Manufacturing, Storage and Import of Hazardous Chemical Rules, 1989
35 Mine Act, 1952 & Mine Rescue Rules, 1985
36 Motor Vehicle Act, 1988 (2019)
37 National Building Code of India, 2016
38 National Offshore Wind Energy Policy, 2015
39 National Renewable Energy Act, 2015
40 Noise Pollution (Regulation and Control) (Amendment) Rules, 2010
41 Occupational Safety, Health and Working Conditions Code and Central Rules, 2020
42 Petroleum Rules, 1976 (Amendment 2021)
43 Plantation-Labour-Act, 1951
44 Public Liability Insurance Act, 1991
45 Public Liability Insurance Rules, 1991
46 Railways Act 1989
47 Static and Mobile Pressure Vessels (Unfired) Rules, 2015
48 UP Fire Prevention And Fire Safety Rules, 2005
49 UP Factories (Control of MAH) Rules, 1996
50 U.P. Factories Rules, 1950
51 UP Disaster Management Act, 2005
52 Uttrakhand Fire Service Act, 2016
53 Uttrakhand Factories (Control of Major Accident Hazard Rules, 1996
54 Water (Prevention & Control of Pollution) Act, 1974
55 Water (Prevention & Control of Pollution) Rules, 1975

Note: Interment facility may be used to update the latest amendments in OH&S related applicable acts and rules.

6 Accident Reporting Procedure

6 Legal requirement for reporting / notice of Accident, Dangerous Occurrence and Occupational Disease

6.1 Role and Responsibility for reporting of accident and dangerous occurrences

HOD (HR&A) of Plant / Project shall be responsible to report the accident on prescribed format and within stipulated time frame as per the applicable rules to the concerned authorities.

6.2 Intimation of electrical accidents

Legal requirement

- Regulation-4(i) of CEA Regulation, 2011
- Section-161 of the Electricity Act, 2003
- CEA Intimation of Accidents (Form & time of Service of Notice) Rules, 2004 (Amended in 2005)

INTIMATION OF ELECTRICAL ACCIDENT

(1) If any accident occurs in connection with the generation, transmission, supply or use of electricity in or in connection with, any part of the electric lines or other works of any person and the accident results in or is likely to have resulted in loss of human or animal life or in any injury to a human being or an animal, such person or any authorized person of the generating company or licensee, not below the rank of Junior Engineer or equivalent shall report to the Inspector within 24 hours of the knowledge of the occurrence of fatal accident and a report in writing in 'FORM-A' within 24 hours of the knowledge of the occurrence of fatal and all other accidents. Where possible a telephonic message should also be given to the Inspector immediately, if the accident comes to the knowledge of the authorized officer of the generating company / licensee or other concerned.

(2) For the intimation of the accident, telephone numbers, email ID and address of Chief Electrical Inspector or Electrical Inspectors, District Magistrate, Police Station, Fire Brigade and nearest hospital shall be displayed at conspicuous place in generating station, sub-station, enclosed sub-station/switching station and maintained in the office of the in-charge/ owner of the Medium Voltage (MV) / High Voltage (HV) / Extra High Voltage (HEV) installations.

6.3 Intimation of accident occurred in a factory

Legal requirement

- Section-88, 88A and 89 of Factories Act, 1948 and rules made there under.

INTIMATION OF ACCIDENT / DANGEROUS OCCURRENCE OCCURRED IN FACTORY

(1) In any factory an accident occurs which causes death, or which causes any bodily injury by reason of which the person injured is prevented from working **for a period of forty-eight hours or more immediately following the accident**, or which is of such nature as may be prescribed in this behalf,

the manager of the factory shall send notice thereof to the Inspector of Factories of the region concerned and the Chief Inspector of Factories on 'Form-18 / Form-18A in case of Dangerous Occurrence' within such time, as prescribed under rules.

(2) When an accident or dangerous occurrence as specified below whether or not they are attended by personal injury or disablement—

(a) Bursting of a plant used for containing or supplying steam under pressure greater than atmospheric pressure.

(b) Collapse or failure of a crane, derrick, winch hoist or other appliances used in raising or lowering persons or goods, or any part thereof, on the overturning of a crane.

(c) Explosion, fire, bursting out, leakage or escape of any molten metal, or hot liquid or gas causing bodily injury to any person or damage to any room or place in which persons are employed, or fire in rooms of cotton pressing factories when a cotton opener is in use.

(d) Explosion of a receiver or container used for the storage at a pressure greater than atmospheric pressure of any gas or gases (including air) or any liquid or solid resulting from the compression of gas.

(e) Collapse or subsidence of any floor, gallery, roof, bridge, tunnel, chimney, wall, building or any other structure;

shall also be sent notice thereof to the Inspector of Factories of the region concerned and the Chief Inspector of Factories; and

1. the District Magistrate or Sub-Divisional Officer,
2. the Officer-in-charge of the nearest police station, and
3. the relatives of the injured or deceased person.

(3) The State Government may make rules for regulating the procedure at inquiries under this section.]

6.4 Intimation of accident occurred in construction Site

Legal requirement

- Section-39 of the Rule-210 of the Building and Other Construction Workers '(Regulation of Employment and Conditions of Service) Act, 1996
- Rule-210 of the Building and Other Construction Workers '(Regulation of Employment and Conditions of Service) Central Rules, 1998

INTIMATION OF ACCIDENT OCCURRED IN CONSTRUCTION SITE

Notice of any accident on the construction site which either—

(a) Causes loss of life; or

(b) Disables a building worker from working for a period of forty-eight hours or more immediately following **the accident, shall forthwith be sent email, telephone, fax or similar other means including special messenger within four hours in case of fatal accidents and seventy-two hours**, in case of other accidents involving building workers shall be sent on **'Form XIV'** to—

(i) The Regional Labour Commissioner (Central), having jurisdiction in the area in which the establishment in which such accident or dangerous occurrence took place is located.

(ii) Board with which the building worker involved in accident was registered as a beneficiary;

(iii) Director General; and

(iv) The next of kin or other relative of building worker involved in accident.

(2) Notice of any accident at a construction site of a building or other construction work which—

(a) Causes loss of life; or

(b) Disables such building worker from work for more than ten days following the accident, shall also be sent to—

(i) The Officer In-charge of the nearest police station;

(ii) The District Magistrate or if the District Magistrate by order so desires to the Sub-Divisional Magistrate.

(3) Where any accident-causing disablement subsequently results in death of a building worker, **notice in writing of such death shall be communicated to the authorities as mentioned above within seventy-two hours of such death.**

(4) Following classes of dangerous occurrences shall be reported to the Inspector having jurisdiction, whether or not any death or disablement is caused to a building worker namely: -

(a) Collapse or failure of lifting appliances or hoist or conveyors or other similar equipment for handling building or construction material or breakage or failure of rope, chain or loose gears; overturning of cranes used in building or other construction work; falling of objects from height;

(b) Collapse or subsidence of soil, any wall, floor, gallery, roof or any other part of any structure, platform, staging, scaffolding or any means of access including formwork;

(c) Contract work, excavation, collapse of transmission;

(d) Explosion of receiver or vessel used for storage, at a pressure greater than atmospheric pressure, of any gas or gases or any liquid or solid used as building material;

(e) Fire and explosion causing damage to any place on construction site where building material;

(f) Spillage or leakage of hazardous substances and damage to their container;

(g) Collapse, capsizing, toppling or collision of transport equipment;

(h) Leakage or release of harmful toxic gases at the construction site.

(6) In case of failure of a lifting appliance, loose gear, hoist or building and other construction work machinery and transport equipment at a construction site of a building or other construction work, such appliances, gear, hoist, machinery or equipment and the site of such occurrence shall, as far as practicable, be kept undisturbed until inspected by the inspector having jurisdiction. (7) Every notice given under sub-rule (1), sub-rule (2) or sub-rule (4) shall be followed by a written report to the Inspector, authority under section 39 of the Act, the Board and the Director General in **'Form XIV'** under proper acknowledgement

6.5 Intimation of accident in mines

Legal requirement:

The following Act and Rules shall be applicable for reporting of accident in mines.

- Mines Act, 1952
- Rule-8 of the Coal Mines Regulation, 2017
- DGMS Mine user manual for accident

6.6 Intimation of electrical accident

(1) If any accident occurs in a mine than Owner or Manager shall forthwith inform the Regional Inspector about the occurrence by phone, email or by special messenger and shall also, within twenty-four hours of every such occurrence, give notice thereof in the Form and method specified by the Chief Inspector for the purpose, to the District Magistrate, the Chief Inspector and the Regional Inspector.

Provided that in case of such notice is sent vide e-mail, it shall be immediately followed by letter.

(2) The owner / manager shall simultaneously exhibit a copy of the notice on a special notice board of the mine for a period of not less fourteen days from the date of such exhibition.

(3) If the death results from any injury already reported as serious, the owner or agent or manager shall within twenty-four hours of his being will inform to the District Magistrate, the Chief Inspector, and the Regional Inspector and to the competent authority for payment of compensation.

2. Role and responsibility to report and investigation of accident

2.1 The immediate responsibility to report accident to;

- Project Head;
- HR Head;
- Head of Safety

shall be of the Site In-charge / Site Engineer or Contractor in case of the contract workers.

2.2 The immediate responsibility to investigate the accident site immediately or within 12 hours of the knowledge of the occurrence of accident to collect information about the injured person(s) and machine / equipment involved in accident and to capture evidences with photos wherever possible to prepare the first hand report before the site evidences are disturbed, shall be of the Head of Safety Department / Safety Officer of the project.

2.3 Submit the first information report to HOP and Corporate Head of Safety within 48 hours of the knowledge of the occurrence of accident.

2.4 HOD, Safety Deptt. of the Plant/Project/Sites shall submit a detailed accident investigation report with in five days from the date of accident to HOD, Corporate Safety Deptt.

2.5 After receiving accident investigation report from Plant/Project/Site the THDCIL Corporate Safety Department shall engage Safety Professional / Safety Institution to conduct third party accident investigation along with the representative of corporate safety department or a Safety Officer of other THDCIL Project within 15 days from the date of receipt of detailed accident investigation report from the plant/project/site where the accident occurred.

2.6 The third party will submit soft copy the investigation report within three to four days from the date of completion of accident site visit to the Safety Head of THDC Corporate Office.

2.7 Corporate Safety Head will forward the third party inspection report to HOP where accident occurred for necessary corrective and preventive action.

2.8 Project safety head in consultation with the head of concerned Dept. will submit the road map for the implementation of recommendations and consistently do the follow-up and intimate progress report to corporate safety Dept. till the recommendation are complied.

3. The following accident report forms are annexed for ready reference;

Annexure-3.1: Form-XIII - For reporting electrical accident.

Annexure-3.2: Form-18&18A - For reporting Accident and Dangerous Occurrence resulting Death or Bodily Injury in factory.

Annexure-3.4: Form-XIV - For reporting accident at construction site.

Normative References

- *Regulation-4(i) of Central Electricity Authority (Safety Requirements for Construction, Operation and Maintenance of Electrical Plants and Electric Lines) Regulations, 2011*
- *Electricity Act, 2003*
- *CEA Intimation of Accidents (Form & time of Service of Notice) Rules, 2004 (Amended in 2005)*
- *Building and Other Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996 and Central Rules, 1998*
- *Factories Act, 1948 and rules made thereunder*
- *Occupational Safety, Health and Working Conditions Code 2020 and (Central) Rules 2020*
- *Mines Act, 1952*
- *Coal Mines Regulation, 2017*
- *DGMS Mine user manual for accident*

Annexure-3.1

ANNEXURE – XIII
Form for Reporting Electrical Accidents
(See Rule – 44 – A)

1. Date and time of Accident

2. Place of Accident:-
(Village/Town/Thana)
District and State:-

3 System and Voltage of supply:-
(Whether EH/HV/LV line, sub – station
/generating station/consumer installation):-

4. Designation of the officer – in – charge of the
Supplier in whose jurisdiction the accident occurred:-

5. Name of owner/user of energy in whose premises the accident occurred:-

6. Detail of victim(s):-

Sl. No	Name	Father's Name	Sex of victim	Full Postal Address	Approximate age	Fatal/Non Fatal

(b)

Sl.No	Description of Animal(s)	Number(s) of owner	Address of owner	Fatal/ Non Fatal
1				
2				

7. Incase the victim(s) is/are employee(s) of supplier:-

(a) Designation of such person(s):-

(b) Brief description of the job:-

If any,
(c) Whether such person/persons was/were allowed to work on the job:-

8. In case the victim(s) are employee (s) of a licensed contractor:-

(a) Did the victim(s) possess any electric workman's permit(s)
Supervisor's certificate of competency issued under Rule 45:-

9. In case of accident in the supplier's system was the permit to work(PTW) taken:-

10. (a) Describe fully the nature and extent of injuries e.g fatal/disablement(permanent or temporary) of portion of the body or burn or other injuries:-
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 detail):-

13. Whether the District Magistrate and police station concern
Have been notified of the accident if so give detail:-

14. Step taken to preserve the evidence in connection with the accident to extend possible:-

15. Name and designation(s) of the person (so assisting, supervising the person(s)
killed or injured:-

16. What safety equipments were given to and used by the person(s) who met with this accident e.g rubber gloves, rubber mats, safety belt and ladders):-

17. Whether isolating switches and other sectionalizing devices were employed to deaden the section of working on the same:-
Whether working section was earthed at the time of work:-

18. Whether the work on the live lines was undertaken by authorised person(s)? If so, the name and designation of such person(s) may be given:-

19. Whether artificial resuscitation treatment was given to the person(s) who met with the electric accident? If yes, how long it continued before its abandonment?

20. Name and designation of persons present at witnessed the accident:-

21. Any other information? Remarks:-

Place: -

Time: -

Date:-

Signature

Name

Designation

Annexure- 3.2

ACCIDENT REPORT FORM - 18

(Section 88 of the Factories Act, 1948 and Rule 110 of the State Factories Rules)

NOTICE OF ACCIDENTS OR DANGEROUS OCCURRENCE RESULTING IN DEATH OR BODILY INJURY

To, Date: .....

Assistant/ Deputy Director of Factories
UTTRAKHAND

Sir,

I hereby give notice under Section 88 of the Factories Act, 1948 that fatal/non-fatal accident occurred in this factory to the person mentioned below:

1. Name of occupier (of factory)/Employer: .....
2. Address of E.S.I. Employer's Code No. ..... Premises where accident or dangerous occurrence took place .....
3. Nature of Industry .....
4. Branch or department and exact place where the accident or dangerous occurrence took place .....
5. Name and address of injured person .....
6. (a) Sex .....
   (b) Age (last birth) .....
   (c) Occupation of the injured person .....
7. Local E.S.I. Office to which the injured person is attached .....
8. Date, shift and hour of accident or dangerous occurrence .....
9. (a) Hour at which the injured person started work on the day of accident or dangerous occurrence .....
   (b) Whether wages in full or part are payable to him for the day of accident or dangerous occurrence .....
10. Cause or nature of accident or dangerous occurrence .....
11. Cause of accident or dangerous occurrence .....
    (a) If caused by machinery .....
        (I) Give name of the machine and the part causing the accident or dangerous occurrence .....
        (iii) State whether it was moved by mechanical power at the time
    (b) State exactly what the injured person was doing at that time .....
    (c) In your opinion, was the injured person at the time of accident or dangerous occurrence .....

Annexure-3.2

(i) acting in contravention of provisions of any law applicable to him, or

(ii) acting in contravention of any order given by or on behalf of his employer, or

(iii) acting without instructions from his employer.

(d) In case reply to (c) (i) (ii) or (iii) is in the affirmative state whether the act was done for the purpose of securing the safety in connection with the employer's trade or business.

(12) In case the accident or dangerous occurrence happened while traveling in the employer's transport state whether .....

(i) The injured person was travelling as a passenger to or from his place of work .....

(ii) the injured person was travelling with the express or implied permission of his employer,

(iii) the transport is being operated by or on behalf of the employer or some other person by whom it is provided in pursuance of arrangements made with the employer, and

(13) In case the accident or dangerous occurrence happened while meeting emergency state .....

(i) its nature .....

(ii) whether the injured person at the time of accident or dangerous occurrence was employed for the purpose of his employer's trade or business in or about the premises at which the accident or dangerous occurrence took place.

(14) (14) Describe briefly how the accident or dangerous occurrence occurred.

(15) Name and address of witness:

(1) _____

(2) _____

(16) (a) Nature and extent of injury (e.g. fatal, loss of finger, fracture of leg, sealed or scratch and followed by sepsis.)

(b) Location of injury (right leg, left hand or left eye, etc.)

(17) (a) If the accident or dangerous occurrence is not fatal, state whether the injured person was disabled for more than 48 hours.

(b) Date and hour of return to work.

(18) (a) Physician, dispensary/hospital from whom or in which the injured person received or is receiving treatment.

(b) Name of panel doctor selected by the injured person

(19) (i) Has the injured person died .....

Annexure- 3.2

(ii) If so, date of death .....

I certify that to the best of my knowledge and belief, the above particulars are correct in every respect.

Signature

Name and Designation of the Occupier or Mgr-Employer .....

Employer's Address and Code No. .....

(This space is to be filled by the Inspector of Factories)

Sex (Men, Women, Boy or Girl)

District ..... Date of Receipt .....

Number of accident or dangerous occurrence, Causation number, other particulars (e.g. fatal, leg injury, arm injury, etc

Date of Investigation .....

Result of investigation:

_____

_____

_____

_____

_____

_____

_____

_____

Annexure-3.2

FORM NO. 18-A
[Prescribed under Rule 96]

Notice of dangerous occurrence which does not result in death or bodily injury
[Vide para 2 of the Schedule under Rule 96]

1. Name and address of the Factory 2. Name of the occupier 3. Name of the Manager 4. Nature of Industry 5. Branch or Department and exact place where the dangerous occurrence took place. 6. Date and hour of occurrence 7. Nature of Dangerous Occurrence (state exactly what happened)	

I certify that, to the best of my knowledge and belief, the above particulars are correct in every respect.

Signature of the occupier or Manager.

Date of dispatch of report:

Note:- To be completed in legible handwriting or preferably typewriting.

(This space is to be completed by the Inspector of Factories)
District:

Number of accidents or dangerous occurrence:

Industry No.:

Other particulars (Example fatal, leg injury, arm injury etc.):

Causation No.:

Date of receipt:

Date of investigation:

Result of investigation:

Annexure-3.3

ACCIDENT REPORT FORM - XIV

[See Rule 210 (7) of Central BOCW Rules, 1998]

REPORT OF ACCIDENTS AND DANGEROUS OCCURRENCES

1. Name of the project/work
2. Location of project/work
3. Stage of construction work
4. Particulars of Employer
   (a) Main contractor Firm/Co:
   Name
   Address
   Phone Nos.
   Nature of business:
   (b) Sub-contractor's particulars:
   Name
   Address
   Phone Nos.
   Nature of business
5. Particulars of injured person
   (a) Name _____ _____ _____
   (First) (Middle) (Surname)
   (b) Home Address
   (c) Occupation
   (d) Status of the worker:
   Casual
   Permanent
   (e) Sex: Male Female
   (f) Age
   (g) Experience
   (h) Marital status: Married / Unmarried / Divorced
6. Particulars of Accident
   (a) Exact place where accident occurred
   (b) Date
   (c) Time
   (d) What the injured person was doing at the time of accident?
   (e) Weather condition
   (f) How long employed by you for this particular job?

Annexure-3.3

(g) Particulars of equipment/machine/ tool involved & condition of the same after the accident occurred

(h) Brief description of the accident

7. Nature of injuries

(a) Fatal

(b) Non-fatal

(c) If non-fatal, state precisely the nature of injuries

(Describe in detail the nature of injury for instance fracture of right arm, sprain etc.)

(d) First-Aid: Given: Not given:

(e) If not, give the reasons

(f) Name & designation of the person by whom first-aid was given

(g) If admitted to hospital,

Name of the hospital:

Address of the hospital

Phone No. Name of the Doctor:_____

8. Mode of transport used Ambulance / Truck / Tempo Taxi Private Car

9. (a) How much time was taken to shift the injured person?

If very late, state the reasons

(b) How the reporting was made?

Telephone / Special Messenger / Letter

(c) Who visited the accident site first and what

action was proposed by him?

(d) What are the actions taken for the investigation of the accident by the employer?

(Describe about photographs/ Video film/measurements taken, etc.)

10. Particulars of the persons given witness:

(a) Name Address Occupation

1.

2.

(b) Whether Temporary Permanent

11. Particulars in case of fatal:

Date Time

Whether registered with Building and other construction Workers' Welfare Board If yes, give Reg. No.

2

Annexure-3.3

12. Dangerous occurrences as covered under the Regulation No. (Give details)
    (a) collapse or failure of lifting appliances, hoist conveyors, etc.
    (b) collapse or subsidence of soil, any wall, floor, gallery, etc.
    (c) collapse of transmission towers, pipeline, bridges, etc.
    (d) explosion of receiver, vessel, etc.
    (e) fire and explosion
    (f) spillage or leakage of hazardous substances
    (g) collapse, capsizing, toppling or collision of transport equipment
    (h) leakage or release of harmful toxic gases at the construction site
    (i) failure of lifting appliance, loose gear, hoist or building and other construction work machinery, transport equipment, etc.
13. Certificate from the Employer or authorised signatory.

I certify that to the best of my knowledge and belief, the above particulars are correct in every respect.

Place ..... Signature

Date ..... Designation

c.c. forwarded for information and follow-up action:

1.

2.

Note.— If more than one person is involved, then for each person, information is to be filled up in separate forms.

7 Fire Safety Prevention and Protection

7.1 Role and Responsibility

- **Immediate Responsibility**

  Immediate responsibility for Prevention and Fire Protection' shall be of the HODs, HOD – Project Safety, Contractors and CISF Commandant/Dy. Commandant and Inspector, CISF – Fire Wing.

- **Ultimate Responsibility**

  Ultimate responsibility to ensure compliance legal requirements of legislations and NBC (National Building Code-2016) applicable for fire safety shall be of the Occupier / Owner / Employer / Manager in case of Mines.

7.2 Legal provisions applicable for fire safety

a) Section-38 of the Factories Act, 1948 and Rule 61 of the State Factories Rules; Precautions in case of fire.

b) Rule-44(IX) of the CEA (Measures Relating to Safety and Electric Supply) Regulations, 2010

c) Rule-5 (Schedule-1) of the Central Electricity Authority (Safety Requirements for Construction, Operation and Maintenance of Electrical Plants and Electric Lines) Regulations, 2011

d) Rule-44(ix) of the Rule-35 of the Central BOCW Rules, 1998;

e) Part-4 of National Building Code-2016.

f) Rule-18(2) Schedule-II, Rule-80 and Rule-136 of the Occupational Safety, Health and Working Conditions Code 2020 and (Central) Rules 2020

7.3 Fire Prevention and Fire Protection

Fire is a rapid chemical process involving the combustion of materials, releasing heat, light and various gases, primarily carbon dioxide and water vapour. Fire requires three elements to burn; Fuel, Oxygen and Heat. This energetic reaction breaks down complex molecules in the fuel, liberating their stored energy. Fire plays a vital role in human history, from providing warmth and cooking to enabling industrial processes. However, uncontrolled fire can lead to destruction and danger. Understanding its properties and behaviours is essential for managing and utilizing fire safely.

Fire protection and fire prevention are two crucial aspects of fire safety that work together to minimize the risk of fires and their potential damage. While they are often used interchangeably, they have distinct meanings and applications.

Fire Prevention

Fire prevention focuses on eliminating or reducing the likelihood of a fire starting. This involves identifying and addressing potential fire hazards, implementing preventative measures, and educating individuals on fire safety practices. Common fire prevention strategies include:

- Proper storage and handling of flammable materials

- Regular maintenance and inspection of electrical systems
- Installation and maintenance of fire detection and suppression systems
- Enforcement of fire codes and regulations
- Public fire safety education and awareness programs, etc.

Fire Protection

Fire protection, on the other hand, focuses on mitigating the impact of a fire once it has ignited. This involves measures that aim to detect, suppress, and control the spread of fire, thereby safeguarding lives and property. Key fire protection systems include:

- Fire alarm system and smoke detectors
- Sprinkler systems
- Fire extinguishers
- Fire suppression systems (e.g., water mist, foam, inert gas)
- Use of fire-resistant construction materials
- Compartmentation of buildings, etc.

By combining effective fire prevention and fire protection measures, we can significantly reduce the risk of fires and their devastating consequences. A comprehensive fire safety strategy should encompass both approaches to ensure the safety of individuals, property, and the environment.

7.4 Classification of fire

The classification of fires is typically based on the type of materials or substances involved in the fire. Fires are classified into following five different classes to help in identification of appropriate fire extinguishing agents.

CLASSIFICATION OF FIRE BASED ON MATERIAL INVOLVED IN FIRE	
Class-A Fire	Fire in ordinary combustible materials such Paper, Wood, Textile, Rubber and Plastics etc. **Extinguishing Agents:** Water, foam, and dry chemical extinguishers are typically used for Class A fires.
Class-B Fire	Flammable liquid and gas fires such as Petrol, Diesel, Oil, Paint and Thinners etc. and Hydrogen, Methane, Butane, Propane, Dissolved Acetylene Gas and Natural Gas. **Extinguishing Agents:** Foam, Carbon Dioxide (CO_2), and Dry Chemical Extinguishers are commonly used for Class B fires.
Class-C Fire	Energized electrical equipment, including appliances, wiring, and fuse boxes. **Extinguishing Agents:** Non-conductive agents such as Dry Chemical Powder and Carbon Dioxide (CO_2) are suitable for Class C fires. Water should not be used to avoid risk of electrical shock.
Class-D Fire	Metal Fire such as Potassium, Magnesium, Sodium etc. **Extinguishing Agents:** Specialized Dry Chemical Powder Extinguishing agents designed for use on combustible metals.

CLASSIFICATION OF FIRE BASED ON MATERIAL INVOLVED IN FIRE	
Class-K Fire	Involves cooking oils and fats, often found in commercial kitchens. **Extinguishing Agents:** Wet chemical extinguishers are specifically designed to handle the challenges posed by cooking oil and fat fires. **Note: When using a wet chemical extinguisher on a Class K fire, it is important to apply the agent from a safe distance to avoid splashing or spreading the burning oil.**

In addition to fire extinguishers, other fire safety measures include proper building design, fire alarms, sprinkler systems, and evacuation plans. Fire safety regulations and practices may vary by region, and it's essential for individuals and organizations to adhere to local guidelines and codes to ensure the safety of people and property

Note: Different types of fire extinguishers are required for each class of fire. Using wrong type of fire extinguishing media can make the fire worse or cause serious injury to fire fighter and persons in the vicinity.

7.5 Elements of fire safety systems used for fire detection and firefighting

7.5.1 Fire Detection Systems

A fire detection system is a critical component of modern building safety infrastructure designed to identify and alert occupants about the presence of a fire or smoke within a facility. Its primary objective is to provide early warning, allowing for swift evacuation, timely intervention, and effective firefighting measures to mitigate potential damage, injury, and loss of life. These systems combine sophisticated sensors, alarms, communication devices, and central monitoring to create a comprehensive network of fire detection and response. Smoke detectors: These detectors sense the presence of smoke, which is a byproduct of fire.

7.5.2 Fire Suppression Systems

Fire suppression systems are specialized installations designed to quickly and effectively control or extinguish fires in buildings or industrial setups. These systems play a vital role in preventing the spread of fires, minimizing property damage, and safeguarding human lives.

Fire suppression systems incorporate various components such as fire extinguishers, sprinklers, specialized agents, and control panels. Automatic fire suppression systems are activated by heat, smoke, or flames, releasing fire-extinguishing agents directly onto the fire source. These agents could include water, foam, dry chemicals, or gases like carbon dioxide and halon alternatives.

Sprinkler systems are a common type of fire suppression system, with heat-sensitive sprinkler heads distributing water or other extinguishing agents when temperatures reach a certain threshold.

These systems require regular maintenance, inspection, and adherence to fire safety codes and regulations to ensure their readiness and effectiveness in emergencies.

7.5.3 Fire Alarm Systems

These systems are used to warn people of a fire so that they can evacuate the area safely. Fire alarm systems typically include:

a) Audible alarms: These alarms sound a loud siren or bell to alert people to the presence of a fire.

b) Visual alarms: These alarms use flashing lights or strobe lights to alert people to the presence of a fire.

c) Voice communication systems: These systems broadcast instructions to people on how to evacuate the area safely.

7.5.4 Fire Extinguishers

Fire extinguishers are portable devices that can be used to extinguish small fires. There are a variety of fire extinguishers available, each designed for a specific type of fire.

SUITABILITY OF PORTABLE FIRE EXTINGUISHERS			
Class of Fire	TYPE OF FIRE EXTINGUISHER		
	Water	DCP	CO_2
A	Yes	Yes	Yes
B	No	Yes	Yes
C	No	Yes	Yes
D	No	Yes	Yes
K	Water base special extinguishing agent	yes	Yes

Note: Refer IS: 15683 (2006), Portable Fire Extinguishers Performance and Maintenance – Specification.

7.5.6 Fire hydrants

A fire hydrant system is an essential component of fire safety infrastructure. It comprises a network of water supply points strategically placed throughout the plant to provide firefighters with quick access to a reliable water source in case of a fire emergency. Fire hydrants are usually located along streets, sidewalks, or designated areas and are connected to the municipal water supply

During a fire, firefighters connect hoses to the hydrants to access pressurized water, which is then directed to firefighting equipment like hoses, nozzles, and sprinkler systems. This system enables firefighters to rapidly deliver a substantial amount of water to extinguish or control fires effectively. Fire hydrant systems require regular maintenance and testing to ensure proper functionality, and they play a critical role in enhancing the efficiency of firefighting operations, ultimately contributing to the protection of lives and property.

7.5.7 Fire Doors

Fire doors are designed to slow the spread of fire. They are typically made of fire-resistant materials and have self-closing mechanisms.

7.5.8 Fire Barriers

Fire barriers are used to divide an industrial facility into smaller compartments. This helps to contain a fire and prevent it from spreading to other areas.

7.5.9 Fireproof Safes

Fireproof safes are used to protect valuable documents and equipment from fire. They are typically made of steel or concrete and are designed to withstand high temperatures for extended periods of time.

7.5.10 Evacuation Plan

Evacuation plans are procedures that outline how people should evacuate their workplaces safely in the event of a fire. Evacuation Plan should be communicated to all employees and all those who are working for and on behalf of the organization. The plan should also be displayed at conspicuous places for the communication of visitors

7.5.11 Fire safety training of employee

Employees including contract workers should be trained and re-trained on fire safety procedures, including how to use fire extinguishers and how to evacuate the area safely.

7.5.12 Maintenance and testing

Fire safety systems should be regularly maintained and tested to ensure that they are operable at all the time.

7.6 Firefighting Arrangement

7.6.1 Emergency Exit

- The exits shall be clearly visible and suitable illuminated with suitable arrangement to maintain the required illumination in case of failure of the normal electric supply.
- Lifts, escalators and revolving doors shall not be considered as emergency exits.
- The exits shall be marked in a language understood by the majority of the workers.
- Exits shall be so located that the travel distance on the floor shall not exceed 30 metres.
- In case where high hazard materials are stored or used, the travel distance to the exit shall not exceed 22.5 metres and there shall be at least two ways of escape from every room.
- Exit doorway shall not be less than 100 cm. in width Doorways shall be not less than 200 cm. in height.
- Exit doorways shall open outwards, that is, away from the room but shall not obstruct the travel along any exit. No door when opened, shall reduce the required width of stairway or landing to less than 90 cm. overhead or sliding doors shall not be considered as 'Exit Door'.

7.6.2 First-aid firefighting arrangements

Selection, installation and maintenance of portable first-aid fire extinguishers

Shall done as per IS: 2190-1992;

- Each first-aid fire-fighting equipment shall be allotted a Serial Number by which it shall be referred to in the records. The following details shall be painted with white paint on the body of each equipment:

  (1) Serial number;
  (2) Date of last refilling; and
  (3) Date of last inspection.

- First-aid firefighting equipment shall be placed on platforms/cabinets or in such a way that their bottom is 750 mm above floor level. Fire buckets shall be placed on hooks attached to a suitable stand or wall in such a way that their bottom is 750 mm above the floor level. Such equipment, if placed outside the building, shall be under sheds or covers.
- Firefighting drills shall be held at least once in every 3 months and maintain records.

7.6.3 High Velocity Water Spray (HVWS) System

In High Velocity Water Spray System (HVWS) high-pressure water is used to extinguish fires. The water is typically discharged from nozzles at a velocity of 100-200 feet per second, creating a fine mist / fine droplets that penetrates the flame zone and cools the burning material. HVWS systems are typically used to extinguish fire in high-value assets, such as transformers, switchgear and oil storage tanks, etc.

The key features of a high velocity water spray system are as follows;

High Water Pressure

The water is discharged from the nozzles at a high pressure, typically 100-200 psi. This creates a fine mist that has a greater penetrating power than a lower-pressure stream of water.

Fine Mist

The water is discharged in a fine mist form, which increases its surface area and allows it to absorb more heat from the fire.

Rapid Extinguishment

HVWS systems can extinguish fires quickly and effectively because the high-pressure water mist can penetrate the flame zone and cool the burning material rapidly.

Wide Range of Applications

HVWS systems is be used to protect a wide range of assets, including transformers, switchgear, oil storage tanks and other flammable materials.

The main difference between HVWS (High Velocity Water Spray) system and a MVWS (Medium Velocity Water Spray) system is the water pressure. HVWS systems use a higher water pressure, which creates a finer mist that has a greater penetrating power. The HVWS systems finds applications in petrochemical facilities, power plants, warehouses, and other high-risk environments. It plays a pivotal role in enhancing fire safety by swiftly containing potentially devastating fires, reducing property damage, and safeguarding human lives.

7.6.4 Nitrogen Injection Fire Protection System (NIFPS)

As per Rule-44(IX) of CEA (Measures Relating to Safety and Electric Supply) Regulations, 2010 it mandatory to use **"Nitrogen Injection Fire Protection System" (NIFPS)** for fire safety of Transformers conserving more than 2000 Ltr. of transformer oil or oil filled Power transformer of 10 MVA and above rating.

The Nitrogen Injection Fire Protection System is designed to prevent and control fires in transformers. It operates by injecting nitrogen gas into the transformer's oil-filled enclosure to create an inert atmosphere that suppresses combustion.

In the event of a fire, heat sensors or smoke detectors trigger the system. Nitrogen, an inert gas, is rapidly released into the transformer's internal space and serves following multiple purpose;

1. **Oxygen Displacement**

   Nitrogen displaces oxygen within the enclosure, reducing the oxygen concentration below the level required to sustain combustion. This prevents the fire from spreading or continuing to burn.

2. **Cooling Effect**

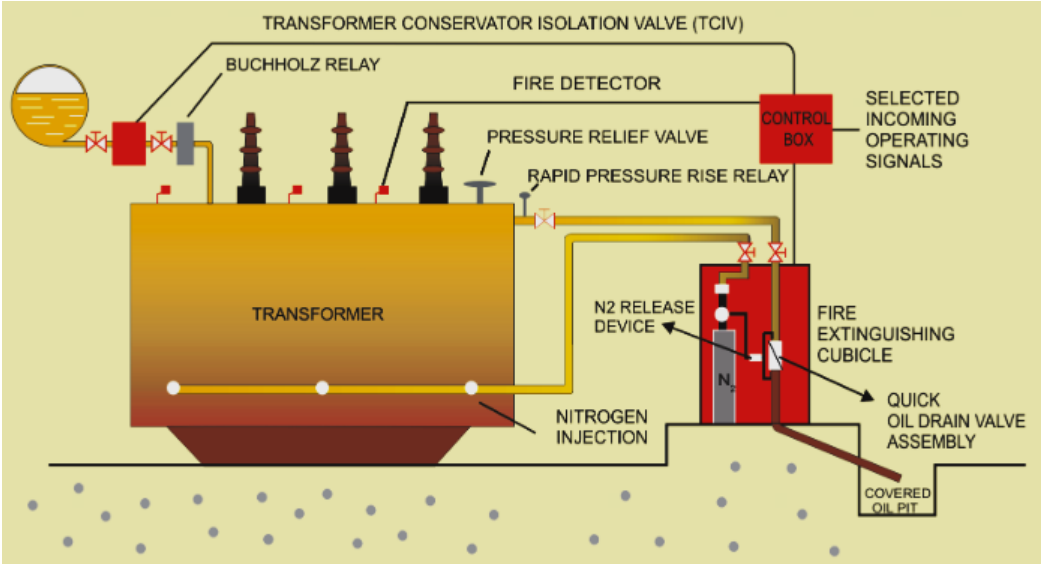
   The release of nitrogen also has a cooling effect on the surrounding environment, helping to lower the temperature and further inhibit the fire's progress.

3. **Pressure Control**

   The injection of nitrogen can help maintain internal pressure within safe limits, preventing the transformer's enclosure from rupturing due to excessive heat and pressure.

In NIFPS fire suppression system nitrogen gas is used to extinguish transformer fires. The system consists of a nitrogen gas cylinder, a pressure regulator, and a network of pipes and nozzles. When the system is activated, the nitrogen gas is injected into the transformer, displacing the oil and creating an inert atmosphere that prevents the fire from spreading.

NIFPS system is used in conjunction with other fire suppression systems, such as water mist systems or foam systems. However, NIPS systems is very effective at preventing fires from spreading and can help to protect the transformer from damage.



NITROGEN INJECTION FIRE PROTECTION SYSTEM (NIFPS)
FOR PREVENTION OF TRANSFORMER EXPLOSION

7.7 Signage used to caution/warn against fire emergency

The some fire emergency signage are placed below for reference to display in THDC Projects and associated facilities. The signage should be displayed on luminescence boards to enable their visibility in darkness too;

Normative References

- *Factories Act, 1948 and Rules made thereunder*
- *Building and Other Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996 and Central Rules, 1998*
- *CEA (Measures Relating to Safety and Electric Supply) Regulations 2010*
- *Central Electricity Authority (Safety Requirements for Construction, Operation and Maintenance of Electrical Plants and Electric Lines) Regulations, 2011*
- *National Building Code 2016*
- *IS: 2190-1992 Code of practice for selection, installation and maintenance of portable first-aid fire extinguishers*
- *IS: 5896 Code of practice for selection, operation and maintenance of fire-fighting appliances*
- *Occupational Safety, Health and Working Conditions Code 2020 and (Central) Rules 2020*

8 Medical Facilities & Medical Examination of Workers

8.1 Role and Responsibility

➢ **Immediate Responsibility**

Immediate responsibility to ensure compliance of periodical medical examination of employees working in hazardous areas shall be of the HOD- Concerned Department and HOD-HR&A Department.

The medical examination record of employees shall be maintained in the hospital / medical centre for ready reference of Medical Officer.

➢ **Ultimate Responsibility**

Ultimate responsibility to ensure compliance of periodical / medical examination of employees working in hazardous areas shall be of the Occupier / Owner / Employer / Manager in case of Mines.

8.2 Applicable Legal Requirements

Regulation	Act / Rules
Rule-63J	State Factories Rules
Rule-4	CEA (Safety Requirements for Construction, O&M of Elect. Plants & Electric Lines) Regulation-2011
Rule-223 to 229 & 231	Building and Other Construction Workers (Regulation of Employment and Conditions of Service) Central Rules-1998
Rule-37	Coal Mines Regulation 2017
Regulation-6(c)	Occupation Safety, Health and Working Conditions Code, 2020
Clause-A.8.1.2	ISO-45001: 2018, Occupational Health and Safety Management System

8.3 Occupational Health Centre (OHC)

THDCIL has an Occupational Health Centre (OHC) with thirty bed facility in Bhagirathi Puram hospital of Tehri HPP. Every other THDCIL project is having a Medical Centre headed by full time qualified doctor(s) and assisted be qualified paramedical staff. The Bhagirathi Puram hospital / OHC is equipped with the following medical facilities;

- Operation Theatre
- X-Ray facility
- Laboratory
- Pharmacy
- Homeopathy Treatment
- Patient Transfer Ambulance
- Portable Suction Unit
- Incinerator for disposal of bio-medical waste

The Hospital / OHC is managed by a team of qualified doctors and paramedical staff.

8.4 First Aid Facility

8.4.1 At every work site adequate and suitable arrangement for rendering prompt and efficient first aid to injured persons shall be maintained under the guidance of medical officer in charge of the project.

8.4.2 One first-aid box for fifty persons or where there is a probability medical emergency on less than fifty employees one first-aid box distinctively marked with a red cross shall be made available. First-aid box should contain essential first-aid items as recommended in the state factories rules shall be provided and maintained. First aid to the injured persons shall be given by trained first-aider.

8.4.3 As per CEA Regulations 2022 there shall be minimum five persons trained (holds a certificate recognized by the State Government) in first-aid procedures amongst whom at least one shall be available during the working hours.

8.4.4 The 'First-aid Boxes or Cupboards' should be distinctively marked with Red Cross on a white ground. 'First-aid Box' should be kept in charge of a person trained in First-aid and holds a certificate recognized by the State Government. One trained first-aiders should be available in every shift.

8.4.5 The record of first-aid injuries shall be maintained and used to analyse the agency or body part frequently involved to cause first-aid injuries so that necessary CAPA could be taken to prevent recurrence of similar injuries.

8.4.6 Golden Rules of First Aid

- Do first thing first – quickly, quietly without fuss or panic
- Try to maintain vital functions required for maintenance of life
- Artificial respiration
- Cardiac massage
- Stoppage of bleeding, if any
- Guard against or treat for shock-gentle handling, change of posture position
- Do not over do
- Do not allow people to crowd around- fresh air
- Do not remove clothing unnecessarily
- Arrange shifting to medical centre
- Remove from adverse surrounding.
- Use encouraging words to the patients.

8.4.7 The injured person shall be given first-aid. If required, call the ambulance and immediately shift him to OHC or hospital for treatment.

8.5 Duties of construction Medical Officer (Rule-224 of BOCW Rules, 1998)

The duties of construction medical officer shall be;

1. To conduct medical examination of building workers as per Rule-223 of BOCW Rules, 1998;
2. To provide first-aid care including emergency medical treatment of building and other construction workers;
3. Notification of occupational diseases to the concerned authorities in accordance with BOCW Central Rules;
4. Immunization services;
5. Maintenance of medical records of building and other construction workers; and
6. Health education including advisory services on family planning, personal hygiene, environmental sanitation and safety.

8.6 Ambulance Van (Rule-227 of BOCW Rules, 1998)

Ensure availability of an ambulance van at construction sites or arrangement made with nearby hospital for providing such ambulance van for transportation of serious cases of accident or sickness of the building and other construction workers to the hospital. Such ambulance van shall be equipped with facilities as specified in Schedule-V of Rule-227 of BOCW Rules, 1998.

8.7 Stretchers (Rule-228 of BOCW Rules, 1998)

Ensure availability of sufficient number of stretchers for building and other construction workers at construction sites so as to be readily available in an emergency.

8.8 Occupational Health Services for building workers (Rule-229 of BOCW Rules)

Ensure at a construction site of a building or other construction work, where more than five hundred building workers are employed that—

(a) A special medical service or an occupational health service is available at such construction site at all times and such service shall—

- (i) Provide first-aid and emergency treatment;
- (ii) Conduct special medical examination for occupational hazards to such building workers before their employment and thereafter at such intervals as may be specified by the Director General from time-to-time;
- (iii) Conduct training of first-aid personnel of such medical service;
- (iv) Render advice to Project/Plant Head on conditions of work and improvement required to avoid hazards to the health of such building worker;
- (v) Promote health education, including family welfare among such building workers;
- (vi) Cooperate with the Inspector having jurisdiction in the detection, measurement and evaluation of chemical, physical or biological factors suspected of being harmful to such building workers;
- (vii) Undertake immunization for all such building workers against tetanus, typhoid, cholera and other infectious diseases; and
- (viii) Compliance of other provisions of this rule.

8.9 First Aid Boxes (a) Rule-231 of BOCW Rules, 1998.

1. At every work site adequate and suitable arrangement for rendering prompt and efficient first aid to injured persons shall be maintained under the guidance of medical officer in charge of the project.
2. 'First-aid Box' equipped with prescribed contents shall be provided and maintained at suitable locations in the projects and they should be readily accessible during working hours.
3. The 'First-aid Boxes or Cupboards' should be distinctively marked with Red Cross on a white ground. 'First-aid Box' should be kept in charge of a person trained in First-aid and holds a certificate recognized by the State Government. One trained first-aiders should be available in every shift.

8.10 Golden Rules of First Aid

- Do first thing first - quickly, quietly without fuss or panic
- Try to maintain vital functions required for maintenance of life
- Artificial respiration

- Cardiac massage
- Stoppage of bleeding, if any
- Guard against or treat for shock-gentle handling, change of posture position
- Do not over do
- Do not allow people to crowd around- fresh air
- Do not remove clothing unnecessarily
- Arrange shifting to medical centre
- Remove from adverse surrounding.
- Use encouraging words to the patients.

8.11 The injured person shall be given first-aid. If required, call the ambulance and immediately thereafter transferred to OHC or hospital for treatment.

8.12 Emergency care services

As per Rule-232 of BOCW Central Rules, 1998, ensure availability of essential life-saving aids and appliances as mentioned in Rule-232 of BOCW Rules, 1998 to handle emergency treatment and maintained properly under the supervision of construction medical officer. 8.9. Medical Examination of employee

8.13 Medical Examination of Employees

8.13.1 Chief Medical Officer / Medical Officer of THDCIL Projects shall conduct/arrange to conduct medical check-up of all employees as per the details given below and maintain records.

8.13.2 As per Factories Act / State Factories Rules, medical examination of workers employed in a 'hazardous process' shall be medically examined by a qualified medical practitioner once in a period of 6 months, to ascertain that the health status of worker in respect of occupational health hazards to which they are exposed.

8.13.3 As per CEA Regulations 2022, the owner / occupier / employer / manager mines shall ensure periodical medical examination of employees and at least the following medical check-up shall be carried out and records maintained, namely;/employees

a) Once before employment to ascertain physical fitness of the person to do the particular job.

b) Medical check-ups of all employees at intervals not exceeding twelve months.

c) Colour vision tests and eye sight examination for drivers, skilled workers, technicians, supervisors and crane operators annually for those who are less than forty-five years old and every six months for those who are more than forty-five years old.

d) Test for respiratory disorder exposed to dusty environment such as coal dust in thermal power generating stations once in every six months.,

e) Medical examination of employees working in hazardous areas shall be done once in six months as per the legal requirement under Factories Act and state factories rules and records maintained.

f) Once in twelve months 'Auditory Test' of persons working in high noise (means more than 90 dBA) environment.

Normative References

- *Building and Other Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996 and Central Rules, 1998*
- *Central Electricity Authority (Safety Requirements for Construction, Operation and Maintenance of Electrical Plants and Electric Lines) Regulations, 2011 (2022)*
- *Occupational Safety, Health and Working Conditions Code 2020 and (Central) Rules 2020*
- *Factories Act, 1948 and rules made there under.*
- *Coal Mines Regulation 2017*
- *ISO-45001: 2018, Occupational Health and Safety Management System.*

9 Worker's Participation in Safety Management

9.1 Role and Responsibility

➢ **Immediate Responsibility**

Immediate responsibility for workers Participation in Safety Management,

Safety Promotional Activities and Safety Training shall be of the;

(a) HOD – Safety: For workers Participation in safety management and safety promotional activities

(b) HOD – HR&A: For safety training of employees however HOD-Safety will assist in organizing and finalizing safety professionals as per organization's safety training need.

➢ **Ultimate Responsibility**

Ultimate responsibility to ensure to ensure compliance of the provisions of this chapter shall be of the Occupier / Owner / Employer / Manager in case of Mines.

9.2 Legal Requirement:

Rule-4	:	CEA (Safety Requirements for Construction, O&M of Electric Plants & Electric Lines) Regulation-2011
Rule-37(5)	:	Coal Mines Regulation 2017
Rule-6	:	Occupational Safety, Health and Working Conditions Code, 2020
Rule-44	:	BOCW Central Rules, 1998
Section-7A	:	Factories Act, 1948 and Rules made thereunder
ISO-45001-2018	:	Occupational Health and Safety Management System

9.3 Workers Participation In Safety Management & Safety Promotional Activities

9.3.1 Workers Participation in Safety Management

Worker's participation in safety management will be ensured through Safety Committee. Head of Safety Department will initiate action to constitute safety committee consisting of equal number of representatives of workers and **management to promote cooperation between the workers and the** management in maintaining proper safety and health at work and to review periodically the measures taken in that behalf.

1. The Project Head shall be the Chairman of Committee;
2. Safety Officer shall be the Secretary of the Committee;
3. Medical Officer, a representative from Powerhouse, Operation & Maintenance and Purchase Department shall be the member in safety committee. During construction the safety committee shall also include representatives of contractors and their employees with equal representation;
4. The tenure of safety committee shall be two years;

The committee shall meet at least once in three months and decisions/recommendations of the committee shall be complied by concerned Head of Department within the time frame as recommended by the committee.

9.4 Safety Promotional Activities

The HOD- Safety shall ensure celebration of following National Days as mentioned against each as part of safety promotional activities;

- ❖ Celebration of 'National Safety Day/Week' on 4th March every year.
- ❖ Celebration of 'National Fire Day' on 14th April every year.
- ❖ Celebration of 'Road Safety Week' from 11 to 17 January every year.
- ❖ Celebration of 'World Environment Day' on 5th June every year.
- ❖ Display of Banners, Posters and Stickers related to subject matter across the plant to create awareness. Organize competitions such as slogan competition, poster competition, essay competition, quiz and debate on related topics to involve workers in safety thought process.
- ❖ Involve then to give TBT (Toolbox Talk) / Pep Talk etc.

9.5 Safety Training

Legal provision;

- ➢ Section-7A of the Factories Act, 1948 and Rule-62B(7)(d) of the U.P. Factories Rules, 1950.
- ➢ Rule-39(B)(v), 64 and 229 of BOCW Central Rules, 1998.
- ➢ Rule-4-4(h) and Rule-11(1 and 2) of CEA Regulations, 2011

To ensure compliance of Occupier / Employer / Owner / Manager of Mines' statutory obligation of training and re-training of workers including contract workers following actions shall be taken every year;

9.5.1 To ensure compliance of Rule-4 of the CEA (Safety Requirements for Construction, Operation and Maintenance of Electric Plants & Electric Lines) Regulation-2011, HOD (HR&A) of the project shall ensure 10 hours safety training of employees at all levels including contract workers every.

9.5.2 HOD (Safety) of the plant/project shall collect safety training need of employees from all HODs of the plant/project in the month of January latest by 31st January every year. HOD (Safety) will compile safety training requirement received from different HODs and forward the same to the HOD (HR&A) latest by 15th February every year.

9.5.3 The HOD (HR&A) shall take necessary action for obtaining financial approval for safety training programs. HOD (HR&A) shall take necessary action in co-ordination with HOD (Safety) to organize safety training programs with the assistance of internal or external Safety Professionals or Safety Institutions.

9.5.4 HOD (HR&A) shall forward the quarterly report of safety training to HOD - Corporate Safety in the last week of every quarter on the following format;

Quarter	Topic of Safety Trainings	Duration of Training	No. of Participants Attended
1st			
2nd			
3rd			
4th			

10 Personal Protective Equipment (PPE)

10.1 Responsibility to ensure availability and use of PPE

➢ **Immediate Responsibility**

a) The immediate responsibility for selection, procurement and to ensure availability of PPE (Personal Protective Equipment) and safety gadget to THDC employees shall be of the HOD - Project Safety / Manager (Coal Mine).

b) In case of Contractors and Sub-contractors, the immediate responsibility to provide good quality PPE (Personal Protective Equipment) and safety gadget to workers shall be of the Main Contractor. However during exigency of work or under exceptional circumstances, HOD - Safety Department may permit to issue PPE to contractor on returnable basis or at the cost of contractor.

c) The Site In-charge, Site Engineer and Site Supervisors and contracts shall be responsible to ensure use of PPE by workers while at workplace.

➢ **Ultimate Responsibility**

The ultimate responsibility to ensure availability and use of PPE at workplace shall be of the Owner / Occupier / Employer / Factory Manager as the case may be.

10.2 Legal requirement

- Section 7 (A), 32, 35, 36 of the Factories Act, 1948 and Rule 58 of the U.P. Factories Rules, 1950.
- Rule 5(4), 34, 40(a), 42(6), 44, 45, 46, 47(3), 54, 131, 178, 179 and 180 of the Building and Other Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996 and Central Rules, 1998
- Rule-4 of the Central Electricity Authority (Safety Requirements for Construction, Operation and Maintenance of Electrical Plants and Electric Lines) Regulations, 2011
- Rule-37 of the Coal Mine Regulation, 2017
- Code-82 of the Occupational Safety, Health and Working Conditions Code 2020

10.3 Introduction - Personal Protective Equipment (PPE)

Personal protective equipment (PPE) is any equipment that protects workers from job-related hazards. It is essential for reducing the risks of injury, illness, and death in the workplace.

10.3.1 Benefits of PPE

- Reduces the risk of injury, illness, and death
- Protects workers from a wide range of hazards, including:
- Physical hazards, such as falls, slips, trips, and struck-by hazards
- Chemical hazards, such as toxins, irritants, and corrosives
- Biological hazards, such as viruses, bacteria, and mold

- Radiological hazards, such as ionizing radiation
- Heat and cold stress
- Improves worker productivity and morale
- Lowers workers' compensation costs
- Promotes a positive safety culture

10.3.2 Responsibility of Occupier, Employer, Owner and Manager Mines

- Provide PPE to their workers free of charge.
- Must ensure that PPE is properly selected, used, and maintained.
- Must train workers on the proper use of PPE.

10.3.3 Workers' Responsibilities

- Workers must use PPE as per hazard / job requirement for personal protection.
- Workers must inspect PPE before each use to ensure that it is in good condition.
- Workers must report any damage or malfunction of PPE to their employer.

10.3.4 Examples of PPE

- Hard hats: Protect workers from head injuries from falling objects.
- Safety glasses: Protect workers' eyes from flying debris, dust, and chemicals.
- Earplugs or earmuffs: Protect workers' hearing from damaging noise levels.
- Respirators: Protect workers' lungs from inhaling hazardous substances.
- Gloves: Protect workers' hands from chemicals, heat, and abrasions.
- Safety shoes: Protect workers' feet from injury from falling objects and chemicals.
- Full-body suits: Protect workers from exposure to hazardous substances.
- Full-body Harness: Protect workers from fall from height.

10.3.5 Importance of PPE Training

PPE training is essential for ensuring that workers use PPE properly. Training should cover the following:

- Hazards that PPE is designed to protect against
- Proper selection and use of PPE
- Importance of maintaining PPE in good condition
- Signs of damage or malfunction
- Proper disposal of PPE

By using PPE properly, workers can reduce their risk of injury, illness, and death.

10.4 Selection Criteria

The following points should be considered during selection of PPE;

- PPE should be confirming to National or Internal Standards;
- Provide adequate protection against the hazard;
- Provide maximum comfort to the wearer; and
- Do not restrict essential movements of the wearer.

10.5 Types of PPE (Personal Protective Equipment)

10.5.1 Non-respiratory PPE

Sl. No.	PPE NAME	USED FOR
1	Industrial Safety Helmet (IS: 2925 – 1884)	Head Protection
2	Ear Plugs or Ear Muffs	Ear Protection against high noise level
3	Safety Goggles	Eye protection against Chips, Welding/ Cutting, Chemical Splash & Dust Particles etc.
4	Gloves, Fingers etc.	Hand protection against Chemicals, Hot Objects, Sharp Edges, Oily surface etc.
5	Aprons / Coat / Suit	Body Protection against Chemicals, Hot Objects, Sharp Edges etc.
6	High Visibility Waistcoat	Protection in nights and confined spaces
7	Safety Shoes	Foot protection
8	Full Body Harness	Fall protection while working at heights

10.5.2 Respiratory Personal Protective Equipment

Sl. No.	PPE NAME	USED FOR
1	Disposable Mask, Chemical Cartridge Mask, Canister Type Mask,	Respiratory protection for low concentration of pollutants in work environment
2	Breathing Apparatus	Respiratory protection against high concentrations of pollutants

10.5.3 Non-Respiratory Personal Protective Equipment

PPEs which are used for protection against injury from outside the body, i.e. for protecting the head, eye, face, hand, arm, foot, leg and other body parts.

10.5.4 Head Protection

Safety helmets are the hard hats or headgear of varying materials, designed to protect workman's head, not only from impact but also from flying particles and electric shock or combination of these.

Industrial Safety Helmet

The role of industrial safety helmet is to provide protection to the wearer against falling objects and other hazards which may be encountered in mining, tunneling, quarrying, construction activities. Specifications of industrial safety helmet should be in accordance with the IS: 2925-1984.

Precautions in use of helmets

Helmets should be inspected for cracks, dents or for any other damage before every use. Discard damaged helmets. Check suspension because it plays an important role in absorbing shock of a blow. Adjust headgear as per your requirement and tight chin strap to ensure intended safety. Clean the helmets regularly.

Firemen's Helmet

The main objective of firemen's helmets is to provide protection against falling objects during firefighting, rescue operations and to some extent, against heat or electric shock. Specifications of firemen's helmet should be in accordance with the **IS: 2745-1983**.

10.5.5 Eye and Face Protection

Eye protection is required for protection against following hazards;

SL. NO.	TYPE OF HAZARD	REMARKS
1	Chemical	Corrosive; easily absorbed through the skin; known to cause eye damage
2	Biological	
3	Optical Radiation	High intensity light sources, lasers, ultraviolet lamps welding, brazing, cutting, furnaces, heat treating
4	Radioactive Materials	
5	Impact	Machinery or processes where any movement of tools, machine elements or particles could exist
6	Electrical hazards (e.g., arc flash)	Do not use metal frame protective devices in electrical hazard areas
7	Heat	High temperatures that could result in facial burns, eye injury or ignition of PPE
8	Specialty eye protection includes;	• Laser (Class 3 or 4) Optical density based on beam parameters • UV (Marked “ANSI Z87 U shade”) • Welding (Marked “ANSI Z87 W shade”) • Impact/Machine Shop (Marked “ANSI Z87+”)

TYPE OF SAFETY GOGGLES FOR PROTECTION AGAINST DIFFERENT HAZARDS

HAZARDS	TYPE OF SAFETY GOGGLE
UV AND WAVELENGTH SPECIFIC EYEWEAR: Wavelength-specific eye protection needs to be used whenever there is a potential for eye damage from any light source. Typical examples include laser use, working around high temperature furnaces, long-time exposure to sun, exposure to UV lights, or working with welding torches.	
CHEMICAL SAFETY GOGGLES Chemical Safety / Chemical Splash goggles also provide impact protection but fit more tightly around the eyes so they provide a greater degree of protection from all angles.	
SAFETY GOGGLE FOR PROTECTION AGAINST IMPACT Grinding, Buffing, Chipping, Cutting	

FOR PROTECTION DURING ELECTRIC ARC WELDING (IS: 1179-1967)	
FOR PROTECTION DURING GAS WELDING AND CUTTING OPERATION Stationery frame with ophthalmic grade zero power toughened lenses. Comes with Blue for Furnaces, Green for Gas Cutting and Dark Green for ARC Welding.	

Face Protection

Face Shield is used where whole face protection is required against physical injury, chemical splash and flying chips / objects etc. Face- shields can also be used in combination with basic eye protection to guard against impact.

Selection of eye and face protection equipment

Eye protection equipment shall be made of appropriate material free from visual defects and able to meet relevant performance and protection requirements. They should be durable, strong non-irritant and corrosion-resistant. The following points should be considered while selecting of eye and face protection equipment:

- Type of protection required;
- Conform to relevant BIS;
- Availability of test certificate;
- Comfortable to wear, lightweight material of excellent clarity and convenient fit;
- A non-penetrable protective seal around the forehead, nose and cheek areas in case of chemical goggles;
- Soft, flexible frame that adjusts perfectly to irregular facial contours of individual wearers;
- Uninterrupted vision
- Free from refractive distortion; and
- No hindrance while using helmet, dust filters and corrective spectacles.

10.5.6 Fingers, Hand and arm protection

Hand and arms injuries are likely to occur while handling materials with sharp ends, hot metals, chemicals, corrosive substances, electrical works, electronic components etc. Because of apparent vulnerability of the fingers, hands and arms, the use of PPE for their protection becomes necessary. Refer IS: **8807-1978** for selection of gloves. Materials commonly used for hand and arm protection against different types of hazards are given below;

FINGER INSTALL

Sl. No.	Material	Protection Against Hazard
1	Kevlar	Hot materials and heat.
2	Chrome leather	Sparks, hot materials, hot liquids, flying Particles, cuts and abrasions.
4	Plastic	Moisture and materials causing dermatitis.
5	Rubber	Acids and alkalis, electric shock, oils, moisture and materials causing dermatitis.
6	Chemical resistant material like PVC, PVA etc.	Acids and alkalis, chemicals causing cold burn, oils
7.	Cotton or fabric	Dirt, slivers, chafing
8.	Metal mesh	Knife work, sharp or rough objects

GLOVES

Specifications for Hand and Arm Protection Equipment

a) Specifications for Electrical Rubber Gloves

Electrical safety rubber glove should be in accordance with IS: 4770-1991.

b) Gloves for Protection against Chemicals

Gloves for protection against chemicals should be made of:

Butyl: Synthetic rubber offers the highest penetration resistance to acid, gases and water vapors.

Neoprene: Synthetic rubber material has excellent tensile strength, heat resistance, ability to withstand most acids, caustics and remains flexible at low temperature.

Nitrile: Synthetic rubber offers superior chemical and abrasion resistance.

PVC: Synthetic thermoplastic polymer provides excellent wet grip and abrasion resistance.

Latex: Natural rubber material has outstanding tensile strength and temperature resistance. Thick latex gloves also provide resistance to acids and alkalis.

c) Specifications of Leather and Cotton Gloves

Leather and cotton gloves should be in accordance with IS: 6994(P1)-1973.

d) Specifications for Leather Gauntlets

Leather gauntlets are generally used by welders for protection against heat and abrasion during welding and by workers engaged in handling hot materials or materials with sharp or rough edges. Leather gauntlets should be in accordance with **IS: 2573-1986 (R 2003)**.

10.5.7 Foot and Leg Protection

Protection to foot and leg is required while engaged in construction, handling of materials and chemicals etc. Safety shoes, foot guards, knee pads, leggings should be used for foot and leg protection. Refer **IS: 10667-1983** (R2002) for selection of PPE for the protection of foot and leg. Depending upon the nature of hazards, safety shoes should be selected;

a) General purpose leather safety shoes with steel/fiber reinforced toe

Leather safety shoes with steel/fiber reinforced toe shall be widely used in construction activities and for the handling heavy materials or in activities where there is likelihood of heavier objects falling and striking the toe, then foot guards in addition to safety shoes should also be worn. Protective steel toe cap for footwear should be in accordance to **IS: 5852-2004**.

b) Electrical Safety Shoes

The electrical safety shoe shall be used in areas where potential for electrical shocks exists. Electrical safety shoes should not have any exposed metal. The hard toe used in electrical safety shoes should be made of FRP. Electrical safety shoes provided personal protection when they are dry and in good condition. The protection is diminished when they are in wet condition. It recommended that in addition to electrical safety shoes, Insulating Rubber Mat confirming to **IS: 15652-2006** should also be used wherever possible.

c) Fireman's Leather Boots

Fireman's Leather Boots (Wellington type) are intended for use by fire-brigade personnel while engaged in firefighting operations, to protect their feet and legs from direct heat and fire. Specification of this boot should confirm to IS: **4128-1980 (R2002)**.

d) PVC and Rubber Gumboots

PVC gumboots with stockinet lining inside and conforming to **IS: 12254-1993** shall be used for protection against chemicals.

For reference types of safety shoes to be used for protection against different types of hazards are given below:

Sl. No.	Type of Safety Shoes	Protection Against Hazard
1	Leather	Striking against stationary object, striking by moving object, stepping on hot objects, stepping on sharp objects, Heat radiation and welding spark, light chemicals.
2	Rubber	Electric shock, acids, alkalis and corrosive chemicals, moisture
3	PVC	Acids, alkalis, corrosive chemicals, moisture.

10.5.8 Body Protection

Certain jobs require whole body protection, like exposure to fire, extreme heat, molten metal, corrosive chemicals, cold temperature etc. Protection to body against such exposures can be

provided by wearing aprons, over all, jackets, coat, complete head-to-toe protective suits, etc. Selection of type of PPE for body protection depends on the nature of hazard, severity of hazard and activities of the user. Wherever complete body protection is not needed, it is advisable to avoid unnecessary safety clothing, as it may hamper the efficiency of user. If a user needs complete coverage selection of PPE should be done in accordance with **IS: 8519-1977 (R2002).**

Electric Arc Suit

For reference, type of body protection to be used against different types of hazards is given below;

S. No.	Material	Protection Against Hazard
1	Aluminized Fabric	Radiant heat, flame, hot metal splash and sparks
2	Glass Fibre insulated Fabric	Radiant heat, flame
3	Leather	Hot metal splash and sparks, grinding, wood working and shot blasting
4	Rubber	Electric current, water splash, strong and mild acids and alkalis
5	Plastics, Plastics Coated Fabric	Water splash, strong and mild acids and alkalis, organic solvents, oils
6	Wire mesh	Severe blows and sharp tools
7	Reinforced leather	Severe blows and sharp tools
8	Lead plastics or lead rubber or lead leather	X-rays and gamma rays
9	Overall Arc Flash Suit	Electric Arc

Specifications for Different Types of Body Protection Equipment

Apron, lead rubber, X-ray protection	:	IS: 7352-1974
Aprons, rubber, for hospital use	:	IS: 6407-1971
Aprons, rubberized, acid and alkali resistant	:	IS: 4501-1967
Belt and strap, leather, linemen's	:	IS: 3521-1965
Clothing, leather, protective	:	IS: 6153-1971
Fabric, PVC coated, for foul weather clothing	:	IS: 3322-1965
Suits, flame resistant and heat resistant	:	IS: 7612-1974
Overall Arc Flash Suit	:	IEC 61482 – 2

10.5.9 Ear Protection

Exposure to excessive high levels of noise can cause irreparable damage to hearing. Wherever the noise exceeds the permissible value of 90 dBA (as per Factories Act, 1948), control measures shall be adopted to reduce the exposures. There are following two types of ear protectors;

Ear Muff

1. **Ear Muff**

   Earmuffs reduce the noise level up to 25 dBA.

2. **Ear plugs**

   Ear Plugs reduce the noise level up to 15 dBA.

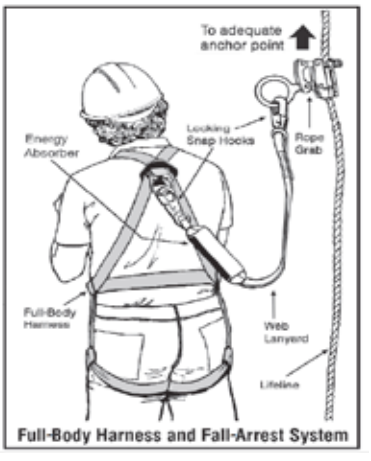
Ear Plugs

10.5.10 Fire Blanket

IS: 15381-2003 marked Fire Safety blankets shall be kept in important locations from fire risk point of view.

10.5.11 Full body harness safety belt

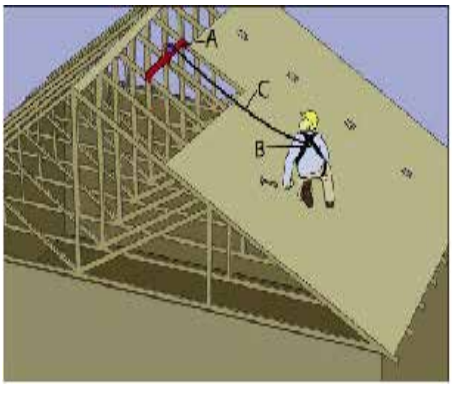
Full body harness safety belt is required for protection while working at heights e.g. maintenance at higher elevations, construction, erection, installation, installation and maintenance of outdoor transformers, to work inside tanks, silos, chimneys, manholes, sewers, maintenance of buildings. Safety belts with full body harness should be in accordance with **IS: 3521-1999 (R 2002)**.



Full-Body Harness and Fall-Arrest System

Specifications for Safety Belts and Harness

The waist belt, shoulder straps, hoisting straps, pole straps of all types of safety belts and harnesses shall be made of nylon/ polyester webbing which shall not break under a minimum tensile load of 2000 kg. The width and thickness should be 44 ± 1mm and 3 ± 0.05 mm respectively.



- All rivets and washers used for joining the various sections shall be made from copper.
- Nylon, polyester or synthetic fiber shall be used for lifeline/safety line. It shall not break under a minimum tensile load of 2000 kg. The minimum diameter of the lifeline should be 10 mm.
- The metal components shall be solid or forged, the joints should not be visible and the jointed part of the metal should not impair the strength or quality.
- All fittings should be corrosion-resistant and chromium coated with ample thickness to last for a minimum period of three years of storage. All the metal parts mating with the webbing shall be smoothly finished, rounded and designed to prevent damage to the webbing.

- The hooks, clamps or other fastening and holding devices shall be of similar quality and properly treated or plated. The design of the hooks shall be self-closing type and care shall be taken to ensure that if pressure is exerted accidentally on the tongue or the latches, they shall not disengage. Aluminum, magnesium or titanium metals or alloys thereof shall not be used.
- If springs are used, they shall be so arranged and loaded that when the hooks are closed,

the springs rest in position and are free from any movement until pressure is applied to release or to engage.

- The length of lanyard shall not be more than 3 m in length subject to the condition that free fall shall not be more than 1.8 m.

Care of Safety Belts and Harness

Safety belt/harness should be inspected every time before use to check its fitness. If any damage in safety belt/harness is observed, the same should be rejected.

10.5.12 Safety Nets

Safety net is used to catch personnel and / or debris falling from height / high rise buildings / construction sites

Specifications of safety nets

Material, design, dimensions, finish, marking, performance and testing (drop test and cord strength test) of industrial safety net should confirm to IS: 11057-1984 (R 2001).

Care of safety nets

Safety nets are liable to wear and mechanical damage and may be weakened to some extent by various agencies such as chemicals and heat, damage from abrasion, chemical attack and overloading. Nets in use should be inspected weekly by a competent person to ensure that the nets are still serviceable.

10.6 Respiratory Protective Equipment

Respirators protect inhalation in the environment which is contaminated by the presence dust, fumes, toxic vapors, and where there is oxygen deficiency. Temperature and humidity are also to be taken into consideration.

10.6.1 Classification of Respiratory Protective Devices

(i) Air Purifying Type: They purify the contaminated air by using suitable types of fillers

(ii) Supplied Air Type: They are also called 'Breathing Apparatus'. In this air to breathing zone is supplied from an external uncontaminated source.

10.6.2 Air Purifying Respirators

These types of respirators devices remove contaminants from the air by filtration and can only protect against limited concentration ranges of known contaminants in air if a suitable filter and face piece are chosen. The contaminated inhaled air passes through filter(s) that reduce harmful airborne contaminants to below permissible exposure levels. Such devices do not provide protection in oxygen deficient atmospheres or an atmosphere where the level of the harmful contaminant is excessive such as a level posing immediate danger to life and health (IDLH).

The maximum contaminant concentration against which an air purifying respirator will protect for gases and vapors and for particles having a TLV (Threshold Limit Value) of less than 0.1 mg/m3. Respirators will not provide the maximum design protection specified unless the face piece is

1. **Chemical Cartridge Type**

   For protection against gases and vapors

2. **Particle Filter**

   For protection against dust particles.

Chemical Cartridge Type (IS: 8523-1977)

3. **Canister Type Gas Masks (IS: 8523-1977)**

   Chemical cartridge respirators are designed for atmospheres not 'Immediately Dangerous to Life or Health' (IDLH). They are generally used only for evacuation purposes. The presence of some contaminants can be felt by human senses. When user is able to feel the presence of such a contaminant, he should immediately evacuate from the area. If required, to continue to work in the same environment then cartridge of the respirator should be replaced by a fresh one before resuming the job,

COLOUR IDENTIFICATION CFODES FOR AIR PURIFYING CANISTERS (IS: 8318-1977)

Sl. No.	Atmospheric Contaminants to be Protected Against	Color Assigned
1	Acid gases	White
2	Organic vapors	Black
3	Ammonia gas	Green
4	Carbon monoxide gas	Blue
5	Acid gases and organic vapors	Yellow
6	Acid gases, ammonia and organic vapors	Brown
7	Acid gases, ammonia, carbon monoxide and organic vapors	Red
8	Other vapors and gases not listed above	Olive
9	Radioactive materials, except for tritium and noble gases	Purple
10	Dusts, fumes and mists (non-radioactive)	orange

CANISTER TYPE

10.6.3 Supplied air type respirators

In supplied air type respirators, rrespirable air is supplied from an independent source to the person through airline, or from a air cylinder carried by the person. B.A. Sets provide protection against oxygen deficiency and most toxic atmospheres. The breathing atmosphere is independent of ambient atmospheric conditions. There are two types of supplied air respirators

1. Airline Respirators

Breathable air is supplied via a fresh air hose, or from a compressor / compressed air cylinder. The hose is attached to the user by a belt or other suitable means and can be detached rapidly and easily in an emergency. A flow control valve is provided to regulate the rate of airflow to the user. Exhaled air passes to the outside atmosphere through a Non-returnable valve. The movement of wearer is restricted in this case.

Requirements for use of supplied air respirator

The air used to supply respirators should;

- contain not less than 18 percent oxygen and not more than 23.5 percent by volume of air;
- not contain more than 5 ppm of carbon monoxide,
- not contain more than 500 ppm of carbon dioxide,
- not contain more than 0.50 mg/ms of oil mist, and
- not have objectionable or nauseous odor.

The temperature of air should not exceed 290 C and relative humidity not exceeding 85 percent.

The necessary capacity of any air supply for respiratory protection should meet a minimum requirement of 170 liters/minute.

2. Self-Contained Breathing Apparatus (SCBA)

The wearer carries the breathing air cylinder. The service duration depends on the amount of oxygen carried and whether oxygen in the exhaled breath is recirculated. It should be used in atmospheres with unknown air contaminants, IDLH levels or oxygen deficient atmospheres. The period over which the device will provide protection is limited by the amount of air or oxygen in the apparatus. A warning device is be provided to warn the wearer when the service life is reduced to a low level. The main limitations of these respirators are their weight and limited service life, training in proper use and maintenance to ensure safety of the wearer.

Note:

1. **Self-contained breathing apparatus can only be used with full face mask.**
2. **All breathing apparatus shall be cleaned and disinfected at suitable Intervals and thoroughly inspected once every month by a responsible person.**

3. **Records of the cleaning and maintenance and of the condition of the breathing apparatus shall be maintained in a register provided for that purpose which shall be readily available for inspection by an Inspector-cum-Facilitator.**
4. **No person shall be employed to perform any work for which breathing apparatus is necessary unless he has been fully instructed in the proper use of that equipment.**
5. **No breathing apparatus which has been worn by a person, shall be worn by another person unless it has been thoroughly cleaned and disinfected since last being worn and the person has been fully instructed in the proper use of that equipment.**

There are two types of SCBA Sets:

1. Open-circuit type SCBA Set [Refer – IS: 10245 (Part 2)]
2. Closed-circuit Type SCBA Set [Refer – IS: 10245 (Part I)]

10.7 Reflective Jackets

Reflective jackets, also known as high-visibility or safety jackets, are essential safety gear used in various settings to enhance visibility and reduce accidents. These jackets feature reflective materials that reflect light, making wearers more conspicuous in low-light conditions or areas with poor visibility. They are widely used by construction workers, road maintenance crews, and traffic police to remain visible to drivers and prevent accidents on busy roads and construction sites. Use IS: 15809 (2008) certified 'High Visibility' warning clothes.

10.8 Life buoys

Life buoys, also known as life rings or life-saving buoys, are essential safety devices used in water-related environments to aid in rescuing people in distress. These buoyant circular devices are typically bright-coloured and equipped with reflective strips for easy identification in emergencies. They are commonly found on beaches, swimming pools, lakes, and aboard boats and ships. In case of a water-related emergency, such as a drowning incident, life buoys are thrown to the person in distress, providing them with buoyancy and helping them stay afloat until rescuers arrive. These simple yet effective devices play a crucial role in saving lives and promoting water safety. Use IS: 5326 (2007) certified Life Buoys.

10.9 Life Jacket

Life jackets, also known as personal flotation devices (PFDs), are essential safety gear used to keep individuals afloat and safe in aquatic environments. They are widely used in various water activities such as boating and water sports etc. Life jackets are designed to provide buoyancy and help people stay afloat in case of accidental immersion or emergencies, especially for non-swimmers and weak swimmers. They are crucial in preventing drowning incidents and are required by law on boats and ships to ensure the safety of passengers and crew. Life jackets offer a vital layer of protection and promote water safety awareness. Use IS: 6685 (2009) certified Life Jackets.

10.10 Fall Arrestors

Fall arresters are essential safety devices used to protect workers who perform tasks at heights, such as construction workers, window cleaners, and maintenance personnel. The primary purpose of fall arresters is to prevent or arrest a worker's fall in the event of a slip, trip, or loss of balance. These devices typically consist of a body harness worn by the worker, connected to a lanyard or lifeline, which is attached to an anchor point or a secure structure. If a fall occurs, the fall arrester activates, absorbing the energy and stopping the fall, minimizing the risk of serious injury or fatality. Fall arresters are crucial for ensuring workplace safety at elevated locations. Use IS: 3521 (1999) certified Full Body Harness Industrial safety belts and EN 353-1:2002 specifies the requirements, test methods, marking, manufacturer information, and packaging for guided type fall arresters that include rigid anchor lines.

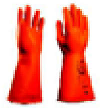
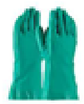
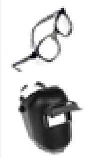
10.11 Roof Crawling Board

Roof crawl boards or roof walk boards, are used as fall protection devices in construction and maintenance work on sloped roofs. These sturdy and lightweight boards provide a secure platform for workers to crawl or move across the roof safely. By distributing the worker's weight over a broader area, crawling boards help prevent damage to fragile roofing materials while reducing the risk of slips and falls. Additionally, they allow workers to maintain their balance and stability while performing tasks such as roofing repairs, inspections, or gutter maintenance. Crawling boards are essential safety tools that enhance worker safety and productivity when working at heights.

ANNEXURE

Annexure-1: **Personal Protective Equipment (PPE) Matrix.**

Annexure-2: **Corporate Circular No. THDCIL/OMS-Safety/Rishikesh/2023-24/F-1009/4035-63 dated 26.10.2023 regarding 'Rules for providing Safety Items/Equipment'**

LOGO	GLOVES				HELMET	MASK		SUIT	GOGGLE & FACE SHIELD		EAR PLUG	APRON	SAFETY SHOES		SCBA SET	SAFETY BELT
	GENERAL COTTOPN	WELDERS' SPLIT LEATHER	ELECTRICAL SAFETY	CHEMICAL NITRILE / PVC	INDUSTRIAL SAFETY HELMET	CHEMICAL MASK	DUST GUARD	ARC FLASH SUIT	CHEMICAL SAFETY	MACHINIST, WELDERS	EAR PLUG	PVC/ COTTON/ LEATHER	STEEL TOE SAFETY SHOES	RUBBER SHORT GUM	Self-Contained Breathing Apparatus	FULL BODY HARNESS SAFETY BELT
OPERATION																
Work at Height	✓	✗	✗	✗	✓	✗	✗	✗	✗	✗	✗	✗	✓	✗	✗	✓
Chemical Process	✗	✗	✗	✓	✗	✓	✗	✗	✓	✗	✗	PVC ✓	✗	✓	✓	✗
Electrical Maintenance	✗	✗	✓	✗	✓	✗	✗	✓	✗	✗	✗	✗	FRP Toe ✓	✗	✗	✗
Confined Space	✓	✗	✗	✓	✓	✗	✗	✗	✓	✗	✗	✓	✓	✓	✓	✓
Hot Works	✗	✓	✗	✗	✓	✗	✗	✗	✗	✓	✗	Leather ✓	✓	✗	✗	✗
High Noise	✗	✗	✗	✗	✓	✗	✗	✗	✗	✗	✓	✗	✓	✗	✗	✗
Housekeeping	✓	✗	✗	✗	✓	✗	✓	✗	✗	✗	✗	✗	✓	✗	✗	✗
Machinist	✗	✗	✗	✗	✓	✗	✗	✗	✓	✗	✗	Cotton ✓	✓	✗	✗	✗
MATERIAL HANDLING	✓	✗	✗	✗	✓	✗	✗	✗	✗	✗	✗	✗	✓	✗	✗	✗

Chapter-10_Annexure: PPE Matrix

टीएचडीसी इण्डिया लिमिटेड
(भारत सरकार व उत्तर प्रदेश सरकार का संयुक्त उपक्रम)
THDC INDIA Ltd.
(A Joint Venture of Govt. of India & Govt. of U.P.)

Annexure

अन्तरकार्यालय ज्ञापन

संख्या :- टीएचडीसीआईएल/ओ.एम.एस.- सुरक्षा/ ऋषिकेश /2023-24/एफ-1009/4035-63 दिनांक:26 /10/2023

प्रेषक-	प्रेषित -
मुख्य महाप्रबंधक (ओएम्एस-सुरक्षा) टीएचडीसी इंडिया लिमि., ऋषिकेश।	वितरण सूची अनुसार।

विषय- संशोधित "Rules for providing Safety Items /Equipment's" के सम्बन्ध में।

संदर्भ :- कॉर्पोरेट कार्मिक परिपत्र संख्या 5/94 दिनांक 15.11.1994.

उपरोक्त विषयक पूर्व प्रेषित कॉर्पोरेट कार्मिक परिपत्र संख्या 5/94 दिनांक 15.11.1994. में संशोधन करते हुए संशोधित "Rules for providing Safety Items /Equipment's" को जारी किया जा रहा है।

अत: उक्त पूर्व कॉर्पोरेट कार्मिक परिपत्र संख्या 5/94 दिनांक 15.11.1994 को संशोधित करते हुए सभी परियोजनाओं, सयंत्रो एवं अन्य कार्य क्षेत्रो पर उनके कार्य की प्रकृति के अनुसार कार्यान्वयन हेतु "Rules for providing Safety Items /Equipment's" प्रेषित की जा रही है।

यह संशोधन सक्षम अधिकारी के अनुमोदनोपरांत जारी किया जा रहा है।

संलग्नक - "Rules for providing Safety Items /Equipment's"

(वीरेन्द्र सिंह) 26/10/23

वितरण :- अनुरोध है कि संलग्न कॉर्पोरेट कार्मिक परिपत्र को सभी विभागों एवं कार्यालयों में कार्यान्वयन करने हेतु अग्रसारित करने का कष्ट करे।

1. महाप्रबंधक (एस.एच.ई.पी) ,कुरुवा।
2. अपर महाप्रबंधक (सुरक्षा),टिहरी/कोटेश्वर ।
3. अपर महाप्रबंधक (सुरक्षा),एस.टी.पी.पी.,खुर्जा।
4. अपर महाप्रबंधक (सेवाएं),ऋषिकेश।
5. अपर महाप्रबंधक (सोलर),जयपुर
6. अपर महाप्रबंधक (डब्लू.टी.जी) ,द्वारिका ।
7. अपर महाप्रबंधक (डब्लू.टी.जी),पाटन।
8. अपर महाप्रबंधक (सुरक्षा),वी.पी.एच.ई.पी,पीपलकोटी।
9. उप महाप्रबंधक (सोलर),कासरगोड,केरला।
10. उप महाप्रबंधक (माइनिंग), अमेलिया कोल माइन ,सिंगरोली।

प्रतिलिपि :- सूचनार्थ प्रेषित।

1. अधिशासी निदेशक(टिहरी कॉम्प्लेक्स),टिहरी।
2. अधिशासी निदेशक(तकनीकी),ऋषिकेश।
3. अधिशासी निदेशक(परियोजना) , एस.टी.पी.पी.,खुर्जा।
4. अधिशासी निदेशक(बिज),ऋषिकेश।
5. ओ.एस.डी (वी.पी.एच.ई.पी),पीपलकोटी।
6. मुख्य महाप्रबंधक (एच.आर एंड ए),ऋषिकेश।
7. मुख्य महाप्रबंधक (परियोजना), अमेलिया कोल माइन,सिंगरोली।
8. मुख्य महाप्रबंधक (एन.सी.आर),कोशाम्बी ,गाजियाबाद।
9. मुख्य महाप्रबंधक (सेवाए),ऋषिकेश।
10. मुख्य महाप्रबंधक (ओ एंड एम्),टिहरी।
11. मुख्य महाप्रबंधक (TUSCO),लखनऊ।
12. महाप्रबंधक (परियोजना),कोटेश्वर ।
13. महाप्रबंधक (सोलर) , कासरगोड,केरला।
14. महाप्रबंधक (जी एंड जी),ऋषिकेश।
15. महाप्रबंधक (नियोजन),टिहरी।
16. महाप्रबंधक (UHV),देहरादून।
17. तकनीकी सचिव – अध्यक्ष एवं प्रबंध निदेशक।
18. तकनीकी सचिव – निदेशक (तकनीकी),ऋषिकेश।
19. उप प्रबंधक – निदेशक (एच.आर),ऋषिकेश।

टीएचडीसी इंडिया लिमिटेड
THDC INDIA LIMITED

RULES FOR PROVIDING SAFETY ITEMS/EQUIPMENTS

The employees who are deployed on specific areas/jobs as mentioned hereunder, may be provided safety items /equipment as indicated against each:

S.no	PPEs/ Safety Equipment's	Periodicity/Life	IS Code/Type	Nature of Work/ Job
*1	Industrial Safety Helmets	1 year/ On Replacement Basis	IS 2925 :1984	Civil open works, Civil Underground works, Material Handling at site, Concreting/Reinforcement works, Dewatering Works, Shotcreting/Gunting, Drilling/Rock Supporting, Electrical works Sub-Station, Overhead Lines, Electrical Maintenance Operations, Underground Electrical works, Mechanical Workshop, Fabrication/Welding, Mechanical field operation/Maintenance, Auto Electrical Shop & Water Supply &Mines work
2	Welding Glasses	1 year/ On Replacement Basis	IS 1179: 1980	Civil open works, Civil Underground works, Material Handling at site, Concreting/Reinforcement works, Dewatering Works, Shotcreting/Gunting, Drilling/Rock Supporting, Overhead Lines, Electrical Maintenance Operations, Underground Electrical works, Mechanical Workshop, Fabrication/Welding, Mechanical field operation/Maintenance, Auto Electrical Shop, Spray/Paint Shop & Mines work
*3	Industrial Safety Shoes (Steel Toe)	1 pair in a year and for mine works 6 months.	IS Code 15298-2 :2011	Civil open works, Civil Underground works, Material Handling at site, Concreting/Reinforcement works, Dewatering Works, Shotcreting/Gunting, Drilling/Rock Supporting, Mechanical Workshop, Water Supply & Mines work
*4	Gum Boots	1 Pair in a year	IS 5557 (Part 2): 2018	Civil open works, Civil Underground works, Material Handling at site, Concreting/Reinforcement works, Dewatering Works, Shotcreting/Gunting, Drilling/Rock Supporting & Water Supply & Mines work
5	Gloves (Chrome Leather)	1 Pair in a year/ On Replacement Basis	IS 6994:1973	Civil open works, Civil Underground works, Material Handling at site, Dewatering Works, Shotcreting/Gunting, Drilling/Rock Supporting, Mechanical Workshop, Fabrication/Welding, Water Supply & Mines work
*6	Torch	1-year Rechargeable type/ on replacement Basis	Any Durable Quality	Civil open works, Civil Underground works, Material Handling at site, Concreting/Reinforcement works, Dewatering Works, Shotcreting/Gunting, Drilling/Rock Supporting, Electrical works Sub-Station, Overhead Lines, Electrical Maintenance Operations, Underground Electrical works, Mechanical Workshop, Fabrication/Welding, Mechanical field operation/Maintenance, Auto Electrical Shop & Water Supply &Mines work

7	Apron (Cotton/ Canvas Type)	2 Nos per Years/ On Replacement Basis	Any Durable Quality	Mechanical Workshop, & Mines work
8	Rain Coat	2 years/ On Replacement Basis	Any Durable Quality	Civil open works, Overhead Lines, & Water Supply & Mines work
9	½ Meter Clothes	As per Requirement	Cotton Type	Civil open works, Civil Underground works, Material Handling at site, Concreting/Reinforcement works, Dewatering Works, Shotcreting/Gunting, Drilling/Rock Supporting, Electrical works Sub-Station, Overhead Lines, Electrical Maintenance Operations, Underground Electrical works, Mechanical Workshop, Fabrication/Welding, Mechanical field operation/Maintenance, Auto Electrical Shop & Water Supply &Mines work
10	Cells	On Replacement Basis/ As Per Requirement	Any Durable Quality	Civil open works, Civil Underground works, Material Handling at site, Concreting/Reinforcement works, Dewatering Works, Shotcreting/Gunting, Drilling/Rock Supporting, Electrical works Sub-Station, Overhead Lines, Electrical Maintenance Operations, Underground Electrical works, Mechanical Workshop, Fabrication/Welding, Mechanical field operation/Maintenance, Auto Electrical Shop & Water Supply &Mines work
11	High Visibility Vest	1 year/ On Replacement Basis for mines work 6 months/ On Replacement Basis	IS 15809:2008	Civil open works, Civil Underground works, Concreting/Reinforcement works, Dewatering Works, Shotcreting/Gunting, Drilling/Rock Supporting, Electrical works Sub-Station, Overhead Lines, Underground Electrical works, Mechanical Workshop, Mechanical field operation/Maintenance, Auto Electrical Shop, Water Supply & Mines work
12	Electrical Safety Shoes (Composite Toe)	1 year	IS 15298(Part 2):2016	Electrical works Sub-Station, Overhead Lines, Electrical Maintenance Operations, Underground Electrical works
13	Electrical Insulating Gloves(11KV/33KV)	6 Months/ On Replacement Basis	IS 4770-1991	Electrical works Sub-Station, Overhead Lines, Electrical Maintenance Operations, Underground Electrical works
14	Nitrile Gloves/PVC/Rubber	2 year/ On Replacement Basis	IS 8807-1978 E-23	Civil open works, Civil Underground works, Concreting/Reinforcement works, Dewatering Works, Shotcreting/Gunting, Drilling/Rock Supporting, Water Supply .
*15	Earplugs	As per requirement	IS 9167-1979	Civil open works, Civil Underground works, Material Handling at site, Concreting/Reinforcement works, Dewatering Works, Shotcreting/Gunting, Drilling/Rock Supporting, Electrical works Sub-Station, Overhead Lines, Electrical Maintenance Operations, Underground Electrical works, Fabrication/Welding, Mechanical field operation/Maintenance, Spray/Paint Shop, Water Supply &Mines work

*16	Earmuffs	1 Year/ On Replacement Basis	IS 9167-1979	Civil open works, Civil Underground works, Material Handling at site, Concreting/Reinforcement works, Dewatering Works, Shotcreting/Gunting, Drilling/Rock Supporting, , works Sub-Station, Overhead Lines, Electrical Maintenance, Spray/Paint Shop Operations, Underground Electrical works, Fabrication/Welding, Mechanical field operation/Maintenance, Water Supply &Mines work
*17	Disposal Dust Mask	As Per Requirement Basis	IS 9473:2002	Civil open works, Civil Underground works, Material Handling at site, Dewatering Works, Shotcreting/Gunting, Drilling/Rock Supporting, Electrical works Sub-Station, Underground Electrical works, Mechanical Workshop, &Mines work
18	AMBU Bag	On Replacement Basis (If required)	IS 8347:2008	Civil open works, Civil Underground works, Material Handling at site, Dewatering Works, Shotcreting/Gunting, Drilling/Rock Supporting, Electrical works Sub-Station, Underground Electrical works, Mechanical Workshop, &Mines work
19	SCABA (Self-contained breathing apparatus)	On Replacement Basis (If required)	IS 10245: 1982	Civil open works, Civil Underground works, Material Handling at site, Dewatering Works, Shotcreting/Gunting, Drilling/Rock Supporting, Electrical works Sub-Station, Underground Electrical works, Mechanical Workshop, &Mines work
20	Kinetic Shock Absorber Lanyard	6 Months/ On Replacement Basis	EN 355:2002	Civil open works, Civil Underground works, Concreting/Reinforcement works, Shotcreting/Gunting, Electrical works Sub-Station, Overhead Lines, Electrical Maintenance Operations, Mechanical field operation/Maintenance, & Mines work
21	Full Body Harness	6 Months/ On Replacement Basis	IS 3521:1991	Civil open works, Civil Underground works, Concreting/Reinforcement works, Shotcreting/Gunting, Electrical works Sub-Station, Overhead Lines, Electrical Maintenance Operations, Mechanical field operation/Maintenance, & Mines work
22	Knee and elbow Pads	1 year/ On Replacement Basis	IS 5557:2004	Civil open works, Civil Underground works, Material Handling at site, Concreting/Reinforcement works, Shotcreting/Gunting, Drilling/Rock Supporting, Mechanical field operation/Maintenance, Auto Electrical Shop, & Mines work
23	Portable Multi Gas Detector Equipment	5 Years	Any Durable quality	Civil Underground works, Blasting Works, Underground Electrical works, &Mines work (Remarks Calibration Yearly Basis)
24	Sound Level Meter	5 Years / On Replacement Basis	Any Durable quality	Civil open works, Civil Underground works, Material Handling at site, Concreting/Reinforcement works, Dewatering Works, Shotcreting/Gunting, Drilling/Rock Supporting, Electrical works Sub-Station, Overhead Lines, Electrical Maintenance Operations, Underground Electrical works, Mechanical Workshop, Fabrication/Welding, Mechanical field operation/Maintenance, Auto Electrical Shop & Water Supply & Mines work
25	Lux Meter	5 Years / On Replacement Basis	Any Durable quality	Civil open works, Civil Underground works, Material Handling at site, Concreting/Reinforcement works, Dewatering Works, Shotcreting/Gunting, Drilling/Rock Supporting, Electrical works Sub-Station, Overhead Lines, Electrical Maintenance Operations, Underground Electrical works, Mechanical Workshop,

				Fabrication/Welding, Mechanical field operation/Maintenance, Auto Electrical Shop & Water Supply & Mines work
26	Whistle	1 year/ On Replacement Basis	Any Durable quality	Civil Underground works, Dewatering Works, Blasting Works, Underground Electrical works, Water Supply & Mines work
27	Back Support Belt	1 year/ On Replacement Basis	IS 11242:1985	Material Handling at site, &Mines work
28	Life Jacket or PFD (Personal Floating Device	5 Years/ On Replacement Basis	IS 6685: 2009	Dewatering Works, Water Works & Water Supply
29	Lifebuoy	5 Years/ On Replacement Basis	IS 5326:2007	Dewatering Works, Water Works & Water Supply
30	Face shield or Visor	1 year/ On Replacement Basis	IS: 8521-1977	Shotcreting/Gunting, Overhead Lines, Electrical Maintenance Operations, Underground Electrical works, Mechanical Workshop, Mechanical field operation/Maintenance, Spray/Paint Shop &Mines work
31	Fall Arrestor	2 Years/ On Replacement Basis	IS 10333:2000	Electrical Maintenance Operations, Mechanical field operation/Maintenance, Overhead Lines, & Mines work
32	Welding Apron (Leather Type)	2 Years/ On Replacement Basis	Chrome Leather Type	Fabrication/Welding
33	Towel/Ghamchaa	1 year	Any Durable Quality	Mines Work
34	Winter Reflective Jackets	2 years	IS 15809:2008	Civil open works, Civil Underground works, Material Handling at site, Concreting/Reinforcement works, Dewatering Works, Shotcreting/Gunting, Drilling/Rock Supporting, Electrical works Sub-Station, Overhead Lines, Electrical Maintenance Operations, Underground Electrical works, Mechanical Workshop, Fabrication/Welding, Mechanical field operation/Maintenance, Auto Electrical Shop & Water Supply & Mines work
35	Rescue Foldable Stretcher	As per Requirement	IS 949:2012	Civil open works, Civil Underground works, Material Handling at site, Concreting/Reinforcement works, Dewatering Works, Shotcreting/Gunting, Drilling/Rock Supporting, Electrical works Sub-Station, Overhead Lines, Electrical Maintenance Operations, Underground Electrical works, Mechanical Workshop, Fabrication/Welding, Mechanical field operation/Maintenance, Auto Electrical Shop & Water Supply & Mines work
36	Head Lamp	As per Requirement	Helmet Mounted Type	Civil open works, Civil Underground works, Material Handling at site, Concreting/Reinforcement works, Dewatering Works, Shotcreting/Gunting, Drilling/Rock Supporting, Electrical works Sub-Station, Overhead Lines, Electrical Maintenance Operations, Underground Electrical works, Mechanical Workshop, Mechanical field operation/Maintenance, Water Supply & Mines work

37	First Aid Box	As per Requirement	IS 13115-1991	Civil open works, Civil Underground works, Material Handling at site, Concreting/Reinforcement works, Dewatering Works, Shotcreting/Gunting, Drilling/Rock Supporting, Electrical works Sub-Station, Overhead Lines, Electrical Maintenance Operations, Underground Electrical works, Mechanical Workshop, Mechanical field operation/Maintenance, Water Supply & Mines work
38	Half Face Mask with Cartridge	1 year/ On Replacement Basis	IS 14166-1997 for Mask and IS 8522-1977 for Cartridge	Civil open works, Civil Underground works, Material Handling at site, Concreting/Reinforcement works, Dewatering Works, Shotcreting/Gunting, Drilling/Rock Supporting, Electrical works Sub-Station, Overhead Lines, Electrical Maintenance Operations, Underground Electrical works, Mechanical Workshop, Mechanical field operation/Maintenance, Water Supply & Mines work

Note: Items highlighted with * in the above table are subject to immediate distribution to VIP visitors, consultants, and auditors during site visit/ inspection.

General:

1. The Safety items/equipment's may not be issued to the employees based on designation but nature of actual job he normally performs.
2. Some helmets should be given in common pool for use of employees whose normal nature of job does not require helmet but he has to attend to such job occasionally.
3. Similarly, some umbrellas may also be kept in the common pool.

11 On-Site Emergency Plan & C&DMP

11.1 Role and Responsibility

- Immediate Responsibility

  The role and responsibility of Head of the Safety Department shall be;

  - to prepare the 'On-site Emergency Plan
  - training of personnel about the plan and their role and responsibilities during emergency;
  - to conduct mock-drills at least once in six months and maintain records; and
  - to up-date the plan as and when required on the basis of mock-drill observations or at least after every two years.

- Ultimate Responsibility

  Ultimate responsibility for the preparation and periodical up-dating of 'On-site Emergency Plan' shall be of the Project Head.

11.2 Statutory provision

- Section-41-B of the Factories Act, 1948 and Rule 63-D of the State Factories Rules, Precautions in case of fire.
- Rule-36 of the Central BOCW Rules, 1998.
- Rule-4-4(k), Rule-9 and Schedule-III under Regulation 9(2) of the CEA Regulations, 2011.

11.3 Hazard identification and risk assessment

The process of hazard identification, risk assessment and determine controls should be followed for all THDCIL activities, products and services. The objective of Hazard Identification is to recognize and understand the severity and probability of occurring of hazard so that necessary action could be taken to address them. To achieve this objective every THDCIL project shall prepare an 'On-site Emergency Plan' for the project level emergency situations and shall conduct mock drills at least once in six months.

11.4 Preparation of 'Emergency Management Plan'

The On-site emergency management plan shall be developed to deal with all probable emergencies which can occur at the premises such as;

- Major fire in cable gallery;
- Major fire in transformer yard;
- Collapse of Lifting Appliance and Transport Equipment;
- Collapse of a Building Shed or Structure;
- Gas Leakage / Spillage of Chemical;
- Flooding of powerhouse;

- Landslides; and
- Earthquake

11.5 The plan shall include following;

(a) Name and address of the Chief Incident Controller;

(b) Alarm system and method of reporting and declaring emergency;

(c) Emergency response procedure including response to off-site emergency management plan and crisis and disaster management plan;

(d) Details of the key employees of the emergency team and their responsibilities;

(e) Address and contact numbers of local administration, police, hospitals, involved in assessing during emergency;

(f) Risk assessment information giving possible nature of incidents and events giving raise to emergency conditions, risk analysis and impact assessment;

(g) Details about the site;

- (i) Locations where emergency may arise;
- (ii) Emergency control room and alternate emergency control room;
- (iii) Demarcation of safe assembly zone relevant to each type of emergency conditions;

(h) Description of hazardous chemicals and fuels at project sites;

- (i) Chemicals (quantities and toxicological data);
- (ii) Fuels (Quantities and storage type);
- (iii) Material Safety Data Sheets;

(i) Internal and external communication plan during emergency;

(j) Details of firefighting and other facilities available to deal with emergency conditions;

(k) Details of first aid and hospital services available and their adequacy;

(l) Post emergency activities;

- (i) Collection of records;
- (ii) Conducting enquiries and conducting preventive measures;
- (iii) Making insurance claims;
- (iv) Preparation of enquiry report and suggestion scheme;
- (v) Implementation of enquiry report recommendations;
- (vi) Rehabilitation of affected persons within project;
- (vii) To re-start the project.

11.6 Periodicity for updating of 'On-site Emergency Plan'

The on-site emergency plan shall be up-dated as and when required or at least after every two years from the date of its issue / last revision.

11.7 C&DMP

Role and Responsibility

- Immediate Responsibility shall be of the C&DMP Team

The C&DMP Committee shall be constituted under the chairmanship of Project / Plant Heads. The committee will consist of following members;

- Project / Plant Heads : Chairman
- All HODs : Member
- CISF, Commandant/Dy. Commandant : Member
- HOD – Safety : Member Secretary
- Chief Safety Officer and In-charge CISF Fire Wing : Co-opt Members

The C&DMP Committee shall also constitute following 'Emergency Response Teams' (ERT) to manage any emergency situation;

ERT Firefighting and emergency response for other crisis situations

- ERT Rescue
- ERT First-aid
- ERT Communication
- ERT Administration

➢ **Ultimate Responsibility**

The ultimate responsibility for the preparation of C&DMP and constitution of 'Emergency Response Teams' (ERT) shall be of the Occupier / Owner / Employer / Manager in case of Mines.

11.8 Legal requirement

➢ Rule-36 of the Building and Other Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996 and Central Rules, 1998

➢ Rule-4-4(k), Rule-9 and Schedule-III of Central Electricity Authority (Safety Requirements for Construction, Operation and Maintenance of Electrical Plants and Electric Lines) Regulations, 2011 (2022)

➢ Section-36 of Dam Safety Act, 2021

➢ Rule-13 and 14 of the Manufacturing. Storage and Import of Hazardous Chemicals Rules, 1989

➢ Rule-84(4) of the Occupational Safety, Health and Working Conditions Code 2020 and (Central) Rules 2020

➢ Section-41-B and Rule 63-D of the Factories Act, 1948 and State Factories Rules respectively.

➢ Disaster Management Act 2005

11.9 Introduction Crisis and Disaster Management Plan (C&DMP)

A crisis or disaster can strike at any time, and it is important to be prepared. A crisis and disaster management plan is a roadmap that outlines the steps that organization will take to prepare for, respond to, and recover from a crisis or disaster. The goal of a crisis and disaster management plan is to minimize the negative impact of a crisis or disaster on an organization's operations, its reputation, and its employees.

What is a crisis?

A crisis is an event that can cause significant disruption to organization's operations, its reputation, or its employees. A crisis can be caused by a natural disaster, a man-made disaster, or a human error.

What is a disaster?

A disaster is a large-scale event that causes widespread damage or loss of life. A disaster can be caused by a natural disaster, a man-made disaster, or a human error.

Preparation of crisis and disaster management plan is important because it helps the organization to:

- Preparation of crisis and disaster management plan helps the organization to identify the potential risks that it faces and to develop crisis and disaster management plan to mitigate those risks.
- Crisis and disaster management plan helps the organization to respond quickly and effectively to a crisis or disaster. This will help to minimize loss of lives and property damage that may be caused by the crisis or disaster.
- C&DMP helps the organization to recover from a crisis or disaster more quickly. This will help to restore the organization's operations, its reputation, and its employees.

The following key components should be covered in C&DMP;

- The scope of the plan should define the types of crises and disasters that the plan will cover.
- The C&DMP should include the following;

  a) The List of hazardous chemicals / gases stored and used in the plant along with their storage quantity and MSDS (Material Safety Data Sheets).

  b) Quantitative Risk Assessment (QRA) of bulk storage of hazardous chemicals used in the plant.

  c) 'Communication Plan' that outlines how the organization will communicate with its employees, its customers and the media during a crisis or disaster.

  d) Details of 'Emergency Control Room', 'Assembly Point(s)' and Medical Facilities available in the plant.

  e) Details of how the emergency will be communicated during emergency and what will be audio signal for termination of emergency.

  f) Details of mutual-aid agreements with neighbouring industries / organizations.

  g) Training plan that outlines how the organization will train its 'Emergency Response Team Members' and employees.

  h) Existing resources available in the plant to manage any crisis or disaster.

  i) Contact numbers of senior officers of the plant/project and emergency services of that area including District Administration, SDRF (State Disaster Response Force), NDRF (National Disaster Response Force), Nearby Hospitals with details of medical facilities available in the hospital and contact numbers nodal officers of mutual-aid organizations.

  j) 'Emergency Response Teams' and 'Emergency Response Team Members' who will be responsible for executing the plan during crises or disaster.

  k) Evaluation plan by conducting periodical mock drills at least once in every quarter to assess the adequacy of the plan and existing resources. The HOD–Project Safety will organization / coordinate mock-drills in collaboration with CISF and maintain records of mock-drill observations and recommendation.

  l) Mock-drill should be conducted for all identified crisis and disaster situations, both in day time and night time to assess the adequacy of the plan, resources and competency of ERT members.

  m) The strategies that the organization will use to mitigate the risks that it faces.

  n) Site map of the area.

Note: (1) HOD –Project Safety will forward observations and recommendation report of every mock-drill to HOD – Corporate Safety within seven days from the date of mock drill. HOD – Corporate Safety shall submit the combined mock-drill reports of all the plants / projects to CEA.

(2) The progress of 'Action Taken Report' of mock-drill observations & recommendation should be reviewed in 'Safety Committee' meetings.

11.10 Identification and assessment of major hazard associated with the plant / projects' activities

The major crisis or disaster can usually take birth from one or combination of the following;

- Fire (Fire in cable gallery/Transformer/Coal Yard)
- Earthquake
- Bursting of pipeline / pressure vessel
- Landslide
- Cloud Bursting
- Hurricanes or tornadoes
- Grid Failure/Blackout
- Flooding of powerhouse
- Sabotage
- Terrorist attack
- Labour unrest
- Thunder Storm and Lightning, Squall, Dust Storm and Strong Winds
- Terrorist attack
  a. Bombings
  b. Chemical attacks
  c. Cyberattacks
- Collapse of tunnel / tank / building structure / Chimney
- Explosion; Hydrogen plant, Turbo Generators where hydrogen is used for cooling of TG, Boiler, Coal dust in mills boilers, Pressure vessel
- Uncontrolled release of toxic / corrosive / flammable liquid or gases
  a. Chlorine gas / Hydrogen gas
  b. Pulverised coal dust from mills and associated piping
  c. Fly Ash from chimneys and ash ponds, ESP hoppers
- National emergency

11.11 Risk Assessment of above potential hazards should be done to know the impact of hazardous incident, extent of effected area and duration of impact

12 Safety in Handling and Storage of Chemicals

12.1 Role And Responsibility

- **Immediate Responsibility**

  The immediate responsibility to ensure compliance of the provisions of this chapter shall be of the Site In-charge, Head of Executing Department, Store In-charge and the Contractor.

- **Ultimate Responsibility**

  The ultimate responsibility to ensure to ensure compliance of the provisions of this chapter shall be of the Occupier / Owner / Employer / Manager in case of Mines.

12.2 Legal Requirement

- Schedule VII, XII, XVIII, XXVI, Section 41-B, 112 of the Factories Act, 1948 and Rule 63-C of the State Factories Rules
- Rule-40, 43 and 45 of the of the Building and Other Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996 and Central Rules, 1998
- Rule-4-4(f) of the Central Electricity Authority (Safety Requirements for Construction, Operation and Maintenance of Electrical Plants and Electric Lines) Regulations, 2011
- Manufacturing, Storage and Import of hazardous chemical Rules, 1989
- Rule-88 of the Occupational Safety, Health and Working Conditions Code 2020 and (Central) Rules 2020
- Rule-2(b) of the Chemical Accidents (Emergency Planning, Preparedness and Response) Rules, 1996
- Hazardous Wastes (Management, Handling and Transboundary Movement) Rules, 2008

12.3 Introduction

Chemical safety involves the cautious management of substances to prevent harm to humans, the environment, and property. It encompasses proper handling, storage, transportation, and disposal of chemicals, along with risk assessment, labelling, and communication. Adhering to safety protocols, using appropriate protective equipment, and understanding a chemical's properties are vital for minimizing accidents, exposure, and pollution.

12.4 Type of Chemical Hazards

Chemical hazards encompass a range of potential dangers posed by various substances. Chemicals pose two types of potential hazards;

a) Physical Hazards b) Health Hazards

a) Physical Hazards :

May cause physical injury or damage to property and/ or Environment

- Flammability
- Explosiveness
- Reactivity, which can lead to fires
- Compressed Gases
- Oxidizers; and
- Explosions, or violent reactions
- Radioactive

b) Health Hazards

o	Corrosive	:	Damage or destroy tissues and cells
o	Irritants	:	Burn, Injuries to skin
o	Sensitizers	:	Allergic reaction
o	Toxic (Poisonous)	:	Mercury, Snake Venom
o	Hepatotoxic	:	Liver damage
o	Nephrotoxic	:	Damage Kidney Cells / Tissues
o	Neurotoxin	:	Affects our nervous system

12.5 How chemicals can harm human beings?

Chemicals can harm humans by entering the body through;

- Inhalation
- Ingestion
- Skin contact
- Injection

Inhalation

When airborne particles or gases are breathed in, potentially affecting the respiratory system or bloodstream.

Ingestion

Happens when substances are consumed orally, posing risks to the digestive system and other organs.

Skin contact

Involves direct interaction with chemicals, which can lead to absorption through the skin and affect underlying tissues or circulate in the body.

Injection

Injection – Though it is not a common hazard. Injection of chemicals into the body can harm when a sharp object contaminated with hazardous chemical or substance penetrate the skin. Then chemical can make its way into the bloodstream, where it can damage organs or other tissue.

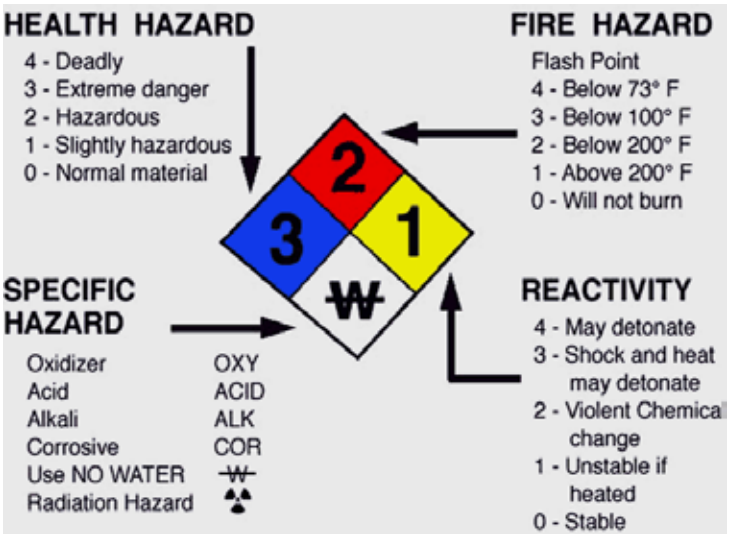
These pathways allow chemicals to disrupt bodily functions, cause health issues, and even result in long-term illnesses or acute reactions.

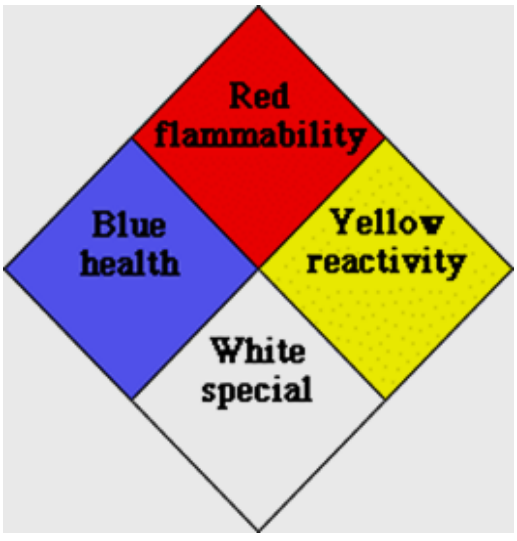
12.6 Know the labels fixed on Chemical Cons / Containers

As per Rule-134 and Rule-137 of the Central Motor Vehicle Rules, 1989 the details of 'Emergency Information Panel' is as follows;

12.6.1 Every goods carriage used for transporting dangerous goods shall be legible and conspicuously marked with an emergency information panel in each of the three places indicated in the table below so that the emergency information panel faces to each side of carriage and to its rear and such panel cell contain following information only;

NFPA (National Fire Protection Association) Safety Diamond





12.7 Hazard Symbols

12.7 General safety rules for safety in handling, storage and use of chemicals

1. Personnel working with chemicals must receive appropriate training on their properties, handling procedures, and emergency protocols. Adequate knowledge reduces the risk of mishandling.
2. Identify the chemicals before use.
3. Read Material Safety Data Sheets (MSDS) supplied by the manufacturer to know the potential hazards and safety measures recommended by him. Ensure availability of MSDS of chemicals at the point of their use and storage for ready reference.
4. Prepare 'Emergency Preparedness & Response Plan (EP&RP)' for managing chemical emergency and communicate the same to employees.
5. Conduct periodical mock-drills of EP&RP at least once in every six months and maintain records.
6. Keep minimum inventory of chemicals in workplace.
4. Labeling and Identification: All containers must be properly labeled with chemical name, hazards, and handling instructions. Never use un-labeled containers or remove labels from existing ones.
5. Use FIFO (First In - First Out) system for issue of chemicals.
6. Always wear the recommended PPE, such as gloves, goggles, lab coats, and respirators, based on the chemical's properties and potential hazards.
7. Follow Standard operating procedure (SOP).
8. Food and beverages should never be consumed in areas where chemicals are handled or stored to prevent accidental ingestion. Never store chemicals with food items.
9. Always wash hands thoroughly after handling chemicals. If a chemical spills, wash it off at once with plenty of running water for at least 15 minutes. Use chemical shower as shown in figure to get cleaned up quickly.
10. Compatibility of chemicals should be checked as per MSDS before storage.
11. Store chemicals in well ventilated place in such a way that they are protected against physical damage and direct sunlight.
12. The floor of chemical store shall be made of impermeable surface. A sump shall be provided in the floor the out let of which is connected to effluent treatment plant.
13. The hazardous wastes as specified in Column-3 of Schedule-I of Rule-3 of the Hazardous Wastes (Management, Handling and Transboundary Movement) Rules, 2008 such as used / spent oil and lead acid batteries etc. should be disposed of to the vendor/firm, authorized by CPCB (Central Pollution Control Board) or by SPCB (State Pollution Control Board) or Ministry of Environment & Forest, Govt. of India for "Handling, Recycling, Reprocessing, recovery and Reuse of Hazardous Waste" as per rules and maintain records.

The safe handling and storage of chemicals require a proactive approach, strict adherence to established guidelines, and continuous vigilance. By following safety rules, risk associated with chemical handling can be significantly reduced.

12.8 Protection against Handling, Storage and Use of Chemicals

Chemicals in the work environment are common place and necessary for making our jobs easier and more productive. But these benefits are also accompanied by many hazards. Failure to understand the hazards of products can lead to their casual use and often leads to employee injuries, costly clean-up, or property losses. Used properly, most products can be both safe and effective. The following safety guidelines shall be implemented to ensure safety against chemical hazards;

a) Identify the chemicals before use.

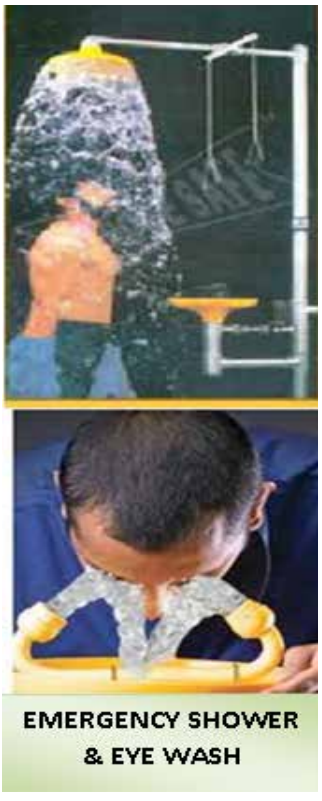
b) Keep minimum inventory of chemicals in workplace.

c) Request Material Safety Data Sheets (MSDS) from the companies that supply the chemicals.

d) Ensure availability of MSDS (Material Safety Data Sheet) of chemicals at the point of their use and storage as this may be required for quick reference in the event of an emergency.

e) Concerned area In-charge shall ensure that the MSDS of hazardous substance used in the workplace is available and accessible to workers. The warning label on a product might feature cautionary words such as 'corrosive', 'poison' or 'hazardous' etc. The MSDS lists important information on handling the product safely, including:

- Potential health effects
- Precautions for use
- Safe storage suggestions
- Emergency first aid instructions
- Contact numbers for further information



f) Label all containers with the following information:

- Name of the chemical.
- Information about hazards associated with the chemical (For example, skin irritant) and emergency information ("If chemical gets in eyes…").
- Date of receipt of chemical
- The shelf life of the chemicals
- Date of receipt of chemical

g) Always wash yourself thoroughly after handling chemicals. If a chemical spills, wash it off at once with plenty of running water for at least 15 minutes. Use chemical shower as shown in figure to get cleaned up quickly.

- Use FIFO (First In - First OUT) system.
- Use PPE "Personal Protective Equipment" while handling chemicals;
- Follow Standard operating procedure (SOP).
- Don't eat, drink, or smoke when handling chemicals. Never store chemicals with food items.
- Chemicals must always be stored in a safe place with similar-type chemicals. Check compatibility of chemicals before storage. Most chemicals will belong to a specific category, and you need to make sure that only chemicals from the same category are stored together. If you're not sure what category a chemical belongs to, always check its label or refer to its MSDS.

h) Categories might include:

Flammable Chemicals

Chemicals such as methanol, ethanol, and kerosene are very flammable and need to be kept away from heat and substances that might cause them to ignite or explode. In most workplaces, flammable chemicals are stored in a separate cupboard or cabinet that has been specially designed for them.

Oxidizing Substances

Oxidizing chemicals quickly and easily react with other chemicals. Because of this, they should only be stored with other oxidizing chemicals.

Corrosive chemicals

Chemicals such as acids can corrode substances. They can also react violently and explosively if they come into contact with other types of chemicals.

i) Store chemicals in well-ventilated place in such a way that they are protected against physical damage and direct sunlight.

j) The floor of chemical store shall be made of impermeable surface. A sump shall be provided in the floor the out let of which is connected to effluent treatment plant.

12.9 Chemical Works – Do's and Don'ts

Do's

- Identify the chemicals before use.
- Read the MSDS (Material Safety Data Sheet) of chemicals before use and / or storage, follow the manufacturers / suppliers instructions. Display MSDS at the point of their use for quick reference in the event of an emergency.
- Keep minimum inventory of chemicals in workplace.
- Use FIFO (First In – First Out) system.
- Use appropriate PPEs while handling chemicals.
- Check compatibility of chemicals before storage.
- Oxidizing chemicals should only be stored with other oxidizing chemicals.
- Store corrosive chemicals in a well.
- Provide Safety shower and Eye wash near chemical storage area.
- Provide adequate ventilation in the chemical handling area.
- Clean up any spills in the area immediately.

Don'ts

- Don't leave chemical containers with lid open.
- Don't store chemical in direct sunlight.
- Water reactive chemicals should not be stored where there is a risk of exposure to water.
- Don't allow reuse of empty chemical containers for storage other chemicals.
- Don't use plastic container to transport and store flammable chemicals.
- Don't store combustible waste near the chemical storage area.

Normative References

- *Building and Other Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996 and Central Rules, 1998*
- *Central Electricity Authority (Safety Requirements for Construction, Operation and Maintenance of Electrical Plants and Electric Lines) Regulations, 2011*
- *Manufacturing, Storage and Import of hazardous chemical Rules, 1989*
- *Occupational Safety, Health and Working Conditions Code 2020 and (Central) Rules 2020*
- *The Chemical Accidents (Emergency Planning, Preparedness and Response) Rules, 1996*
- *Hazardous Wastes (Management, Handling and Transboundary Movement) Rules, 2008*
- *The Factories Act, 1948*
- *State Factories Rules*

13 Electrical Safety

13.1 Role and Responsibility

- **Immediate Responsibility**

  The immediate responsibility to ensure safety in use of electricity shall be of the Site In-charge, Site Engineer, HOD – Electrical Maintenance and Contractor.

- **Ultimate Responsibility**

  The ultimate responsibility to ensure to ensure safe in use of electricity shall be of the Occupier / Owner / Employer / Manager in case of Mines and Project Manager in case of contractor.

13.2 Legal provisions

- Central Electricity Authority (Measures Relating to Safety and Electric Supply) Regulations 2010
- Central Electricity Authority (Safety Requirements for Construction, Operation and Maintenance of Electrical Plants and Electric Lines) Regulations, 2011
- Indian Electricity Act, 2003 and Electricity Rules, 2005
- IS:10028 (part-III) 1981 (RA2003) - Code of Practice for Selection, Installation and Maintenance of Transformers
- IS: 15652 (2006) Insulating Mats for Electrical Purposes
- IS: IS 17893 (2023) Work Permit System Code of Practice
- IS: 3043 (1987) Code of practice for earthing
- IS: 3034 (1993) Fire Safety in Industrial. Building for Electric Generating & Distributing Station.

13.3 Introduction

Electrical safety is a critical concern in industries, as electricity poses a significant risk of injury or death if not handled properly. Electrical hazards can arise from various sources, including energized equipment, damaged wiring, and improper grounding. To ensure the safety of workers from electrical hazards, ensure implementation of comprehensive electrical safety programs that encompass hazard identification, risk assessment, and control measures.

13.4 Electrical Hazards

Several electrical hazards can be encountered in industrial activities. Some of the key electrical hazards are as follows:

i. Electrical Shock

Electrical shock occurs when an individual comes into contact with an energized source, causing current to flow through the body and our body becomes part of the electrical circuit. Electrical shock can lead to severe injuries, including burns, muscle spasms, cardiac arrest, and even death.

The severity of an electric shock depends on several factors, including the voltage, current,

duration of the shock, path of the current through the body, individual's health.

a. Duration of the shock is the length of time the current flows through the body. Longer shocks are more likely to cause severe injuries, as they give the current more time to damage tissues; and

b. Path of the current through the body is also important. Current that passes through the heart is more likely to cause serious harm than current that passes through other parts of the body.

ii. Arc Flash

Arc flash can be caused by short circuits, ground faults, or human error. The arc flash is a sudden release of electrical energy caused by a fault in an electrical system. It produces an intense burst of heat, light and pressure that can cause burns, vision damage / blindness, and even death.

iii. Electrical Fires

Electrical fires can be caused by overloaded circuits, short circuits, or faulty wiring or improper use of electrical equipment. Electrical fires can cause extensive damage to property and lives, as they can spread quickly and be challenging to control.

iv. Overloading

Overloading occurs when electrical circuits are burdened with more current than they are designed to handle. This can lead to overheating, equipment damage, and increased fire hazards.

v. Inadequate Grounding

Improper grounding can cause a buildup of static electricity and increase the risk of shock, especially in equipment and tools. Grounding is crucial to direct excess electricity away from people and objects.

vi. Equipment Malfunction

Faulty electrical equipment, such as frayed cords, damaged plugs, or defective machinery, can trigger electrical hazards, including shocks and fires.

vii. Inadequate Wiring

Poorly installed or deteriorated wiring can cause short circuits, electrical fires, and a higher likelihood of shock incidents.

viii. Exposed Conductors

Exposed wires and conductors increase the risk of accidental contact, leading to shocks and potential burns.

To mitigate these hazards, proper training, usage of appropriate personal protective equipment (PPE), adherence to safety regulations, regular inspections, and proper maintenance of electrical systems are essential.

13.5 General Safety in the use of Electricity

1) Only Authorized (Licensed holder of Electrical Inspector / Director – Electrical Safety of the State Govt.) and experience electricians shall be appointed for wiring, repair, and maintenance and installation of electrical equipment / machines.

2) Before commencement of any building or other construction work, adequate measures shall be taken to prevent workers from electrical hazard by coming in physical contact with unsafe electrical equipment or apparatus, machines or live electrical circuit which may cause electrical accident during the course of his/her employment.

3) Suitable safety warning signs shall be displayed and maintained at conspicuous places in Hindi and in local language understood by the majority of the building workers.

4) As far as practicable, no wiring or cable, which may come in contact with water or which may be mechanically damaged or which may result in electric shock shall be left on ground.

5) All electrical appliances and current carrying equipment used shall be made of sound material and adequately earthed.

6) All temporary electrical installations shall be provided with ELCB (Earth Leakage Circuit Breakers) or RCCB (Residual Current Circuit Breaker).

7) All portable power-driven hand tools are provided with double insulation to secure a high degree of protection from electrical hazards.

8) Electrical installations shall comply with the requirements of any law for the time being in force, especially the Indian Electricity Act/Rules in particular with specific reference to the following:

   i) All parts of installations shall be of standard construction not lower, from the safety point of view, than the national standards, as applicable. All parts of electrical installations shall be so constructed, installed and maintained so as to prevent electrical fires, explosion and shock;

   ii) Earthing of metal work of electrical equipment, other than the parts which carry current, shall be provided and will conform to Electricity Act and IS: 3043 (1987) Code of practice for earthing.

9) Before operation of OCBs, oil level must be checked and the event of short, extra quantity must be filled.

10) Use of rubber gloves and rubber gum boots of tested quality where electric shock is likely to occur shall be provided, but these shall not be considered as providing adequate protection against the risk of electric shock in lieu of inbuilt safety arrangement in the system.

11) First-aid boxes, instruction chart for restoration of persons affected by electric shock in Hindi or Regional language shall be made available in Sub-stations.

12) Adequate quantity of CO2 / Chemical Powder Fire Extinguishers / Sand Buckets etc. should be made available in Sub-stations and near electrical panels as per the legal requirement.

13) Effective measures shall be taken to ensure that persons removing or inserting fuses will not be endangered, in particular by any adjacent live parts.

14) In case of blow of fuses only after finding out and correcting of the fault, new fuses shall be provided in the circuit.

15) All switches shall be of enclosed type and so installed and earthed as to prevent danger in their operation.

16) Earthing shall be connected to all motors, generators etc. at two places from two distinct earth pits as prescribed in the Indian Electricity Rules, amended from time to time.

17) Conductors shall be joined, branched or led into an apparatus through junction boxes, bushings, glands or equivalent connecting devices.

18) When parts of conductors are joined together, or conductors are joined to one another or to an apparatus, the attachment shall be made by screwing, clamping, and soldering, riveting, brazing, through connectors, thimbles/ crimping, or equivalent means. Loose connections shall not be provided in any case.

19) Whenever armoured cables are joined, the junction boxes shall be bridged by a suitably conducive bond between the armouring of the cables.

20) Portable electrical tools, unless flameproof, shall not be used in flammable or explosive atmosphere.

21) Only three-core cable shall be used for single-phase operated tools with the third core connected to earth.

22) Hand lamps shall be equipped with strong cover of glass or other transparent material. Portable lamp holders shall have: (i) All current carrying parts enclosed; (ii) Insulated handle and (iii) They shall operate at 24 V;

23) At the beginning of every shift every person using electrical equipment shall make a careful external examination of the equipment and conductors for which he is responsible, especially flexible cables.

24) Periodic inspections, testing, maintenance of all electrical equipment is to be done and record of test of transformer oil and earthing pit's testing shall be maintained.

25) Before any work is begun on conductors or equipment that does not have to remain live

(i) The current shall be switched off and LOTO (Lockout & Tagout)

(ii) The conductors or the equipment shall be tested to ascertain that they are dead

(iii) The conductor and equipment shall be earthed and short-circuited and

(iv) Neighbouring live parts shall be adequately protected against accidental contact.

26) Electricians shall be provided with adequate tools, and personal protective equipment, such as rubber gloves, IS: 15652 (2006) insulating rubber mats etc.

27) All conductors and equipment shall be considered to live unless there is certain proof to the contrary.

28) When any excavation is to be made or any bore-holed sunk, the contractor shall ascertain whether there are any underground conductors, in or in dangerous proximity to, the zone of operations.

29) In workplaces where the exact location of underground electric power line is not known, the building workers using jack hammers, crow bars or other hand tools which may come in contact with a live electrical line shall be provided with approved insulated protective gloves and footwear.

30) No work shall be done in dangerous proximity to a conductor or an installation until it has been made dead.

31) All electrical maintenance / repair works on or near electrical lines / machines shall be done under 'Electrical Isolation / Energisation – Safety Work Permit' as per the recommendation of IS: 17893 – 2023 (Work Permit System Code of Practice).

32) Before the current is restored, the contractor shall certify in writing that no work, tools/equipment and workmen remains on the work site and current can be restored.

13.6 Safety Precaution for work on Overhead Mains, Service Lines

Working on Dead line and Equipment: No person shall work on line supports or conductors unless they are discharged and earthed as follows:

1. The circuit or conductor to be worked on shall be made dead by switching off or opening the isolator links or fuses and by locking isolator/links in the off position. A danger notice board with the words "DO NOT CLOSE', 'MEN ON LINE' should be fixed securely, below the switch or links/ isolator.

2. After switching off the supply, before touching the lines, every one of the conductors shall be tested for pressure (voltage) by a discharge rod. The discharge wires should be kept at least two feet away from the body. The procedure is necessary in order to make sure that the line to be worked on is actually the line that has been isolated. Rubber gloves or preferably gauntlets should be used on both hands.
3. All the conductors shall then be short circuited together and adequately earthed; this shall be done at the points on each side of the place thereby creating a safety zone where the work is carried out. Rubber gloves or gauntlets shall be used while doing this work. Poles on which work is actually to be carried out should also be earthed.
4. A working section at either end of which the conductors are earthed shall not exceed 1.5 km in length. In the case of lines meeting or crossing at any pole which forms the site of work, all the lines crossing or ending at that pole shall be earthed as stated above unless work on the one line with any or all the remaining lines alive is otherwise permissible and so specified in the permit-to-work.
5. Ensure that there is no possibility of back feed.
6. All phases shall be earthed even if work is to be carried out on one phase only.
7. When work is to be carried out on lines of all insulated conductors where grounding points are not provided at point of work, temporary, grounds shall be connected at point of work to an efficient portable earth straight driven into the ground. The line shall also be grounded at the nearest line grounding point on either side of the point of work.
8. Where two or more crew are working independently on the same line or equipment, each crew shall properly protect them by placing their own temporary grounds.

13.7 Repair work on H.T. Lines and Equipment

a. Handling and working on live electric circuits are hazardous occupations and shall be done only by workmen who are qualified by training and experience to do the work safely and only after authorization.

b. Repair work on H.T. lines on poles where L.T is also running under H.T. should be carried out only after switching off the L.T. effectively. Work on the L.T. lines should not be carried out unless there is an efficient earth screen between H.T. and L.T. lines or in the absence of such a screen, unless the H.T. line is switched off or in the opinion of the engineer In-charge, the work is otherwise safe.

c. Any line wherein the pressure does not exceed 250 V to earth may be worked on live line by an authorized person provided and ensure use of following PPE by the person(s);

   i. Full body harness safety belt.

   ii. Rubber gloves or gauntlets and is accompanied by an assistant with an effective torch light if working at night.

   iii. Before a lineman undertakes any work on a pole or any other line support, he should first make a complete inspection from the ground of the position of all live wires, in order to determine the amount of precautions to be adopted and should inspect his insulating equipment and operating tools and tackles for their good condition before he attempts to do the actual.

13.8 Safe Work Practices for SF6 Gas Insulated Equipment and Emissions Minimization

Sulfur hexafluoride (SF6) gas is a synthetic gas used as an insulating medium in electric equipment throughout the First Energy System. SF6 gas and its decomposition products present no injury or illness

problems it dealt with properly. As with other chemicals, health hazards may exist under particular conditions, if exposure or handling is careless or improper. All personnel designated to perform inspection or maintenance work on SF6-insulated apparatus like circuit breakers, current transformers, and interrupting switches etc. should read and follow all of the instructions herein. SF6 gas is a very stable chemical that has been identified as a highly potent greenhouse gas. Because of its long lifespan and potential impact on the environment, the venting of the gas to atmosphere should be avoided.

13.8.1 Properties of SF6 Gas

In its pure, natural state, SF6 gas is colourless, odourless, and tasteless and possesses a low order of toxicity. The only danger in breathing pure SF6 gas is that it displaces oxygen and can cause suffocation. SF6 gas is chemically inert and non-flammable. The gas has a high dielectric strength and thermal properties conducive for insulating high voltage and quenching electrical arcs. Refer MSDS (Material Safety Data Sheet) of SF6, to know the specific chemical details.

SF6 gas, if subjected to an electric arc heat causes the gas to decompose into potentially toxic by-products. (This gas also decomposes when exposed to other high temperature conditions such as heater filaments, smoking, welding, etc.) Fluorides of sulphur are the most toxic decomposition products and are in gaseous form. A molecular sieve (desiccant bag) containing activated alumina is provided in each pole tank. This molecular sieve eliminates most of these gaseous decomposition products. The less toxic metal fluorides are in the form of white, tan or grey powder. The amount of decomposition of the gas is a function of the intensity and duration of the arc. Some of the SF6 decomposition products form corrosive and conductive compounds when exposed to moisture. These compounds, which can be harmful to human beings, are also aggressive towards materials within the circuit breaker, especially insulating surfaces if subjected to prolonged exposure. That's why it's best not to perform breaker maintenance on rainy, humid days.

By weight SF6 gas is approximately five times heavier than air and tends to diffuse towards the pull of gravity and pools in low places. As a result of this pooling, the gas displaces oxygen and can cause suffocation without warning if the oxygen content of air is reduced from the normal 20 percent to less than 13 percent. In the presence of moist air, noxious decomposition products have a characteristic odour of rotten eggs.

13.8.2 Hazards in handling of SF6 Gas

Since SF6 gas displaces oxygen, avoid inhaling SF6 gas. Oxygen deficiency can cause nausea and drowsiness. Prolonged exposure to this gas in a confined space can cause serious breathing difficulty and suffocation.

Avoid skin or eye contact with the decomposition products because they can cause skin rashes, eye irritation, and chemical burns.

In the presence of moist air, noxious decomposition products have a characteristic odour of rotten eggs. Avoid inhaling these by-products because, unprotected prolonged exposure can injure the respiratory tract. Wear the prescribed protective gears.

13.8.3 Equipment to be used to handle SF6 Decomposition Products

The following equipment should be used to perform maintenance on SF6 gas insulated apparatus where decomposition products may be present:

- Neoprene Gloves – 14 Inch size;
- Rubber Boots;
- Clean, oil-free dry air supply with a capability to provide sufficient purging and ventilating capacity;
- Full-face chemical respirator with twin cartridges for organic vapors and acid gases;

- Supplied air-line respirator
- Industrial wet or dry type vacuum cleaner with non-metallic attachments.
- Cleaning solvent: Denatured Ethyl Alcohol.

13.8.4 Protective Gear

The following protective gear shall be worn while handling SF6 gas-insulated apparatus are:

- ✶ Gloves; and
- ✶ Full-face respirator or equivalent with twin cartridges for organic vapors and acid gases.

13.8.5 Safe Procedure in handling of SF6 gas

Follow the following safe practices when handling SF6 gas-insulated apparatus are:

- ➢ Perform SF6 gas handling, filling or reclaiming outdoors;
- ➢ No exposed heaters, flames, or arc-producing equipment should be used in the area while the gas is being handled; and
- ➢ No smoking;
- ➢ If procedures involving SF6 gas insulated equipment must be done indoors, work in a well-ventilated room; make sure the ventilating equipment is operating;
- ➢ If when handling used SF6 gas, the odour of rotten eggs is detected, personnel not wearing respiratory equipment should promptly evacuate the area.

13.8.6 Storing SF6 Gas Cylinders

Pressurised cylinders, which contain SF6 gas, can be damaged or ruptured by careless handling. Requirements for storing gas cylinders include:

- ▪ Store cylinders in a well-ventilated area;
- ▪ Secure the cylinders in a way to prevent them from falling or being knocked over.

13.9 Working on bus-bars and transformers

1) Bus-bar

In electrical power distribution, a bus bar is a strip of copper or aluminium that conducts electricity within a switchboard, distribution board, substation or other electrical apparatus. The size of the bus bar determines the maximum amount of current that can be safely carried.

Bus bars are typically either flat strips or hollow tubes as these shapes allow heat to dissipate more efficiently due to their high surface area to cross-sectional area ratio. So hollow or flat shapes are prevalent in higher current applications.

A bus bar may either be supported on insulators, or else insulation may completely surround it. Bus bars are protected from accidental contact either by a metal earthed enclosure or by elevation out of normal reach. Neutral bus bars may also be insulated. Earth bus bars are typically bolted directly onto any metal chassis of their enclosure. Bus-bars may be enclosed in a metal housing, in the form of bus duct or bus way, segregated-phase bus, or isolated-phase bus.

2) Transformers

While the operating principles of transformers have remained the same for nearly a century, the challenges of maintaining and testing transformers have evolved along with transformer design and construction. Modern transformers are designed to closer tolerances than ever before. Proper testing is essential for evaluating the condition of a transformer.

Why to do maintenance?

- Safety
- Fires
- Reliability
- Risk / Insurance
- Extend the life of the asset
- Environmental; Oil Spills

Equipment Record

- Know what equipment you have and where it is;
- Keep accurate drawings most recent revisions only;
- OEM manuals - recommendations for maintenance;
- Commissioning records - keep for future reference;
- Maintenance records - keep for trending;
- Keep records in centralized depository;
- Computerized Maintenance Management Systems (CMMS); and
- Don't rely on individual's knowledge and memory.

Transformer Inspection

- Check for leaks;
- Check for rust;
- Inspect bushings for damage or cracks;
- Record temperature gauge readings;
- Check oil level gauges;
- Check pressure/vacuum gauges;
- Cleanliness of tank and radiators;
- Operation of fans (if equipped);
- Grounding connections intact;
- Check for visual signs of overheating on connections; and
- Check condition of desiccant breather, replace desiccant if pink.

13.10 Safety measures in case of flooding of power house

In case of flooding of Hydro Power Stations in consistent with the CBIP Manual for flooding of power house, following safety measures should be followed;

General

- Flood warning system shall be established on the upstream of dam/barrage so as to have advance information regarding high inflows ensuring sufficient lead time for taking protective measures. Immediately on commencement of project works, adequate and reliable communication system shall be established between flood warning stations and the project.
- Hourly monitoring of inflows and silt levels (PPM) shall be carried out during complete monsoon/ high inflows period especially in case of silt prone projects/power stations. Websites of weather prediction agencies should be regularly assessed for additional requisite data.
- Disaster Management Plan for each project/power station including that related to flood management be prepared on commencement of project work and widely circulated.

- ✶ Fixed type public address system and Siren (along with audio-visual devices at suitable locations, if required) for covering the complete project/power station area shall be provided. In addition, portable public address system shall also be made available.
- ✶ List of probable sources for emergent supplies, drainage/dewatering pumps including diesel operated pumps, all types of pipes, spares, etc. may be identified in advance and kept readily available.
- ✶ Head of Planning Department shall be responsible for proper liaison with local bodies for sharing information regarding inflows, any blockade in upstream of dam and sudden release of water etc. Directory of contact numbers of key persons of civil administration, police/ambulance, fire station, etc. should be available with the project. Periodical revision/updating of the same shall be carried out.
- ✶ Periodical Training Program for the operating personnel on "Flood prevention of Power Stations" shall be conducted by professional institutions / authorities on mandatory basis in each project to enhance their alertness and effectiveness during such exigencies.

13.11 First aid of electric shock

Direct Artificial respiration is the method whereby a person ventilates the lungs of an unconscious non-breathing victim by blowing his own breath directly into the mouth or nose of the victim. Expired air is not dead air. It has been proved more than adequate for artificial respiration.

Direct mouth-to-mouth breathing is the most effective method of artificial respiration.

Direct Artificial Respiration (mouth-to-mouth method):

(a) Place the victim on back immediately.

(b) Clear throat of water, mucus, toys, coins, or food.

(c) Tilt head back as far as possible.

(d) Lift jaw up to keep tongue out of air passage.

(e) Pinch nostrils to prevent air leakage when you blow.

(f) Blow until you see the chest rise.

(g) Listen for snoring and gurgling signs of throat obstruction.

(h) Repeat blowing 10-20 times a minute. In case of infants and small children tilt the head fully back, surround the mouth and nose completely with your mouth. Blow with only enough force to produce a visible rise in the victim's chest and no more. Repeat every 3 seconds.

Continue direct artificial respiration until victim breathes for himself, or until expert help is obtained.

13.12 Construction Stage

All safety measures as stated above in "Design Stage" of Civil, Hydro-Mechanical and Electro-Mechanical shall be considered for the implementation during construction stage also.

Civil

1. Plugging of construction audits after completion of works to be undertaken as per design requirement.
2. TRT portal shall be provided with a Plug (either of rock preferably or concrete or masonry), which shall be completely removed only after the completion of outfall structure and installation of gate (s).

3. Outfall structure of TRT shall be constructed during non-monsoon period. TRT works shall be carried out after taking all precautions or else avoided during high flow period.

Hydro-Mechanical

If the installation of draft tube gate (s) is not completed before monsoon, then a suitable plug/bulk head may be provided before onset of monsoon. Similarly, if the portal of TRT falls near the river, bulk head may be provided there also.

Electro-Mechanical

Suitable designed bulk heads (Plugs) shall be provided on top of the draft tube (s) inside the power station for each unit with Francis type Turbine during construction stage to avoid flooding from tail race.

13.13 O&M Stage

1. Adequacy of various systems, i.e., Civil, Hydro-Mechanical and Electro-Mechanical installed in existing power stations under operation and maintenance stage may be reviewed with reference to flood control measures and modified suitably to remove deficiencies, if any.
2. List of internationally known and reputed firms specializing in restoration of flooded Power Stations to be kept ready. Details of competent contractors/agencies and good workmen in nearby areas, who can be assigned the job of restoration is to be prepared by all Power Stations and regularly updated.

Civil

1) Steep and vulnerable slopes in the power station area need to be identified and protective measures shall be taken for ensuring accessibility during exigencies.
2) Drains around the power station area need to be cleaned and maintained regularly specially during monsoon to divert rain water away from power station.

Hydro-Mechanical

1) Regular preventive checks/maintenance of HRT, surge shaft, draft tube, TRT, bulk head gates and associated seals and their hoisting mechanism shall be carried out to ensure their healthiness particularly before monsoon.
2) TRT gate, if provided, to be closed during high flood after stoppage of units.

Electro-Mechanical

1) All the outdated/obsolete equipment and components specially relating to prevention of flooding in the power station may be suitably modified/replaced.
2) Regular visual inspection, periodic testing of various pipe/weld joints, valves etc., prone to wear due to silt in the power station shall be carried out.
3) Vigorous monitoring and regular maintenance of all the important and vulnerable systems, e.g., flood warning system, drainage and dewatering system, all gates, inlet valves, standby DG supply, turbine shaft seals, etc., failure of which may lead to flooding of power station shall be carried out.
4) Before onset of monsoon, all the requirements, e.g., standby equipment, adequate spares, requisite consumables, experts, etc. need to be organized. Inventory of parts requiring replacement and located in critical areas must be prepared and these be procured through OEM or from other reputed sources only after proper inspection and testing.
5) Pipes, valves, etc. chocked heavily due to silt/debris shall be cleaned under expert supervision after taking adequate precautions/measures to prevent gushing of water in the power station.

13.14 Safety in Sub-station and Switchyard

Substations and switchyards are vital components of the electrical grid, but they also present significant electrical hazards. Here are some key safety points to remember when working in these areas:

- Only authorized personnel should be allowed in substations and switchyards.
- Wear proper personal protective equipment (PPE), including arc-rated clothing, safety glasses, gloves, hard hat, and steel-toed boots.
- Be aware of your surroundings and watch for potential hazards, such as energized equipment, moving parts, and trip hazards.
- Never work alone in a substation or switchyard. Always have a qualified observer present in case of an emergency.
- Follow all safety procedures and protocols as outlined by your employer or the utility company.
- Never touch energized equipment or conductors.
- Maintain safe clearances from energized equipment as specified by the National Electrical Code (NEC) or other applicable standards.
- Use proper grounding and bonding techniques to prevent electrical shock.
- Be aware of the potential for arc flash and take appropriate precautions, such as wearing arc-rated PPE and using arc flash barriers.
- De-energize equipment before working on it whenever possible.
- Be aware of the potential for fires in substations and switchyards, especially from transformers and other oil-filled equipment.
- Have appropriate fire extinguishers readily available and know how to use them.
- Maintain a clean and clutter-free work area to reduce the risk of fires.

Additional Safety Points:

- Report any unsafe conditions to your supervisor immediately.
- Do not use cell phones or other electronic devices in substations or switchyards.
- Be aware of the weather conditions and take precautions during storms or other hazardous weather events.
- Stay hydrated and take breaks to avoid fatigue, which can increase the risk of accidents.

13.15 Do's and Don'ts of the activity - Electrical Works

Do's

- Isolate electrical equipment before electrical maintenance work and use LOTO (Lockout & Tagout) system.
- Wear approved Electrical insulated gloves, electrical shoes/ boot.
- Use Electrical insulated mat in front of all the electrical panels.
- Only use standard and certified electrical appliances.
- Make sure there are no cuts or joints, cracks, abrasions on the cables or wires.
- Ensure proper grounding of electrical equipment.
- Always use Double insulated power tools.

- Use Arc flash suit, face visor, insulated electrical gloves while energizing or de-energizing the breaker.
- Use only tools & equipment with non-conducting handles when working on electrical devices.
- Use Discharge rod for discharging the stored energy prior taking electrical maintenance.
- Display appropriate electrical warning signage at conspicuous locations.

Don'ts

- Do not use bare fingers or hands to determine whether a circuit is live.
- Do not depend upon insulation of cables for safe working.
- Do not attempt to make any alterations or adjustments in portable electrical equipment without cutting off supply.
- Use liquid fire extinguishing media for fighting electrical fires.
- Don't wear metal objects 'Rings' and 'Bracelet' which may act as conductor of electricity.
- Don't touch unearthed metal surfaces.
- Don't use electrical equipment in wet floor and wet hands.
- Don't use metal ladders when working on or near power lines.

Normative References

- *Central Electricity Authority (Measures Relating to Safety and Electric Supply) Regulations 2010*
- *Central Electricity Authority (Safety Requirements for Construction, Operation and Maintenance of Electrical Plants and Electric Lines) Regulations, 2011*
- *Indian Electricity Act, 2003*
- *Electricity Rules, 2005*
- *IS:10028 (part-III) 1981 (RA2003) - Code of Practice for Selection, Installation and Maintenance of Transformers*
- *IS: 15652 (2006) Insulating Mats for Electrical Purposes*
- *IS: IS 17893 (2023) Work Permit System Code of Practice*
- *IS: 3043 (1987) Code of practice for earthing*
- *IS: 3034 (1993) Fire Safety in Industrial. Building for Electric Generating & Distributing Station.*

14 Safety Work Permit Procedure

14.1 Introduction

Work permit means a certified procedure for allowing certain work to be carried out in a fixed place and during a given period of time. It is also a procedure authorizing entry to certain facilities. It provides a check list for a systematic method of risk assessment, warns the residual hazards in the job, and outlines the precautions to be taken while carrying out the job to achieve the stated objectives. It provides responsibility for the persons who are accountable for authorizing the work and ensuring that the workplace is safe. It establishes safe working conditions for carrying out any maintenance / repair / inspection work and to serve as an official record of those established conditions as requirements agreed upon by the issuer and acceptor of the permit.

Work permit is used to authorize routine / non-routine work to be carried out. It clearly explains the precautions to be taken to ensure safety of personnel, installations and environment while performing the job.

14.2 Legal requirement for implementation and use of Safety Work Permit System

It is mandatory to use "Safety Work Permit System" for certain hazardous activities, such as 'Hot Work', 'Confined Space Entry', 'Work on Electrical Equipment' and 'Work at Heights'.

2.1 Factory Act, 1948:

- Section 36 : Precautions against dangerous fumes, gases, etc.
- Section 36A : Precautions regarding the use of portable electric light.
- Section 37 : Explosive or inflammable dust, gas, etc.
- Section 41 : Power to make rules to supplement this Chapter.

2.2 Rule-9 : CEA (Safety Requirement for Construction, Operation and Maintenance of Electrical Plants and electric Lines) (Amendment) Regulations, 2022.

2.3 Rule-37 of the Coal Mines Regulation 2017

2.4 Rule-3: of the Electricity at Work Regulations, 1989

2.5 Rule-36 of Indian Electricity Rules, 2005

2.6 Rule-4 of the Control of Major Accident Hazards Regulations, 1999

2.7 Rule-4(b) of the Confined Spaces Regulations, 1997

2.8 Rule-85, 98 and 175 of the Petroleum Rules 2002 for repairs of tanks & pipelines of petroleum products.

14.3 Scope

The scope included "Work Permit" for the following work activities;

a) Hot work permit;

b) Confined space/vessel entry permit;

c) Excavation permit;

d) Electrical work permit; and

e) Work at height permit;

14.4 Definitions (As per IS: 17893: 2023, Safety Work Permit –Code of Practice)

14.4.1 Hot Work

Hot work is any type of work which produces heat/spark capable of igniting any flammable or combustible material.

Examples of hot work are as follows:

a) Welding, Grinding, Burning, Soldering, Brazing, Blasting, Gas Cutting, Chipping by spark-producing tools, use of Open Flames, Tar Melting, Electrical Arc of any kind and any other equipment which may create a source of ignition;

b) Hacksaw cutting on equipment, line or vessel of hydrocarbon services;

c) Any equipment, line or vessel which contained any explosive, corrosive or toxic material and removed from service for cleaning, repairing, maintaining, reclaiming or discarding in and around workshop to a location where "Hot Work" is already permitted;

d) Use of Non-flame proof electrical equipment like cameras, mobile phones, non-intrinsically safe radio pagers, etc. use of certain power driven tools like pneumatic concrete breaker, use of equipment operated by internal combustion engines, etc. inside hazardous areas;

e) On line leak sealing (if includes hot work like drilling, etc.) in pipelines and equipment, hot tapping involving welding and drilling in pipelines, and pressure spray painting; and

f) The following jobs though not qualify as hot jobs as per definition, require hot work permit:

1) Work involving radioactive sources: The isolation or restoration of a radioactive source including the use of mobile X-ray/radiography equipment.

2) Work beneath or adjacent to un- insulated electrical power cables (for example, LT, HT lines) within 3.0 m radial distance.

Hot Work (Includes Welding, Cutting and Grinding) – Do's and Don'ts

Do's

- Remove all combustible/ flammable materials away from the area.
- Ensure Work Permit is obtained before executing hot work.
- Keep the right type of Fire Extinguisher near the hot work.
- Barricade the work area and display warning signage to prohibit entry of unauthorized people.
- Wear proper PPEs viz. Leather Glove, Welding Helmet / Welding Shield / Safety Goggles, Aprons, Safety Shoes, etc.
- Ensure safety guard is provided on the Grinding / Cutting Machine.
- Ensure welding machine is properly earthed and grounded.
- Protect nearby gas lines/ equipment from falling sparks.
- Cover the floor opening / grating with Fire blanket to prevent the spread of sparks from one level to another level.
- Tool Box Talk (TBT) shall be given to the workers before executing the job.
- Close the Work Permit after completion of work.

- Carry out proper housekeeping after finishing the work.
- Use Flashback arrestors in Gas Welding / Cutting torch and at the ends of DA gas cylinder to stop the flame or reverse flow of gas back into the equipment.
- Always use trolley for transporting cylinders from one place to another.
- Power supply shall be given through only 30 mA ELCB/ RCCB.
- Grinding or Cutting wheel RPM should be greater than the machine RPM.
- Cylinder valves must be protected with safety valve caps in place.
- Stop the machine before oiling, cleaning or repairing.
- In case of leakage from regulators, valves or other fittings of the gas cylinders, the cylinders should be removed immediately to a safer place and inform the supplier.
- Close the cylinder valve before moving from one place to another.

Don'ts

- Don't use damaged cables and hoses.
- Don't use normal glasses for welding work.
- Don't join the welding cables, use single length cables.
- Don't cool the electrode holders by immersing them in water.
- Never try to shut off the gas supply by folding/ crimping the hose.
- Don't do the hot work with flammable materials such as oils, paints, etc., in the vicinity.
- Don't place cables or pipes in the hallway to avoid tripping.
- Don't cut or weld the empty paint or chemical drum.
- Don't keep the cylinder in horizontal position.
- Don't roll/ lift the cylinders for transporting.
- Don't try to invert the position of the gas cylinders.
- Don't wear loose clothes, rings or watches while working on any rotating machinery.
- Never leave machine in motion unattended. Isolate the main switch before leaving the place.
- Don't store Oxygen gas cylinders near cylinders containing flammable gases like Hydrogen, Acetylene, etc.
- Don't use domestic LPG cylinders for Gas welding and cutting purpose.

14.4.2 Confined Space / Vessel Entry

A confined space is defined as an area which is not designed for continuous human occupancy. It is large enough for a person to bodily enter in the area and perform the assigned work. It has got limited or restricted means for entry and exit and may or may not be enclosed.

Confined space is subjected to potential hazards, namely, accumulation of toxic or flammable gas/vapour, inert gas, oxygen deficiency (< 20 percent v/v), flooding of liquid, steam or any other hazardous substance or development of hazardous conditions.

Some of the examples of confined spaces are as follows:

Tanks, Columns, Reactors, Oil/Water Sewer Pits, Coolers, Condensers, Reservoirs, Pipelines, Tanker Trucks, Skirts of Column and Vessels, Floating Roof Decks, Ducts, Pits, Tunnels, etc.; and

Also includes column skirts, large diameter pipelines, storage tanks, spheres, bullets, bins, silos, sumps, trenches, pits, sewers, furnaces, flare stacks, gas turbine chambers, underground service

lines, work in open type vessel deeper than head level, boiler drums, surface condensers, flue ducts, Heating ventilation and air conditioning ducts, false ceilings and floors, deck of floating roof tank etc. where deficiency of oxygen or presence of toxic / flammable gases is likely and / or the access is difficult during maintenance / inspection work.

Confined Space – Do's and Don'ts

Do's

- All the entry points of the Confined space shall be identified and appropriate signage shall be displayed.
- Drain, wash, dry and purge for enough time to ensure safety atmosphere inside.
- Check and monitor the Oxygen level, LEL and other toxic gas levels.
- Keep stand-by personnel outside the entry point.
- When entering the confined space, use safety belt and life line with a free end held by the stand-by person.
- Keep record of persons entering and leaving confined space.
- Use SCBA, if the Oxygen concentration is less than 19.5 %.
- Use only 24V portable lamp inside the confined space.
- Rope or chain ladder with rigid rungs of wood or metal may be used for vessel entry where straight ladders cannot be used.
- Use Tripod with hoist, lifeline and full body safety harness for emergency.

Don'ts

- No portable electric light or any other electric appliance of voltage exceeding 24 V shall be permitted.
- Don't enter a confined space without valid work permit.
- Don't work without supervision in a Confined space.
- Don't work if you are medically unfit.
- Don't enter confined space if the oxygen concentration is <19.5 % or >23.5 %.
- Don't use CO_2 type fire extinguisher in confined space.

14.4.3 Excavation permit

For carrying out excavation of ground / soil below 1.5 M a separate permit that is excavation permit shall be issued.

Excavation – Do's and Don'ts

Do's

- Before excavation ensure that there is no underground electrical cables, sewer/ drinking water line, telecommunication line, utility line, gas line, fire line is present.
- Adequate and suitable warning signs shall be displayed at conspicuous places at the excavation work to avoid any person falling into the excavations.
- Safety helmet shall be worn by all persons entering trench where hazards from falling stones, timber or other material exist.
- Excavated material shall be kept away from the edge of the trench to provide a clear berm of a width not less than 1/3rd the final depth of excavation.

- Heavy equipment such as excavating machinery and road traffic shall be kept back from the excavated sides at a distance not less than the depth of trench.
- Adequate and well anchored stop block shall be provided on the surface to prevent operating vehicles from falling accidentally into excavation pit.
- Wherever pathways are suspended, they must have guard rails and supports on both sides to prevent fall of workmen into the excavation.
- Excavation areas shall be adequately lighted for night work.
- It shall be ensured that no harmful gases or fumes are present in the trench or tunnel to such a degree as may endanger the health and safety of persons working.
- Where gases and fumes are likely to be present in a trench, sufficient mechanical ventilation shall be arranged to protect the health and safety of persons working.
- Where there is possibility of flooding or water rushing into the tunnel, arrangements shall be made for immediate starting of water pumps to take out water.
- An audible fire alarm shall be provided to warn the building workers whenever a fire breaks out in tunnelling work.

Don'ts

- No excavation or earthwork below the level of any foundation of building or structure shall be commenced unless adequate steps are taken to prevent danger to any person employed, from collapse of the structure or fall of any part thereof.
- The vehicle shall not be permitted to be driven near the tip of the excavation.
- Inflammable oils with the flash point below the working temperature that is likely to be encountered in a tunnel shall not be used in excavation or tunnelling work.
- Don't allow the excavator machine to move near overhead or underground power lines.
- Don't let the person stand on track or on the bucket of the excavator.
- Don't leave the excavator machine before stopping the engine.
- Don't allow reinforcement rods to protrude dangerously cut.

14.4.4 Electrical work permit

For carrying out electrical work, positive isolation of electrical energy of power driven equipment is essential. A separate permit that is electrical work permit shall be issued for the electrical work.

Electrical Works – Do's and Don'ts

Do's

- Isolate electrical equipment before electrical maintenance work and use LOTO (Lockout & Tagout) system.
- Wear approved Electrical insulated gloves, electrical shoes/ boot.
- Use Electrical insulated mat in front of all the electrical panels.
- Only use standard and certified electrical appliances.
- Make sure there are no cuts or joints, cracks, abrasions on the cables or wires.
- Ensure proper grounding of electrical equipment.
- Always use Double insulated power tools.
- Use Arc flash suit, face visor, insulated electrical gloves while energizing or de-energizing the breaker.

- Use only tools & equipment with non-conducting handles when working on electrical devices.
- Use Discharge rod for discharging the stored energy prior taking electrical maintenance.
- Display appropriate electrical warning signage at conspicuous locations.

Don'ts

- Do not use bare fingers or hands to determine whether a circuit is live.
- Do not depend upon insulation of cables for safe working.
- Do not attempt to make any alterations or adjustments in portable electrical equipment without cutting off supply.
- Use liquid fire extinguishing media for fighting electrical fires.
- Don't wear metal objects 'Rings' and 'Bracelet' which may act as conductor of electricity.
- Don't touch unearthed metal surfaces.
- Don't use electrical equipment in wet floor and wet hands.
- Don't use metal ladders when working on or near power lines.

14.4.5 Work at height permit

Work Permit shall be issued for jobs involving work at height greater than 1.8 M. A separate permit that is, working at height permit shall be issued for working at height.

Height Work Do's and Don'ts

Do's

- Before starting work at height, inspect PPEs carefully.
- Always wear PPE; viz. Full Body Safety Harness, Safety Helmet, Fall Arrestor System when you have to work above 2 M from the ground level.
- Always select an acceptable Anchoring Point.
- Always maintain 3-Point Contact while ascending or descending the ladder.
- Maintain the ladder in 1:4 ratio.
- Extend the top of the ladder at least 3 feet above the surface.
- Monkey ladder should be properly made and fitted with cages.
- Safety nets shall be used for prevention / arrest men and materials falling from height.
- Make sure there is adequate edge protection to minimize the risk of falling.
- Take extra care on fragile surfaces such as roof and make sure that surface is stable and strong enough to support both the man and material.
- Proper scaffold and working platform with top rail, mid rail and toe guard shall be provided.

Don'ts

- Don't try to reach too far when working on a ladder.
- Don't use ladder to do heavy work. Only use them to do light works and for reaching heights.
- Don't allow incompetent persons to work at heights.
- Don't place or lean the ladder on fragile surfaces.
- Don't stay quiet when you feel someone is compromising safety.
- Don't use conductive (Metallic) ladders on or near the electrical installations.
- Don't use the scaffold unless it is inspected by the competent person or Scaffold inspector.

14.5 Role and responsibility to initiate / issue SWP

14.5.1 In case the work is to be carried out by THDCIL Engineer

Shift In-charge / Site Engineer of the site/operating plant shall issue the permit for the works to be carried out / jobs under his / her jurisdiction. The issuer shall be THDCIL employee and no person can issue permit for himself/herself.

HOD can authorize engineers / officers working under them to issue the permit for the area under his/her jurisdiction. The list of engineers / officer authorized to issue permit shall be displayed / circulated in the plant/site.

14.5.2 In case the work is to be carried out by Contractor

In case the work is to be carried out by contractor, the responsibility to issue SWP shall be of the authorized person approved by the contractor.

The permit issuer shall be responsible for the following responsibilities;

a) If work under permit continues for more than a shift/day, then the existing permit shall be closed and to continue the same work on next shift/day, a fresh permit shall be obtained/ issued.

b) For the controls the entire work permit process;

c) Necessary equipment preparation has been completed and adequate safety measures have been taken. He shall maintain any special safety precautions and PPE to be used by way of independent risk assessment for difficult jobs and jobs which are to be done for the first time and not so frequent;

d) A separate Work Permit shall be issued for equipment blinding, decomposition, erection of scaffolding / temporary work platform, etc. before the permit issued for actual job execution.

e) The issuer of Work Permit should ensure that relevant check sheets as specified in the permit with respect to job have been identified and completed.

f) The incoming Shift Engineer / Shift In-charge shall review the ongoing work permits and if conditions are not conducive or violated, he can stop the ongoing work.

g) The issuer is responsible for getting the approvals of plant/area in-charge before the permit is given to the acceptor; and

h) The issuer should sign the work permits that have been closed and handed over to him.

14.6 Role and responsibility Executor

a. HODs can authorize personnel working under them to receive the permit. A list of employees who are authorized to receive permit shall be maintained in all Departments. The executor should be an employee of the company.

b. Prior to issue of work permit, the issuer and executor shall jointly inspect the job location to identify the potential hazards associated with the job, assess the safety measures taken to prevent accident and PPE required for safe execution of the job. Ensure availability of required PPE.

c. After the joint inspection of the workplace, the responsibility for safe execution of the job shall lie with the acceptor/executer of the permit.

d. After the executor signs the permit, he will hand over the permit to the Departmental technician / contractor / Site In-charge or Site supervisor of the contractor working under him.

e. The Departmental technician / Contractor / Site In-charge or Site supervisor of the contractor Site In-charge or Site supervisor of the contractor will read carefully the safety instructions mentioned

in the permit and satisfying himself, shall sign in the permit. In case of any doubt, he will contact with Site Engineer / Site In-charge to clear the doubt before starting the work.

f. The executor should display his copy of the permit at the work site for the personnel around the area to be aware of the work being executed and also for any auditor to know that a job is under progress in the area.

g. A toolbox talk (safety talk) has to be conducted by the acceptor to the contract workers prior to start of the job. The safety talk should emphasize the proper procedure for carrying out the job, identify any hazards involved and the precautions to be taken.

h. It is the responsibility of the executor to ensure that the contractor is made aware of the following during the execution of job:

2. The conditions identified in the work permit are compiled at all times during the execution of the work;

3. The contract worker/supervisor should inform executor and area In-charge / Site Engineer, if job conditions deviate from the safe execution of the job; and

4. It is the responsibility of the contract supervisor to provide requisite PPE to the workers for their personal protection.

a. After the work is complete, the executor should ensure that the housekeeping of the area is restored to normal before signing of the permit as completed.

b. In case of confined space/vessel entry the executor should ensure that all men and other material have been removed from the work area before the equipment is boxed up.

c. Arrangement of tools, tackles, ladders and scaffolding required for the job will be the responsibility of the agency undertaking the job. It shall ensure certification of hand tools, portable electrical tools, ladders, scaffoldings etc. from the competent person before taking into use.

Note: To carry out Hot Work, Confined Space Work and for Excavation Permit, authorization of HOD / Site In-charge / Site Engineer of the area where work is to done shall be required.

14.7 Responsibility of the Technician / Mechanic / Operator

1. When the work permit is presented to technician / mechanic / operator by the acceptor, he will satisfies himself that the work conditions identified in the work permit have been complied with, he then signs in work permit and start the work.

2. When the work is complete and the permit is to be closed, the technician / mechanic / operator inspects the work area for the housekeeping and cleanliness and signs in the work permit and hands over the permit to the acceptor.

3. Also the incoming shift operator should review the ongoing works in his work area and give his approval for continuance of work by putting his signature in the appropriate place.

4. The technician / mechanic / operator shall keep himself aware of the jobs being executed in his area and ensure safe conditions are maintained.

5. He shall keep watch on the jobs and take appropriate action, if any hazardous condition is developed during the course of the work. If conditions warrant, he may suspend the job, and immediately inform the shift in-charge/shift engineer.

6. The incoming area operator of the next shift is responsible for endorsing the conditions as specified in the work permit as prior to continuation of the work.

7. After the work is complete, the acceptor should ensure that the housekeeping of the area is back to normal before signing of the permit as completion

14.8 Revalidation and Renewal of Work Permit

1. If work is to be continued without intimation beyond the approved time limits, then the work permit requires to be revalidated. If work is suspended for rest of the day and is restarted on the next day, the work permit requires renewal.
2. Work permits will be revalidated or renewed by issuer when requested by acceptor. Acceptor approaches the issuer with the acceptor's copy of work permit duly filled in with details of extension required at the back side of work permit and signed by him.
3. Revalidation/renewal of work permit will be done by issuer after a joint site inspection along with acceptor and checking the conditions in the work area and then endorsing the extension appropriately in the work permit.
4. All signing authorities must sign the permit for extension / revalidation / renewal of the permit.
5. Validity of a work permit shall not be for more than a shift/day.

Note: Necessary gas tests should be carried out at the time of revalidation / renewal of hot work, vessel entry permit and excavation work permit. The results of the gas tests will be recorded in the appropriate columns on the backside of the permit by gas tester with his signature.

14.9 Closures and Cancellation

Closure of Work Permit

- if there is a break in the work for more than one calendar day, a new permit has to be issued.
- After completion of the job, agency undertaking the job must ensure that all tools, tackles, men and material have been removed from the place of work and the area has been made clean.
- Guards, gratings, railings if have been removed shall be fixed properly.
- All signing authorities for approval must sign the permit for closure of the permit.
- On completion of job before the time of expiry of the permit, the permit must be returned to the issuing authority with the status of the job, date and time duly marked on the permit.

Cancellation of Work permit

- Permit shall be cancelled under the following conditions:
  - Declaration of plant/site emergency situation (fire, etc);
  - Any accident at the permit work area; and
  - Permit conditions are violated.
- In the case of (a) and (b) acceptor should stop the work and cancel the permit automatically while in the case of (c) it will be by any of the signatories of the work permit or an auditor.
- Permit can also be suspended for a short duration if the work conditions are not meeting the conditions specified in the work permit and till such time the conditions are rectified. This can be done by any of the signatories of the work permit or an authorized auditor.

14.10 Important safety precautions to be checked while issuing SWP

- Ensure electrical Isolation by applying LOTOTO (Lockout, Tagout and Tryout) and 'Caution Tag - "Do Not Operate" is applied on isolation switch / panel.
- Ensure that the electric arc welding machine is properly grounded/earthed and ELCB / RCCB provide.

- Welding/gas cutting or grinding operations generate sparks/hot slag which spread in surrounding area and may lead to fire or explosion. Adequate fire protection measures should be specified in SWP to avoid spread of sparks by confining work activities and arresting sparks locally. Additional fire protection measures like wetting the nearby area by spraying water or wet fire blanket can be specified. If required post a trained fireman along with adequate quantity of fire extinguishers for emergency use till the hot work continues.
- For vessel entry / confined space entry, ensure that vessel is decontaminate completely by washing off with cold/hot water, steaming or purging with inert gas and/or air as necessary.
- For Proper Illumination to carry out job in confined space only 24 V Flame proof hand lamp to be used. If lighting is required for any job involving release of flammable vapours or work is carried out in a hazardous area, it is mandatory to use flameproof electrical equipment. Only flameproof 24 V electric hand lamp shall be used. Use of 230 V hand lamps inside confined space/vessel is prohibited.
- Ensure use of 'Non-sparking Tools' for maintenance work in hydrocarbon area or where highly flammable gas / vapours are likely to be present.
- Proper portable ladder provided / suitable scaffolding to be provided-while working at height, where no permanent platforms are available, ladders, temporary fixed / moveable platforms / scaffoldings must be provided. In no case make-shift arrangement like drums, etc. should be used to work at height.
- Specify the appropriate type of ladder to be used as per the requirement to work at height. These include aluminium, wooden, FRP, trestle, roof ladder, rope ladder, telescopic and extension ladders. Scaffoldings; Specify the appropriate type of scaffolding to be used as per the work at height requirement. These include tubular scaffolding. Bamboo scaffoldings are not allowed. Scaffolding should be certified by a competent person before use and suitable identification tags to be provided.
- The issuer should ensure that safe escape route is available and cleared before issuing work permit especially for hot work, confined space/vessel entry. There should not be any obstacles or hindrance in the escape route.
- Adequate ventilation should be ensured for jobs in confine spaces. If required, additional air supply to be made by using air hose/air mover/air blower. Isolation/blinding of pipeline(s) connected to the vessel should be ensured.
- Stand by Person/Fireman
- A trained standby person must be always available at manhole of the vessel/tank during confined space entry. For all work involving confined space/vessel entry, one person is required to be on guard outside the confined space/vessel, for help or in case of any distress call raised by persons working inside. It is the duty of the standby person to arrange for the rescue or raise the call for help. In case a hot work is carried out in a hazardous area, one person trained in fire-fighting should be posted near the work area. The permit issuer should provide standby persons for above cases. The name of such standby persons should be mentioned in the work permit.
- Personal Protection Equipment; employees are required to wear safety helmet, safety goggles, hand gloves and safety shoes in their work areas. Additional PPEs are to be specified by the issuer depending upon nature of work and hazards involved in the work. The agency undertaking the job will do arrangement for protective appliances.
- Gas test for oxygen content, hydrocarbon content and toxic content (if vessel/tank used for chemicals, toxic in nature) are to be carried out by the permit issuer for carrying jobs covered under hot work and vessel entry, for entry into excavated pits inside plant area. The name and time of the person-carrying test shall be mentioned in the respective permits. It is proposed to

carryout gas test for hydrocarbon content within 5.0 m radius of the work location for welding jobs (including drain channels (if any) and close to flange joints/valve glands of adjacent equipment). In case of spark producing activity effective arrangement for prevention of ignition sources coming into contact with combustibles/hydrocarbons should be made by providing booths/cage made of fire-resistant materials.

- If any gas test indicates presence of flammable, toxic gas or vapour or oxygen deficiency, corrective actions have to be taken to make conditions safe for carrying out work before issuing of work permit.

  a) Oxygen content — Min 19.5 percent;

  b) Hydrocarbon content [percent low exposure limit (LEL)]-Zero; and

  c) Toxic content — below threshold limit value (TLV) of the chemical for which the equipment/ tanks being used.

Note: Oxygen test results greater than 23 percent indicate oxygen enrichment of the atmosphere and this condition is extremely hazardous.

The items, specified in table below shall be checked before issuing the permit.
(Items marked with tick (✓) shall be complied by receiver)

Sl. No.	Item	Done	Not Required
1.	Equipment / Work area inspected		
2.	Surrounding area checked, cleaned and covered		
3.	Equipment blinded / disconnected / closed / isolated / wedge opened*		
4.	Equipment properly drained, and depressurized		
5.	Equipment electrically isolated and tagged vide Permit No…….. Dated:		

Remarks:

_____

_____

_____

Permit Issuing Officer

Annexure

Annexure-1: Format – Hot Work Permit
Annexure-2: Format – Confined Space / Vessel Entry Permit
Annexure-3: Format – Excavation Permit
Annexure-4: Format – Work at Height
Annexure-5: Format – Electric Work Permit

Normative Reference
IS: 17893 (2023): Safety Work Permit - Code of Practice

Annexure-1

HOT WORK PERMIT

Sl. No._____

1. Work clearance from: _____ Hr. of Date:_____ to from: _____ Hr. of Date:_____
2. Issued to (Department / Section / Contractor): _____
3. Exact Location of Work (Area / Unit / Equipment No. etc.): _____
4. Permit Type:

Normal		Shut Down		Blanket		Tick [✓] in Required Permit Type

5. Nearest Fire Alarm Point : _____
6. Description of Work to be done: _____

_____

7. Name of Permittee: Mr. _____ Signature of Permittee: _____

Date: _____

8. Check Tick (✓) the following items after to be Checked Before Issuing the Permit

SL. NO.	ITEM	DONE	NOT REQUIRED
A.	**General**		
1.	Equipment/Work area inspected		
2.	Surrounding area checked, cleaned and covered		
3.	Sewers, manholes, etc. and hot surfaces nearby covered		
4.	Considered hazard from other operations and concerned persons alerted		
5.	Equipment blinded/disconnected/closed/isolated/ wedge opened		
6.	Equipment properly drained and depressurized		
7.	Equipment properly steamed/purged / Equipment water flushed		
8.	Free access for approach of fire tenders has been maintained.		
9.	Iron sulfide removed/kept wet		
10.	Equipment electrically isolated and tagged vide Permit No.		
11.	Gas Test : HCs = % LEL; - % Toxic gas = ppm		
12.	Running water hose/ fire extinguisher / Fire water system available.		
13.	Area cordoned off and precautionary tags/boards provided		
B.	**For Hot Work /Entry to Confined Space**		
1.	Proper ventilation and lighting providing		
2.	Proper means of exit / escape provided		
3.	Standby personnel provided from Process /Maintenance/ Contractor/Fire Dept.		
4.	Checked for oil and gas trapped behind the lining in equipment		
5.	Shield provided against spark		
6.	Portable equipment/nozzles properly grounded		
7.	Attendant at man way provided for entry into confined space (2 Persons)		
8.	Adequate communication provided to stand by person		
9.	Trained attendant provided with rescue equipment/SCBA		
10.	Check for earthing/ELCB of any temporary electrical connections being used for welding		

11.	Gas cylinders are kept outside the confined space		
12.	Checked spark arrestor on mobile equipment		
13.	Welding machine checked for safe location		
14.	Permit taken for working at height vide permit no.		
C.	**For Vessel Entry**		
1.	Approved type Spark Arrestor on the mobile equipment/vehicle provided.		

IF REQUIRED ADDITIONAL PPEs SHALL BE USED IN ADDITION TO STANDARD PPEs SUCH AS HELMET, SAFETY SHOES, HAND GLOVES & BOILER SUIT [TICK (✓) THE RELEVANT ITEMS].

Sl. No.	ADDITIONAL PPE TO BE USED IN ADDITION TO STANDARD PPE	TICK (✓) MARK
1.	Face shield / Welder's Face Shield	
2.	Welders Safety Goggles	
3.	Dust Respirator	
4.	Fresh Air Mask	
5.	Lifeline	
6.	Full Body Safety Harness	
7.	Compressed Air Set / Supply	
8.	Ear Muff	
9.	Others (Specify)	

9. **Additional precautions if any**:_____
_____
_____

Details of Recipients

RECIPIENT						
Sl. No.	**Department**	**Signature**	**Designation**	**Name**	**Date**	**Mob. No.**

a) Fire Permit Issuer Name, Sign. & Mob. No.: _____ Sign._____ Mob. No. _____

b) Gas Safety Inspector Name, Sign. & Mob. No.: _____ Sign._____ Mob. No. _____

c) Permittee/Receiver Name, Sign. & Mob. No.: _____ Sign._____ Mob. No. _____

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10. **REVALIDATION AND RENEWAL REQUEST:**

By executor, the job is not taken up or not completed within the same shift. The permit may be Revalidation / renewal

Date: _____ Time: _____ Hr. **SIGNATURE OF EXECUTOR**

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12. **CLOSING OF THE WORK PERMIT**

Receiver: Certified that the subject work has been completed / stopped and are cleared.			**Issuer:** Verified that the job has been completed area cleared and is safe from any hazard.		
Date & Time	**Name & Designation**	**Signature**	**Date & Time**	**Name & Designation**	**Signature**

Annexure-2

CONFINED SPACE / VESSEL ENTRY PERMIT

Sl. No._____

1. Work clearance from: _____ Hr. of Date:_____ to from: _____ Hr. of Date:_____
2. Issued to (Department / Section / Contractor) : _____
3. Exact Location of Work (Area / Unit / Equipment No. etc.): _____
4. Description of Work to be done: _____
5. Expected Date & Time of Entry: / _____ Hr Expected Date of Completion: _____
6. Maximum No. of Entrants Allowed: _____
7. Communication facility provided and procedure established : **Yes / No / Not Required**
8. Rescue procedure established : **Yes / No / Not Required**
9. All electrical equipment is of intrinsically safe / flameproof type: **Yes / No / Not Required**
10. Safety Signs, Boards and Barriers are available : **Yes / No / Not Required**
11. Debriefing of key points / Toolbox Talk to authorized entrants : Done ( ) Not Done ( ) **[✓ Tick Mark]**

PERMITTEE/ENTRY ENGINEER

Name: _____ Designation: _____Signature _____ Date: _____

12. Checklist to be filled By Permit Issuer

13. Checklist to be filled up by Permit Issuer

Sl. No.	Item	Required	Not Required	Done
Energy Isolation				
1.	Pumps or pipelines blinded, disconnected or blocked			
2.	Positive isolation of electrical source, with LOTO			
3.	Other sources such as air, water, steam, gas blinded, disconnected or blocked			
4.	Ventilation			
5.	Portable gas tester checked for healthiness			
6.	Continuous gas monitoring required			
Personal Protective Equipment (PPE)				
1.	Full body harness with life line provided.			
2.	SCBA/Air Supplied Line, if available at site			
3.	Retrieval equipment available at site.			
4.	Dust respirator provided			
5.	Apron/Coat, Gloves, Footwear, Safety Helmet, Ear Protection			
6.	Eye/Face protection			
7.	Hoisting equipment			
8.	Resuscitator-inhalator			

Note: Check-List shall be complied by the executer.

14. Gas testing reading after opening of man way

14.1 Flammable..... percent Low Explosive Limit (LEL)

14.2 Oxygen..... percent by volume

14.3 Any other gas (specify): _____ part per million (PPM)

15. Subsequent Gas Tests After Preparation of Equipment

Sl. No.	Date	Time	Flammable (Percent LEL) (S Percent LEL or less)	Oxygen(Percent by Volume) (Min. 19.5 Percent)	Any Other Gas (Specify), in ppm
1.					
2.					

NOTE: The control measures and precautions appropriate for the safe entry and execution of the work in the confined space have been implemented and the persons required to work in the confined space have been advised of and understand the requirements.

ISSUER (Person in Direct Control)	RECEIVER / ENTRY ENGINEER Person/Contractor Supervisor working in confined space)
Date: ..... Time: ..... (am / pm)	Date: ..... Time: ..... (am / pm)
Name:	Name: .....
Designation:	Designation: .....
Signature:	Signature:
All above points shall be complied by Entry Engineer/ Receiver and checked by Issuer.	

NOTE: The control measures and precautions appropriate for the safe entry and execution of the work in the confined space have been implemented and the persons required to work in the confined space have been advised of and understand the requirements.

16. Items to be checked before issuing the clearance.

SL. NO.	ITEMS	DONE	NOT REQUIRED
1.	Equipment / Work area inspected		
2.	Surrounding area checked, cleaned and covered		
3.	Space is free from all unwanted materials such as scraps/ debris, surplus items, left over tools and tackles and combustible materials		
4.	Space is free from all combustible material		
5.	Space is free from all persons presence after checking and manhole cover has been engaged		
6.	Illumination and ventilation		
7.	The safety sign for “safe entry” has been removed from man way		
8.	Danger sign to caution all against entry has been displayed at man way		
9.	Additional precaution if any		

17. The items specified in Point-15 shall be checked before issuing clearance (to be checked with valid permit for confined space).

PERMITEE	RECEIVER
Date: ..... Time: ..... (am / pm)	Date: ..... Time: ..... (am / pm)
Name:	Name: .....
Designation:	Designation: .....
Signature:	Signature:

9. **REVALIDATION AND RENEWAL REQUEST:**

By executor, the job is not taken up or not completed within the same shift. The permit may be Revalidation / renewal

Date: _____ Time: _____ Hr. **SIGNATURE OF EXECUTOR**

12. **CLOSING OF THE WORK PERMIT**

Receiver: Certified that the subject work has been completed / stopped and are cleared.			**Issuer:** Verified that the job has been completed area cleared and is safe from any hazard.		
Date & Time	**Name & Designation**	**Signature**	**Date & Time**	**Name & Designation**	**Signature**

Annexure-3

EXCAVATION PERMIT

Sl. No._____

1. Work clearance from: _____ Hr. of Date:_____ to from: _____ Hr. of Date:_____
2. Issued to (Department / Section / Contractor) : _____
3. Exact Location of Work (Area / Unit / Equipment No. etc.): _____
4. Name of permittee: _____
5. Date: _____
6. Signature of permittee: _____
7. Please Tick the Type of Permit Required.

Permit Type	Normal		Shutdown		Construction	

8. Exact location of excavation: **(Attach marked up drawing)**

In Plant Area	Tank Dyke Across	Along Pipe way	Along Cable way
Road/Footpath	In Open Ground	Along Pipe way	Others

9. Size of Excavation (Approximately): ..... M Deep, ... M Wide ..... M Long
10. Purpose: _____
11. Commencing Date: ..... Time: ..... Hr. Expiry Date: ..... Time: ..... Hr.
12. Executing Department: ..... Contractor: .....
13. Name & Design. of Permittee: _____ Mob. No .....

Signature: _____

14. Excavation clearance from concerned departments is obtained, copy attached: Yes / No

14.1 Exact Location of Work (Area / Unit / Equipment etc.): .....

14.2 Description of Work: .....

14.3 Sketch of the area of excavation: Enclosed / Not Enclosed

14.4 Permission is solicited from : .....Hr Date: _____ to ..... Hr on Date: _____

Signature of Executer..... **Name & Designation of Executor.**.....

14.5	**Underground Power Cable**	Existing		Not Existing	
	Permission Given	Yes		No	
	Precaution, if Any.				
	Signature: Date: Mob. N0				
14.6	**Underground Telecommunication Cable**	Existing		Not Existing	
	Permission Given	Yes		No	
	Precaution, if Any.				
	Signature: Date: Mob. N0				
14.7	**Underground Firewater Line**	Existing		Not Existing	
	Permission Given	Yes		No	
	Precaution, if Any.				
	Signature: Date: Mob. N0				
14.8	Underground Oil/Sewer Line, Drinking Water Line, Above Ground Open Drain	Existing		Not Existing	
	Permission Given	Yes		No	
	Precaution, if Any.				
	Signature: Date: Mob. N0				

14.9	**Underground Computer Cable**	Existing		Not Existing	
	Permission Given	Yes		No	
	Precaution, if Any.				
	Signature: Date: Mob. N0				
14.10	**Underground Product Line, Utility Line**	Existing		Not Existing	
	Permission Given	Yes		No	
	Precaution, if Any.				
	Signature: Date: Mob. N0				
14.11	**Underground Instrument Cable**	Existing		Not Existing	
	Permission Given	Yes		No	
	Precaution, if Any.				
	Signature: Date: Mob. N0				

15. Personal Protective Equipment

Sl. No.	ADDITIONAL PPE TO BE USED IN ADDITION TO STANDARD PPE	TICK (✓) MARK
1.	Safety Helmet	
2.	Dust Respirator	
3.	Full Body Safety Harness with lifeline	
4.	Others (Specify)	

16. Permission Given : Yes ( ) No ( )

RECEIVER	ISSUER
Date: ..... Time: ..... (am / pm)	Date: ..... Time: ..... (am / pm)
Name:	Name: .....
Designation:	Designation: .....
Signature:	Signature:

17. REVALIDATION AND RENEWAL REQUEST

By executor, the job is not taken up or not completed within the same shift. The permit may be Revalidation / renewal

Date: _____ Time: _____ Hr. **SIGNATURE OF EXECUTOR**

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18. CLOSING OF THE WORK PERMIT

Receiver: Certified that the subject work has been completed / stopped and are cleared.			**Issuer:** Verified that the job has been completed area cleared and is safe from any hazard.		
Date & Time	**Name & Designation**	**Signature**	**Date & Time**	**Name & Designation**	**Signature**

Annexure-4

PERMIT FOR WORKING AT HEIGHT

(REQUIRED FOR WORKING AT HEIGHTS OF 1.8M & ABOVE)

Sl. No._____

THIS PERMIT AUTHORIZES FOR PROVISION OF SAFE ACCESS/PLATFORM/WORKING ARRANGEMENT AT HEIGHT FOR CARRYING OUT THE JOB

1. Permit required from: _____ Hr. of Date:_____ to _____ Hr. of Date:_____
2. Name of the Agency / Contractor: _____
3. Name of the site supervisor: _____
4. Job / Work Order No : _____ Location of Work : _____
5. Description of Work : _____
6. Total No. of Workers Allowed : _____
7. **PERMITTEE SHALL CHECK THE SOLICITING THE PERMISSION**

SL.NO.	ITEMS	YES	NOT REQUIRED
1.	Have scaffolds been checked and certified in prescribed form by scaffold supervisor?		
2.	Have scaffolds been tagged with green card duly filled and signed by scaffold supervisor?		
3.	Is scaffold rechecked and re-certified weekly?		
4.	Is scaffold erected on firm ground and sole plate and base plate have been used?		
5.	Is the hanging baskets used of proper construction, tested and certified for the purpose?		
6.	Is the work platform made free of hazards of all traps/trips/slips and fall?		
7.	Have cat ladders, crawling boards etc been used for safe working at sloping roof?		
8.	Has edge protection provided against fall from roof/elevated space?		

8. **THE FOLLOWING ITEMS SHALL BE CHECKED FOR RISK ASSESMENT BY ISSUER AND COMPLIED BY PERMITTEE BEFORE SOLICITING THE PERMISSION.**

SL.NO.	ITEMS	YES	NOT REQUIRED
1.	Are the platforms been provided with Toe board, guardrail and area below is barricaded?		
2.	Checked whether safety harness and necessary arrangement for tying the life-line, fall arresters etc. provided to the worker for working at height?		
3.	Have precautions been listed below for safe working at height for source of energy Such as electricity?		
4.	Is the raised work surface properly illuminated?		
5.	Are the workers working near unguarded shafts, excavations or hot line?		
6.	Checked for provision of collective fall protection such as safety net?		
7.	Additional PPE recommended?		
8.	Are proper means of access to the scaffold including use of standard aluminum ladder provided?		

9. **Additional Precaution Required, If Any** _____
10. **Permission Given :** **Yes ( )** **No ( )**

RECEIVER	ISSUER
Date: ..... Time: ..... Hr.	Date: ..... Time: ..... Hr.
Name:	Name: .....
Designation:	Designation: .....
Signature:	Signature:

11. 'Medical Check Up Form' of workman engaged by the contractor to work at height' to be submitted by the contractor to get 'Work at Height Permit'.

"FORM"
FORM FOR MEDICAL CHECK UP FOR THE WORKMN ENGAGED BY THE CONTRACTOR TO 'WORK AT HEIGHT'

Certified that I _____ have examined Shri _____ Age _____ Yr who has signed below in my presence. The details of his examination as required are given in the enclosed medical examination report. I certify that all clinical and pathological tests were done in my hospital / dispensary under my instructions and I find him fit. General and physical examinations of Shri do not reveal any abnormality. He does not suffer from any acute/chronic skin disease or any contagious or infectious disease. He is medically fit to work at height of 2 M and more since he is free from Vertigo, Epilepsy or Fits, general giddiness and height related disease. His B.P., Pulse, Eye sight etc. are normal.

In myopinion Shri _____ is physically and mentally fit for job.

Signature of the workmen:

Date:

Signature and Rubber Stamp of Medical Practitioner with Name

NOTE — This certificate is to be given on the letter head of the registered medical practitioner who is possessing allopathic qualification as recognized by the Indian medical council. Below the signature, the rubber stamp of the medical practitioner should be affixed. The letter head normally should contain the following:

Name of the medical practitioner: .....

Qualifications: .....

Registration Number: .....

Designation: .....

Address: .....

12. Personal Protective Equipment

Sl. No.	ADDITIONAL PPE TO BE USED IN ADDITION TO STANDARD PPE	TICK (✓) MARK
1.	Safety Helmet	
2.	Safety Shoes	
3.	Full Body Safety Harness with lifeline	
4.	Others (Specify)	

13. Permission Given: Yes ( ) No ( )

RECEIVER	ISSUER
Date: ..... Time: ..... (am / pm)	Date: ..... Time: ..... (am / pm)
Name:	Name: .....
Designation:	Designation: .....
Signature:	Signature:

14. REVALIDATION AND RENEWAL REQUEST

By executor, the job is not taken up or not completed within the same shift. The permit may be Revalidation / renewal

Date: _____ Time: _____ Hr. **SIGNATURE OF EXECUTOR**

15. CLOSING OF THE WORK PERMIT

Issuer: Verified that job has been completed and area cleared, and is safe from any hazards.

Date: ..... **RTime:** ..... Hr.

Name and Designation: .....

Signature:

Annexure-5

ELECTRICAL WORK PERMIT

ELECTRICAL ISOLATION / ENERGISATION PERMIT

[High Tension (HT) / Low Tension (LT)]

Sl. No._____

Electrical Isolation / Energization Permit (HT / LT)	De-Energize Clearance Certificate for HT / LT equipment	Re-Energize clearance certificate for HT / LT Equipment
(To be filled by operation-in- charge of working area on receipt of job completion **Certificate-PART-I &** II)	(To be filled by operation-in- charge of working area)	(To be filled by operation-in-charge of working area)
a) Unit:	a) Unit: ..... b) Equipment Tag No. _____ c) Date: _____ d) Equipment not in operation: _____ e) Requirement emergency..... f) Ordinary ..... LOTO operation performed on "Local Switch" Kindly de-energize the above equipment	a) Unit: ..... b) Equipment Tag No. _____ c) Date: _____ d) Requirement Emergency..... e) Ordinary_____ f) All locks & tags removed ..... g) Equipment earthing found intact ..... h) All clearances returned with jobb completion certificates .....
Equipment Tag No.	Date..... Name..... (To be filled by operation-in- charge of working area) Time: ..... Hr. Designation: ..... α) **Signature:**	All tools, equipment, manpower and unused materials have been removed and surrounding area of the said equipment has been cleaned. Kindly energize the above equipment.
De-energized on..... Date: ..... Time: ..... Hr. Name: ..... **Signature**:		Date..... Name..... (To be filled by operation-in-charge of working area) Time: ..... Hr. Designation: ..... **Signature:**
Name:	**JOB ISOLATION CERTIFICATE** (To be filled by authorized person of electrical operation)	**JOB CERTIFICATE COMPLETION** (To be filled by authorized person of electrical operation)
Signature:	**The equipment de-energized after performing following checks / activities;** Isolation device is Sl. No. ..... and it's ID..... YES..... NO..... N/A..... a) Equipment not in operation b) All back feeding circuits isolated c) Control supply switched off d) Space heater supply switched off e) Breaker/MCC put off and	**The equipment energized after performing following checks/ activities :** YES..... NO..... N/A ..... a) Damaged internals of breaker/ MCC rectified b) Temporary safety ground's removed c) IR value of cable / equipment: Checked-found O.K. d) Each lid/cover of breaker boxed up e) All LOTO of isolating device removed
Energized on: ..... Date: ..... Time: .....Hr	f) Breaker racked out g) Control fuse pulled out h) Power fuse pulled out its	f) Control fuse put back in place g) Power fuse put back in place h) Breaker control plug put back on base

Name: …… Designation: …… **Signature:**	a) Back lid of breaker panel and opened b) Breaker / MCC visually checked c) Line discharged and voltage test done d) Temporary safety ground provided e) Breaker / MCC back / front lid closed f) LOTO performed on Breaker / MCC Date: ……Name: …… Time: …… Hr. Designation: …… **Signature:**	i) Breaker checked in test position found OK. j) Trip circuit found healthy k) Breaker racked in to service position l) Control supply switched on m) Space heater supply switched on n) Breaker / MCC Module front door closed. o) MCC [MCC module] switched on Date: ……Name: …… Time: …… Hr. Designation: …… **Signature:**

1. Personal Protective Equipment

Sl. No.	ADDITIONAL PPE TO BE USED IN ADDITION TO STANDARD PPE	TICK (✓) MARK
1.	Safety Helmet	
2.	Electrical Safety Gloves	
3.	Full Body Safety Harness	
4.	IS:15652 Mark Rubber Met	
5.	Others (Specify):	

2. Permission Given: Yes ( ) No ( )

RECEIVER	ISSUER
Date: …… Time: …… (am / pm)	Date: …… Time: …… (am / pm)
Name: ……	Name: ……
Designation: ……	Designation: ……
Signature:	Signature:

3. REVALIDATION AND RENEWAL REQUEST

By executor, the job is not taken up or not completed within the same shift. The permit may be Revalidation / renewal

Date: _____ Time: _____ Hr. **SIGNATURE OF EXECUTOR**

4. CLOSING OF THE WORK PERMIT

Issuer: Verified that job has been completed and area cleared, and is safe from any hazards.

Date: …… Time: …… Hr.

Name and Designation: ……

Signature:

15 Safety Audit Checklist

15.1 Introduction

Use of safety audit checklist provides following benefits;

- Checklists help to ensure that safety audits are conducted in a consistent and thorough manner, regardless of who is performing the audit. This reduces the risk of errors or omissions and
- Checklists help to streamline the safety audit process, making it more efficient, effective and increased efficiency.
- Checklists provide a record of what was inspected and the findings of the audit. This documentation can be used to track corrective actions and progress over time.
- In addition to above benefits, safety audit checklists also help organizations to comply with regulatory requirements and improve their overall safety culture.

  Safety audit checklists are a valuable tool for improving safety in any organization. Here are some examples of how safety audit checklists can be used:

  - To ensure that all required safety equipment is in place and working properly.
  - To identify and correct potential hazards in the workplace.
  - To verify that employees are properly trained on safety procedures.
  - To monitor compliance with Occupational Health & Safety (OH&S) regulations.
  - To track progress on corrective actions.

15.2 Master Safety Audit Checklist as per IS: 14489 – 2018

Sl. No.	Description	Present Status
1.	**Occupational Health & Safety (OH & S) Policy**	
1.1	Does the plant has Health & Safety or HSE or SHE Policy	
1.2	Does the organization have a corporate Safety policy	
1.3	Signatory of Safety policy	
1.4	As per statutory guideline Safety Policy is prepared	
1.5	When Safety Policy is declared & adopted	
1.6	How many times it has been updated till date?	
1.7	Is the SP is made known to all concerned?	
1.8	Is SP scrutinized by an expert external agency?	
1.9	What is the last date of updating of Safety Policy?	
1.10	Does it find a place in company's annual report?	
2.	**Safety & Health Organization (A) Safety Department**	
2.1	Safety department existing	
2.2	If yes, a) Head of Safety Dept.- Name, Designation,	
2.3	Qualification, Status	

Sl. No.	Description	Present Status
2.4	b) Safety Dept. strength including Safety Officer and Staff	
2.5	Does Safety Head report to the Chief Executive	
2.6	How often Safety Officer are retrained in the latest techniques of Safety Management? Frequency	
2.7	What are the additional duties SO is required to do	
2.8	What is the power of SO regarding unsafe act and unsafe condition?	
3.	**(B) SAFETY COMMITTEE (S) (SC)**	
3.1	Does the Factory has Safety Committee? Their types, structure and terms of reference	
3.2	Is the tenure of the SC as per statute?	
3.3	Selection of SC elected or nominated	
3.4	Frequency of SC meet	
3.5	What are the subjects/ or the problem discussed in the meeting	
3.6	How are recommendations of the committee(s) implemented?	
3.7	Are the minutes of the safety committee(s) implemented?	
3.8	Are the minutes forwarded to the trade union(s) and chief executive and occupier?	
3.9	How the management and trade union are play their active roles in supporting and accepting the committee(s) recommendation(s)?	
3.10	How are the safety committee(s) members apprised of the latest developments in safety health and environment?	
4.	**(C) SAFETY BUDGET**	
4.1	What is the annual safety budget?	
4.2	How much percentage is this budget of the total turnover of the Company?	
4.3	How much budget has utilized till date?	
4.4	Is the safety budget adequate?	
4.5	How is the safety budget arrived at?	
4.6	What is the pattern of expenditure for the last five years?	
4.7	What are approved sanctions for the expenditure in this budget?	
4.8	Does this budget get reflected in the annual report of the company?	
5.	**ACCIDENT REPORTING, INVESTIGATION AND ANALYSIS**	
5.1	Whether accident data for the last three years for reportable and non-reportable accident available?	
5.2	Is there any system of classifying and analysing the near-miss incidents and accidents? Give the details.	
5.3	Are all near-miss incidents and accidents reported and investigated?	
5.4	For how many years are the investigation report retained?	
5.5	By whom the accident statistics and data are maintained?	
5.6	How is the management apprised of these data?	
5.7	Is the accident statistics effectively utilized?	
5.8	What nature of injuries occurred during last three years?	
5.9	How do you ensure implementation of the recommendations to avoid the recurrence of the incidents and accidents?	

Sl. No.	Description	Present Status
6.	**SAFETY INSPECTIONS**	
6.1	What type of safety inspections are carried out and what are their frequency?	
6.2	Is there any system of internal inspection?	
6.3	Who does the inspections?	
6.4	Are the check-list prepared for these inspections? (Specify item-wise, e.g. House Keeping, fire protection, etc.).	
6.5	To whom the recommendations are submitted?	
7.	**SAFETY EDUCATION AND TRAINING (A) Training**	
7.1	Is there any training department?	
7.2	Is there any program of induction training?	
7.3	Mention the duration of induction training for each category of employees	
7.4	Whether the assessment of the trainee worker is done?	
7.5	What infrastructure facilities with audio-visual support are available for training?	
7.6	Do the programs cover the plant safety rules, hazard, communication and any other special safety rules or procedures unique to the plant or specific departments?	
7.7	Whether the training programs are conducted in the local language?	
7.8	Whether visits to safety institutions / organizations are arranged?	
8.	**(B) Periodic Training / Retraining**	
8.1	Are all the employees trained and what is the frequency of such training?	
8.2	Do training programs cover safety and health aspects and if so how many sessions?	
8.3	Do the trained supervisors train their own employees in safety and health aspects?	
8.4	Is the retraining performed whenever new hazard / process changes are followed / introduced?	
8.5	How are the senior management personnel trained in safety and health?	
8.6	How many employees have been trained in safety and health in the last five years? Give break up?	
8.7	How may man-days / hours are used in training the employees?	
8.8	How do you ensure that the training is put to use by the employees trained in safety and health.	
8.9	What is the training plan for next two years? Give details?	
8.10	What documentation system has been established regarding safety and health training?	
8.11	Does the factory has safety suggestion schemes?	
8.12	Does your factory participate in National Awards / Suggestion schemes?	
8.13	Has your factory been awarded during last five years?	
8.14	Are safety contest organized in the factory?	
8.15	What are the publications of your organization? Do they include information on safety and health subjects?	
8.16	Is the literature on safety and health made available to the employees?	

Sl. No.	Description	Present Status
8.17	How is the safety and health publicized in your factory? i) Bulletin boards ii) Post serious accidents iii) Newsletter iv) Others, specify	
8.18	Does the organization celebrate safety day / week or organize safety exhibition?	
8.19	When was the last safety day / week celebrated?	
8.20	Are adequate number of first aid boxes provided? Give locations details?	
8.21	Is there any first aid / ambulance room?	
8.22	Are qualified / trained first aider available in each shift?	
8.23	How many qualified / trained first aider are available?	
8.24	How many persons are trained /given refreshers training in first aid in a year?	
8.25	Whether occupational safety and health centre is provided or not?	
8.26	Does it confirm to the provisions of the existing legislation	
8.27	Are the Medical Attendants / Doctors available in each shift?	
8.28	Is ambulance van available in each shift?	
8.29	Any liaison with the nearest hospital (s)? Give details.	
	GENERAL WORKING CONDITION	
9.	**(A) House Keeping**	
9.1	Are all the passages, floors and the stairways in good condition?	
9.2	Do you have the system to deal with spillage?	
9.3	Do you have sufficient disposable bins clearly marked and whether these are suitably located?	
9.4	Are drip trays positioned wherever necessary?	
9.5	Do you have adequate localized extraction and scrubbing facilities for dust, fumes and gases? Please specify.	
9.6	Whether walkways are clearly marked and free from obstruction?	
9.7	Do you have any inter-departmental competition for good housekeeping?	
9.8	Has your organization elaborated good housekeeping practices and standards and made them known to the employees?	
9.9	Are there any working conditions which make the floors slippery? If so, what measures are taken to make safe?	
9.10	Does the company have adequate measures to suppress polluting dust arising our from road transport?	
9.11	Are there any machine/processes generating noise. Specify?	
9.12	Was any noise study conducted?	
9.13	Which are the areas having high-level noise?	
9.14	Have engineering and administrative controls been implemented to reduce noise exposure below the permissible limits?	
9.15	Is there a system of subjecting all those employees to periodic audiometric test who work in high level noise areas?	
9.16	Whether the workers are made aware of the ill effects of high noise?	
9.17	Whether any personal protective equipment along with ear muffs / plugs are provided and used?	

Sl. No.	Description	Present Status
10.	**(B) Ventilation**	
10.1	Whether natural ventilation is adequate or not?	
10.2	Whether dust / fumes / hot air is generated in the process?	
10.3	Is there any exhaust dilution, ventilation system in any section(s) to check the record?	
10.4	Whether any ventilation study has been carried out in the section(s) to check the record?	
10.5	Are periodic / preventive maintenance of ventilation system carried out and record is maintained.	
10.6	Does any ventilation system recirculate the exhausted air in work areas?	
10.7	Is the work environment assessed and monitored?	
10.8	Whether personal protective equipment are given to workers exposed to dust / fumes and gases? Give details.	
11.	**(C) Illumination**	
11.1	Was any study carried out for the assessment of illumination level?	
11.2	Is there any system of periodical cleaning and replacing the lighting fittings / lamps in order to ensure that they give the intended illumination levels?	
11.3	Are the workers subject to periodic optometry test and records maintained?	
12.	**Hazard Identification and Control**	
12.1	Are all the hazardous areas identified?	
12.2	What are the types of hazards (physical-noise, heat, etc. and chemical-fire, explosion, toxic release etc.)?	
12.3	What steps have been taken to prevent these hazards?	
12.4	Are there any safety inter-locks, alarms and trip systems? Give details	
12.5	Are these tested periodically? How often? Please specify.	
12.6	Are there any ambient monitoring devices with alarm for leakage of hazardous materials?	
12.7	Are there audit of HAZOP or any other studies carried out and the recommendations implemented?	
12.8	What has been the major modification done in plant / process and has the approval of the competent authority concerned?	
12.9	What decision and monitoring equipment are available and used for checking the environmental conditions in and around the plant?	
	TECHNICAL ASPECT	
13.	**SAFE OPERATING PROCEDURES (SOP)**	
13.1	Are written safe operating procedures available for all operations?	
13.2	Whether the SOP are prepared jointly by the plant and safety departments?	
13.3	What system is used to ensure that the existing SOP is updated?	
13.4	Have the workers been informed of the consequence of failure to observe the SOP?	
13.5	Are contractor workers educated & trained to observe safety at workplace?	
13.6	Whether contractor's workers are permitted on process / operations?	

Sl. No.	Description	Present Status
14.	**WORK PERMIT SYSTEM**	
14.1	What necessary type of work permits exists in your factory?	
14.2	What are the hazardous chemicals handled?	
14.3	Are the keys kept for individual locks which are used for electrical lock outs with the supervisor concerned?	
15.	**WASTE DISPOSAL SYSTEM**	
15.1	Is identification done for various types of wastes? Give details	
15.2	Are these quantities less than those specified by the Hazardous wastes? (Management & Handling) Rules, 1989	
15.3	What are their disposal modes?	
15.4	What is the system / measures adopted for controlling air / waste / land pollution?	
15.5	What is the system of effluent treatment plant and whether it is approved by the competent authority?	
15.6	How are the treated effluent used?	
16.	**PERSONAL PROTECTIVE EQUIPMENT (PPE)**	
16.1	Has a list of required PPE for each area / operation been developed and the required PPE is made available to the workers?	
16.2	Are the safety department & the workers consulted in the selection of PPE?	
16.3	Have the workers been trained in proper use of PPE?	
16.4	What is the system of replacement / issue / of PPE?	
16.5	What is the arrangement for safe custody and storage of PPE provided to the workers?	
16.6	Are the contractor's workers provided with the required PPE? Who is responsible? Give details.	
16.7	Are the PPE confirming to any standard?	
16.8	Give the details of PPE and also specify the responsibility for their inspection and maintenance?	
17.	**FIRE PROTECTION**	
17.1	Indication on a plant layout the location, number (quantity) and type of portable fire extinguishers available?	
17.2	Are the firefighting system and equipment approved, tested and maintained as per relevant standard?	
17.3	What is the inspection & maintenance schedule of the above extinguishers? Who performs these functions?	
17.4	Which areas of the plant are covered by the fire hydrants? Indicate the locations of hydrant points and how the required pressure maintained in the system and ensured.	
17.5	What is the capacity of water reservoir for supply to the hydrants? What is the source of water?	
17.6	i) How is the power supply to the hydrant pump ensured? ii) What is the alternate source of supply in case of power failure?	
17.7	Are all personnel conversant with the fire prevention and protection measures?	

Sl. No.	Description	Present Status
17.8	What Percentage of plant personnel & staff and officers, have been trained in the use of portable fire Extinguishers?	
17.9	Do you have fixed or automatic fire fighting installation(s) in any section of your plant?	
17.10	Are the fire alarms adequate and free from obstruction?	
17.11	Do you have fire dept.? If yes, give details	
17.12	What is the system for conducting mock drills?	
17.13	Do you have any mutual aid scheme with any of your neighbouring industry or local organizations(s)?	
17.14	Give details of the existing fire resistant walls and doors	
17.15	Do you have any system of color coding for all the pipelines for hazardous chemical? Give details including marking of flow direction.	
17.16	Are there any safe containers for the movement of small quantities of hazardous chemicals? Give details	
17.17	Are all self-closing fire doors in good condition and free from obstructions?	
17.18	How many major and minor incidents/fires were there in the factory during last five years? Give department / Plant wise.	
17.19	Have all the fires / incidents been investigated and corrective actions taken?	
18.	**EMERGENCY PREPAREDNESS**	
18.1	Is there an on - site emergency plan for your factory?	
18.1	What is the frequency of conducting mock drill of on - site emergency plan?	
18.2	What are the number & location of emergency control centre, assembly points?	
18.3	Whether emergency team or the key personnel identified?	
18.4	Are suitable & adequate protective & rescue equipment available? How is the emergency rescue team trained to use these equipment?	
18.5	How is the emergency communications with local bodies & other organizations ensured?	
18.6	Is any alternate power source identified?	
18.7	What is the medical emergency response system?	
18.8	Are you a member of any MUTUAL - AID - SCHEME of your area?	
18.9	How many emergency alarm system(s) is / are available?	
19.	**PLANT LAYOUT & AREA CLASSIFIACATION**	
19.1	What is the system of classification of hazardous zones in the plant for electrical installations?	
19.2	Whether a qualified person does periodic inspections and preventive maintenance of electrical installations & records in maintained?	
19.3	Whether plant layout with area classification has been displayed at appropriate place(s)?	
20.	**STATIC ELECTRICITY**	
20.1	Whether the process(s) & equipment generate & accumulate static charge have been identified? Give details.	
20.2	Whether all such equipment are properly bonded & earthed?	

Sl. No.	Description	Present Status
20.3	Are Periodic inspections done and recorded.	
20.4	Are adequate arrangements made at the terminal points where hazardous chemicals are handled through pipes?	
20.5	Are anti-static charged devices fitted wherever necessary?	
20.6	Have all the fires / incidents been investigated and corrective action taken?	
21.	**PRESSURE VESSELS (FIRED & UNFIRED)**	
21.1	Give details of the plants, piping & Vessels / Pressure greater than the atmospheric pressure?	
21.2	How is it ensured that the working pressure inside the pressure vessels / pressure for which it is designed?	
21.3	What means of isolating the pressure vessels or means to prevent rise in pressure are installed?	
21.4	What standards / codes of practices are adopted for design, fabrication, operation & maintenance of the pressure vessels & records maintained?	
21.5	How are the pressure vessels tested?	
21.6	Is there any competent person for testing these pressure vessels?	
21.7	Give details of safety devices available for these pressure vessels?	
21.8	Whether log book for pressure vessels & pressure plant has been maintained?	
22	**NEW EQUIPMENT REVIEW**	
22.1	What is the system for effecting any change in the existing plant equipment or process? Whether it is approved by the appropriate competent authority?	
22.2	Whether Piping & Instrumentation diagram & other related documents are updates accordingly?	
23.	**LIFTING MACHINES & TACKLES**	
23.1	Whether all the lifting machine are marked with SWL?	
23.2	Are all the examinations & tests documented in the prescribed form?	
23.3	Are all the examinations & tests carried out & certified by competent person? Give details.	
23.4	Are adequate lifting tackles provide at all places where it is required? Give details.	
23.5	Are the trained operators engaged for operating the equipment? Give details.	
23.6	What is the system of training such operators?	
23.7	Are all the lifting machine & tackles are maintained in good condition & record maintained?	
24.	**MOBILE EQUIPMENT 7 VEHICULAR TRAFFIC**	
24.1	Are all the mobile equipment are in good condition?	
24.2	Are trained drivers engaged for fork lift trucks?	
24.3	What is the system for identifying these drivers from other drivers?	
24.4	What system do you adopt to access their standard driving as poor/fair/ satisfactory/good?	
24.5	Are there adequate number of signs & signals?	
24.6	Are the hazards associated with transportation within the plant identified & safety measures taken? Give details.	

Sl. No.	Description	Present Status
25.	**ACCESS**	
25.1	Is adequate safe access provided to all places there workers need to work?	
25.2	Are all such access in good condition?	
25.3	Are portable access platforms necessary? If yes:	
25.4	i) Are these sufficient?	
25.5	ii) Are these regularly inspected?	
25.6	iii) Are these provided with toe-boards and railings?	
25.7	Are all drain covers in good condition & fitting flush?	
26.	**MATERIAL HANDLING**	
26.1	Are these adequate storage facilities available?	
26.2	Are these areas clearly defined?	
26.3	Are all racks & steel ages in good condition?	
26.4	Have you adequate equipment for handling materials?	
26.5	Do the workers know the hazards associated with manual material handling?	
26.6	Where manual handling is necessary, are the workers been trained	
26.7	Do they practice this?	
26.8	Do Workers follow safe procedures for storage of materials?	
26.9	Whether contractor workers are trained in safety?	
26.10	What is the system for handing over plant to the maintenance department & receiving back?	
26.11	Is the system consistently applied?	
26.12	What is the system for the preventive & predictive maintenance & how do you ensure its effectiveness? Give details.	
27.	**TANK STORAGE VESSEL AREA**	
27.1	Whether it is pressure vessel or not?	
27.2	Give storage vessels designation (exceeding threshold quantities specified in MSIHC. Rules 1989)	
27.3	Give the names of storage materials in each of them.	
27.4	What are the vessel sizes (capacity of tones)?	
27.5	What is the material of construction for each vessel & what standards followed in designing fabricating the vessel?	
27.6	What are the operating pressure & temperature?	
27.7	What are the vessels location? (please indicate on-site plan or plot plan)	
27.8	Indicate whether vessels are above ground/ underground?	
27.9	If any of the tanks storing flammable material, whether	
27.10	Electrical installations are flameproof or not?	
27.11	Are these storage vessels bunded / dyked?	
27.12	If yes, what is the capacity of the bunds/dykes?	
27.13	Are the vessels isolated in the event of a mishap?	

Sl. No.	Description	Present Status
27.14	How are the vessels isolated in the event of a mishap?	
27.15	Are the vessels fitted with remotely controlled isolation	
27.16	Are vessels provided with emergency vent relief valve, bursting disc, level indicator, and pressure gauge overflow line?	
27.17	Where such do vents discharge?	
27.18	Are the vessels provided with alarms for high level, high temperature & high pressure?	
27.19	Are stand by empty tanks provided for empty in case of emergencies?	
27.20	What are the provisions made for firefighting / tackling emergency situations around the storage vessels?	
27.21	Has any consequence analysis been carried out for these vessels? (If yes give details).	
27.22	What periodical testing is carried out on the vessels to find out the integrity of the vessels?	
27.23	Whether these tests are certified by the approved competent persons?	
27.24	Whether log sheets are filled up on daily basis for recording the parameters of these vessels?	
27.25	On-Site Gas Cylinders Storage Area	
27.26	What are the various gas cylinders used in the plant? Give details.	
27.27	What are the storage facilities?	
27.28	What are the measures taken for combating any emergency in the cylinders storage area?	
27.29	Are valid licenses available for storing all these cylinders?	
27.30	Whether public address system is checked periodically for its proper functioning?	
28.	**COMMUNICTION SYSTEM ADOPTED IN PLANT**	
28.1	Are public address system available in all plant areas?	
28.2	Are public address system provided with uninterrupted power supply?	
28.3	Whether public address system is checked periodically for its proper functioning?	
28.4	Is there any hot line provided to fire station?	
28.5	What is the means of communicating emergency in the plants?	
29.	**TRANSPORTATION**	
29.1	What potentially hazardous materials are transported to or from the site (Including Wasters)?	
29.2	What modes of transport are used?	
30.	**ROAD**	
30.1	Does the company employ licensed vehicle of its own/ outside sources?	
30.2	Are loading/unloading procedures, on-site & safety precautions displayed?	
30.3	Are loaded tankers or trucks parked in a specific area, on-site?	
30.4	Do all trucks & tanker drivers carry TREM card or instruction booklet?	
30.5	Do all truck & tanker drivers get training in handling emergencies during transport?	

Sl. No.	Description	Present Status
31.	**RAIL**	
31.1	What hazardous materials are transported by rail?	
31.2	Does the company have a direct siding on site?	
31.3	Are tankers or others wagons used in transportation?	
31.4	PIPELINES	
31.5	What materials are transported to & from the site by pipeline?	
31.6	Are the pipelines underground or over ground?	
31.7	Are corrosion protection measures employed to the pipelines?	
31.8	Whether intermediate booster pumps are used?	
31.9	What the maximum, minimum & average transfer rates?	
31.10	Are the pipelines extended in the public domain?	
31.11	Are the pipelines dedicated for each type of chemicals?	
31.12	Are the pipelines fitted with safety equipment such as leak detectors, automatic shut off walls etc.	
31.13	What is the frequency & method of testing pipelines?	
31.14	Is there written procedures for tacking leakages in pipelines?	

15.3 THDCIL Safety Audit Checklist

15.3.1 Common Checklist for all THDCIL Power Plants / Projects

<table>
<tr><th>Sl. No.</th><th>Elements to be checked during audited</th><th>Section (S) Rule (R)</th></tr>
<tr><td>1.</td><td>Accredited for;
a) ISO 9001 – 2015, Quality Management System (QMS)
b) ISO 14001-2018, Environmental Management System (EMS)
c) ISO 45001 – 2018, Occupational Health and Safety Management System</td><td></td></tr>
<tr><td>2.</td><td>Strength of the Plant / project
<table>
<tr><th>Sl. No.</th><th colspan="2">Strength</th></tr>
<tr><td>1</td><td>THDC Employee</td><td></td></tr>
<tr><td>2</td><td>Contract Workers</td><td></td></tr>
<tr><td colspan="2">Total</td><td></td></tr>
</table></td><td></td></tr>
<tr><td>3.</td><td>Registration of establishment to submit information relating to employment of Inter-state Migrant Worker accompanied by fee within 60 days</td><td>R-3/2020</td></tr>
<tr><td>4.</td><td>License and Registration of Factory (Form-4)</td><td>S-6 / R-7</td></tr>
<tr><td>5.</td><td>Registration of Establishment under BOCW (the Building and Other Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996 & Central Rules, 1998)</td><td>S-7 / R-7</td></tr>
<tr><td>6.</td><td>Notice of Opening of Mine (Form-I) (Coal Mines Regulations, 1957)</td><td>S-16 / R-4</td></tr>
<tr><td>7.</td><td>Petroleum License under Petroleum Rules-2002
a) Petroleum Class-A: Capacity: KL Valid up to:
b) Petroleum Class-B: Capacity: KL Valid up to:
c) Petroleum Class-C: Capacity: KL Valid up to:</td><td>R-141</td></tr>
<tr><td>8.</td><td>Fire NOC ‘No Objection Certificate’ under Approval of Plan</td><td>S-6/R-3(1g)</td></tr>
</table>

Sl. No.	Elements to be checked during audited	Section (S) Rule (R)
9.	**Notification of Occupier**	S-3(n)
10.	**Notification of Employer** (under BOCW Act, 1996)	2 (i)
11.	Notification of Owner under the CEA Regulation, 2011	2 (c)
12.	Notice of Manager **(Form-4A)**	R-14C / D
13.	a) **Drinking Water** Monitoring (Twice a year) Under Factories Act/State Rules b) Drinking Water Point should not be within 6M of Urinal, BOCW Act c) Drinking Water Point Should not be within 6M of Urinal, Mines Act, 1952	S-18 / R-38 S-32 S-19
14.	**Health & Safety Policy** (S-40 of BOCW Act) and Factories Act, 1948	S-7A(3)/R-63B
15.	a) **Constitution of Safety Committee**, Factory Act and State Rules b) Constitution of Safety Committee, (BOCW Act, 1996) c) Constitution of Safety Committee, (CEA Regulation,2011)	S-41/R-62B S-38 R-6
16.	**Nomination of 'Electrical Safety Officer'** (CEA Regulation, 2010)	R-5
17.	**Inspection of electrical installation** (CEA Regulation, 2010)	R-43
18.	**First-aid boxes** (BOCW Rule-231)	S-45 / R-66
19.	**Ambulance Van**	R-63K
20.	**Occupational Health Centre**	R-63J
21.	**Ambulance Room** (BOCW Rules, R-227, Schedule-V)	S-45 / R-67
22.	a) **Medical Examination of Factory workers engage in hazardous process** b) **Medical Examination of Building workers** (BOCW Central Rules) c) Medical Examination of Power Plant Workers (CEA Regulation, 2011)	S-41C/R-63H R-81 & R-223 R-5
23.	**Testing and Examination of Pressure Plant / Vessels** (BOCW Central Rules)	S-31/R-56 R-207
24.	**Testing and Examination of Hoist / Lifting Machines** a) Hoists b) Lifts and Lifting Tackles (BOCW, R-56)	 S-28/R-55 S-29/R-55A
25.	**On-site Emergency Plan** (Factory Act & CEMA Rules, 1996) (CEA Regulation, 2011) **Emergency Action Plan** (BOCW Central Rules) (a) Fire and explosion; (b) Collapse of lifting appliances and transport equipment; (c) Collapse of building, sheds or structures, etc.; (d) Gas leakage or spillage of dangerous goods or chemicals; (e) Drowning of building workers sinking of vessels; (f) Landslides worker buried, floods, storms, natural calamities; and (g) Electrocution	R-13 R-9 R-36
26.	**Mock Drill Observation**	
27.	**Work Permit System**	
28.	**MSDS**	R-63C
29.	**Consolidate Consent to Operate and Authorization, under EPA, 1986** - The Water (Prevention and Control of Pollution) Act, 1974 - The Air (Prevention and Control of Pollution) Act, 1981; and - Hazardous Waste (Management, Handling & Transboundary) Rules, 2008	
30.	**Authorization of Biomedical Waste** (Bio Medical Waste Mgt. & Handling) Rules, 2016	R-10

Sl. No.	Elements to be checked during audited	Section (S) Rule (R)
31.	**National Ambient Air Quality Monitoring** [Environmental (Protection) Rules, 1986]	R-3(3B) Sch-VII
32.	**Ambient Air Quality Standard Monitoring in respect to Noise** [Environmental (Protection) Rules, 1986]	R-3(3B) Sch-III
33.	**Work Zone Noise Monitoring** (Factories Act, 1948)	S-7A
34.	**D.G. Set Noise Monitoring** [Environmental (Protection) Rules, 1986]	
35.	**D.G. Set Stack Monitoring** [Environmental (Protection) Rules, 1986]	
36.	**Emergency Preparedness to manage SF6 emergency incident**	
37.	**Fire Safety Measures** a) Automatic Fire Dampers in AC/AHU Ducts b) Periodical Test Record of Smoke Detectors c) Availability of SCBA Sets and Training in donning SCBA Set d) Availability of Fire Extinguisher e) Training of persons in use of fire extinguishers	S-38 / R/63
38.	**Display of safety signage and Emergency Escape Route**	
39.	**Earthing Pits' Identification and Testing record**	

15.3.2 Thermal Power Station Related Safety Audit Checklist

1.	Registration of Boiler	
2.	Boiler Operation Engineer / Boiler Operator Certificate	
3.	Conveyor Belt Safety	
4.	Railway Safety	
5.	Safety in coal handling	
6.	Coal Dust Safety Measures	
7.	Coal yard fire safety measures	
8.	Safety in Storage and Handling of Hydrogen Gas	
9.	Safety in Handling and Storage of Chlorine Gas	
10.	Safety in Handling and Storage of HCl	
11.	Safety in Handling of ash	
12.	Ash disposal procedure	
13.	Safety measures in HSD Unloading Station *(Availability of Wheel Chock & Earthing arrangement of tankers)*	
14.	Fire Safety System in bulk HSD Storage / Pumping Station	
15.	Communication Systems including emergency communication	
16.	Fire Safety Measures in Control Room	
17.	Battery Bank Safety *(Eye Washer & Safety Shower installed and working)*	
18.	Training and awareness among workers in operation of fire safety	
19.	Road Safety Systems	
20.	Switch Yard LOTO System	
21.	Safety Work Permit	
22.	Housekeeping in Switch Yard	
23.	Display of 'Artificial Resuscitation Chart' in switchyard	

24.	Training of workers in CPR	
25.	Availability of Ambu Bag	
26.	Availability and use of PPE (Safety Helmet, Hard Toe Safety Shoes and Full Body Harness Safety Belt etc.)	
27.	Provision of emergency light in staircases	
28.	Testing record of 'Smoke Detectors' installed in Cable Galleries	
29.	Provision of Toe Board / Guards	
30.	Unsafe Floor Openings	
31.	Availability of MSDS of chemicals at points of their storage and/or use	
32.	Direction of flow markings on pipelines	
33.	Colour code of pipelines	
34.	Display of emergency communication numbers at important locations	
35.	Installation of 'Wind Soak'	
36.	Availability of Qualified Doctor in OHC	
37.	Number of Beds	
38.	Whether Bio-medical Waste is disposed of to an agency approved by SPCB.	
39.	Whether Hazardous Waste is disposed of to an agency approved by SPCB.	
40.	Record od submission of Annual Report on Form-5	

15.3.4 Hydro Power Station Related Safety Audit Checklist

1.	Safety measures in HSD Unloading Station *(Availability of Wheel Chock & Earthing arrangement of tankers)*	
2.	Fire Safety System in bulk HSD Storage / Pumping Station	
3.	Communication Systems including emergency communication	
4.	Fire Safety Measures in Control Room	
5.	Emergency Exits *(Displayed and Open Outward)*	
6.	Battery Bank Safety *(Eye Washer & Safety Shower installed and working)*	
7.	Training and awareness among workers in operation of fire safety	
8.	Road Safety Systems	
9.	Switch Yard LOTO System	
10.	Safety Work Permit	
11.	Housekeeping in Switch Yard	
12.	Display of 'Artificial Resuscitation Chart' in switchyard	
13.	Training of workers in CPR	
14.	Availability of Ambu Bag	
15.	Availability and use of PPE (Safety Helmet, Hard Toe Safety Shoes, High Visibility Jackets and Full Body Harness Safety Belt etc.)	
16.	Provision of emergency light in staircases	
17.	Testing record of 'Smoke Detectors' installed in Cable Galleries	
18.	Provision of Toe Board / Guards	
19.	Unsafe Floor Openings	
20.	Availability of MSDS of chemicals at points of their storage and/or use	
21.	Direction of flow markings on pipelines	

22.	Colour code of pipelines	
23.	Display of emergency communication numbers at important locations	
24.	Availability of Qualified Doctor in OHC	
25.	Number of Beds	
26.	Whether Bio-medical Waste is disposed of to an agency approved by SPCB.	
27.	Whether Hazardous Waste is disposed of to an agency approved by SPCB.	
28.	Record of submission of Annual Report on Form-5	
29.	Boat Safety Checklist - Registration and Fitness of boat - Insurance of passengers and Hull - Licence validity of boat operator - Availability of Dewatering Pump in good working order - Availability of First-aid Box - Availability of Drinking Water - GPS working in good condition - Horn - Lights - Maintenance of Visitors record on board - Axillary Light arrangement - High Visibility Life Jackets - Availability of Life Bouy - Fire Extinguisher - Storage of extra diesel - Availability of Sisal / Nylon Rope	

16 Working at Height

16.1 Role and Responsibility

- **Immediate Responsibility**

  Immediate responsibility to ensure safety for / during work at height shall be of the Site In-charge / Site Engineer and Contractors.

- **Ultimate Responsibility**

  Ultimate responsibility for compliance of applicable legal requirement shall be of the Head of Executing Department.

16.2 Legal / Statutory Requirements

- Sub-rule-3,5,6&7 of Rule-41,42 and Rule-46 of the Building and Other Construction Workers' (Regulation of Employment and Conditions of Service) Central Rules 1998.
- Point No.17 of Schedule-1 of Regulation-5 of the CEA (Safety Requirement for Construction, Operation and Maintenance of Electrical Plants and electric Lines) (Amendment) Regulations 2011.
- Section-32 of the Factories Act 1948 and rules made thereunder.
- Section 18(2f) (Second Schedule) of the Occupational Safety, Health and Working Conditions Code and Central Rules 2020.
- Following Standards of Bureau of Indian Standards;
  - IS 617 (1975) : Aluminium & aluminium alloy and castings for general engineering purposes
  - IS 1084 (1983) : Textiles - Manila Ropes
  - IS 1410 (1983) : Textile - Coir Ropes
  - IS 2750 (1964) : Steel Scaffoldings
  - IS 3337 (1978) : Ballies for general purposes
  - IS 3696-1 (1987) : Safety code of scaffolds and ladders, Part 1_ Scaffolds

16.3 "Vertigo Test" of all persons involved in height work

As per Rule-6 of the CEA (Safety Requirement for Construction, Operation and Maintenance of Electrical Plants and electric Lines) (Amendment) Regulations, 2022, "Vertigo Test" of all persons involved in height work shall be done before on the job placement and maintain records.

16.4 Work at Height

Work at height means; Work on or above 1.8 M height from the ground level and / or use of;

- Scaffolds
- Ladders

- Working platforms
- Fall arresting equipment
- Temporary stairs
- Suspended Jhoolas
- Floor openings

(a) Work in any place, including a place at or below ground level;

(b) Obtaining access to or egress from such place while at work, except by a staircase in a permanent workplace;

(c) Form where, a person can fall a distance liable to cause personal injury. Fall from height is a major cause of fatal / serious injuries. Following hazards are mainly associated with work at heights:

- Fall of person from height;
- Falling objects; or
- Fall from collapsing structures

16.5 The following points should be considered for working at height;

- Physical condition of worker e.g. age, physical fitness, height phobia and vertigo etc.;
- The activity to be carried out and equipment to be used;
- Location, e.g. near or over water body, road, under power lines etc.;
- Environment, e.g. weather, temperature, lighting etc.;
- Duration of the work; and
- Condition and stability of the work surfaces etc.

16.6 Scaffold

In all stages of construction sites from erection of masonry to the finishing stages, scaffolds are essential construction equipment which offer in them temporary platforms for carrying out all those works which cannot be conveniently and easily carried out either from ground floor or even with the use of a ladder. Scaffolds may be either swung from some point above the working level or built up to the required level from a firm not only for the security of the men employed on the scaffolds but also for the safety of those who may be working or passing below. The accidents from the scaffolds are generally caused either as a direct collapse of the scaffold or as a result of workmen or any material falling down from the top of the scaffold. Great care is, therefore, necessary in the erection, use and dismantling of scaffolds with respect to its various components with a view to bringing in confidence in the work· men who would be in a position to work safely and easily with greater productivity of work.

The scaffold may be constructed either of timber, ballies, bamboos or metal. Timber used in the construction of the scaffolds should be reasonably straight, sound, free from splits, shakes and large cracks, large knots, dry rot, worm holes and other prohibited defects conforming to **IS: 3629-1966**.

Ballies - Used in the construction of the scaffolds should be reasonably straight, sound, free from splits, shakes and large cracks, large knots, dry rot, worm holes and other prohibited defects conforming to **IS: 3337-1978.**

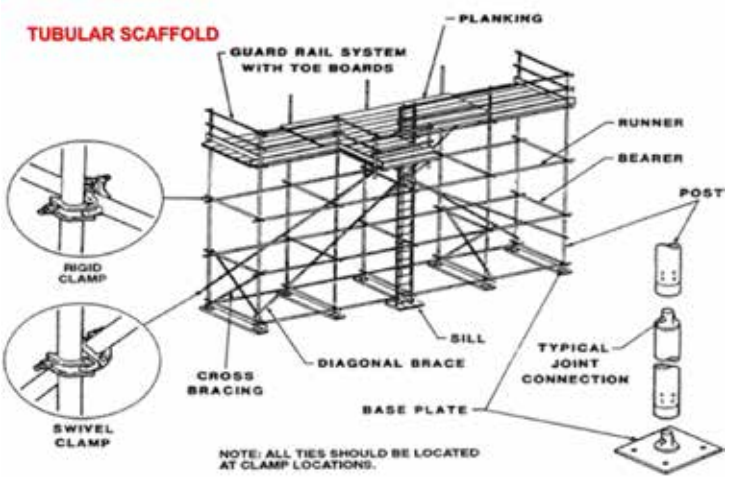
Bamboos used in the construction of the scaffolds should be reasonably straight, sound, and free from splits, knots dry rot, worm holes and other dangerous defects which tend to reduce the strength of bamboos.

Metal scaffolds shall conform to **IS: 2750-1964.**

Fastenings on timber scaffolds should be of steel bolts of adequate dimensions with washers and nuts, fiber rope lacings, adequate clamps, or other means approved by the competent authority. Nails shall not be used for transferring the principal load from one member to another.

TYPES OF SCAFFOLD

(a) Single Pole Scaffold



Single pole scaffold is a structure consisting of putlogs or bearers, the cut or ends of which are supported on standards or ledgers secured to a single row of standard and the inner ends resting on a wall. This is also known as a putlog scaffold.

Single pole scaffold (in bamboo) shall consist of one row of upright poles or standards fixed at a suitable distance from the wall at 1.8 m apart and connected horizontally by ledgers spaced vertically at 1.5 to 1.8 m centers. Cross members known as putlogs shall be spaced at 1.2 m (minimum centers, supported on ledgers on one side and their other ends placed in the holes left in the walls). As the construction or repair work is completed at the top of the structure, the putlog shall be drawn out and the holes left in the wall shall be filled up.

(b) Double Pole Scaffold

Double pole scaffold means a scaffold supported by two rows of standards connected together longitudinally by ledgers and transversally by transoms or bearers and suitably braced. For stone masonry buildings and for structures where other heavier materials of construction are used, a stronger scaffold shall be used. This shall consist of double scaffold, where two rows of standards shall be used; the inner row next to the wall and outer row at a distance of 1.2 to 1.5 m away from the wall. The putlog shall rest entirely on the scaffold ledgers.

(c) Timber Ballies or Bamboo Scaffold

Scaffolds may be single scaffold or double scaffolds for light duty or heavy duty as the case may be. The different components of these shall conform to the provisions laid down under single pole scaffold and double pole scaffold. The minimum dimensions in case of ballies shall conform to IS: 3337-1978.

(d) Outrigger (Cantilever) Scaffold

Outrigger scaffold means a scaffold, the platform of which is supported by outriggers or thrustouts projecting from the building, the inner ends of which are secured inside the building.

This type of scaffold is often used for cornice or other light work where it is not convenient to erect a built-up scaffold and where there are no accessible overhead supports. It consists essentially of a platform placed on horizontal thrustouts extending through window or other wall opening and anchored on the inside of the building.

(e) Trestle

Trestle/Ghoda means a self-supporting framework of timber or metal on which a working platform is laid.

Wooden trestles used for the support of working platforms shall be constructed of sound, straight-grained wood, of material not smaller than, the nominal sizes stated below:

Top horizontal members (up to 1200 mm in length)	:	75 mm X 100 mm
Legs (up to 1400 mm)	:	50 mm X 100 mm
Longitudinal brace between legs	:	25 mm X 140 mm
Gusset at top legs	:	25 mm X 140 mm
Diagonal braces	:	25 mm X 100 mm

A well designed trestle should have base width of about 600 mm (between the feet of the legs) and should be 1200 mm in length. The nailing of extension pieces to the legs of the trestle to increase the height shall be prohibited. Platform planking should be closely laid and the outside planks should be nailed to the bearers of the supporting trestle. The legs of the trestle should be suitably prevented from movement while in use. Not less than 55 mm planks shall be used for platforms and other requirements for platform shall be adhered to. The spacing of trestle which is to be used as a mason's or similar heavy work shall not be more than 2 m. For light duty work, it should not be more than 2.5 m. The trestle should rest on level and firm ground and not on loose bricks or tiles.

RAILINGS AND TOE BOARDS

- Railings should be considered as an essential part of every scaffold and should be provided for all working platforms higher than 2 m above the floor level.
- Standard railings may be constructed of wood, pipe or any other metal sections. The railings shall consist of a top rail from 900 to 1050 mm above the platform level and intermediate rail halfway between the top rail and the platform. The railings should be mounted on standards or uprights.
- The platform edges of every scaffold shall be equipped with toe boards to eliminate hazard of tools or other objects falling from the platform. Toe board shall be so placed that no opening remains between the flooring and the toe board. The sizes of the toe boards rails shall be as given in Tables 1 and 2 of IS: 3696 (Part 1)-1987.
- Where scaffolds are erected over footpaths or other areas over which persons work or pass under protection against hazard of falling objects is necessary. Under these conditions, it is necessary to enclose the space between the toe board and the top railing. The material used for enclosing the space will depend upon the working conditions. On scaffolds used for cleaning surfaces of buildings with chemicals or other corrosive agents, a suitable protective covering such as tarpaulin or PVC sheets, be used to protect persons working or passing near the scaffold from spillage of such liquids.

Note: Scaffold checklist Annexed.

MEANS OF ACCESS

A safe and convenient means of access should be provided to all platform level of scaffolds. Means of access may consist of:

(a) Ladders

Portable ladders are not recommended for flights above 4 meters. They should be placed at an angle of approximately 750 from the horizontal. Both top and bottom should be secured to prevent displacement, and the ladder rails should be extended at least 1 m above the top landing. Fixed ladders should be provided for flights above 4 meters. Fixed ladder should have landings of minimum 600 mm extent at intervals not greater than 6.0 meters. The width of ladder shall not be less than 300 mm and the rungs shall be spaced not more than 300 mm. All the ladders used for access to scaffolds should conform to the requirement of IS: 3696 (Part 2) – 1966.

Inspection and Testing of Ladders

(b) Ramps or gangways

Ramps or gangways are advantageous for access to scaffold platforms from hoisting towers or from adjacent floor levels, but are not practicable where there is appreciable difference in levels. Where used, they should be built to provide strength equal to that specified for scaffold structures and should not unduly rag under the corresponding dead or moving loads. If the ramp or runway is 1.5 meter or more above the ground or floor level, the open sides should be protected by standard railings and toe boards.

(c) Stairways

For scaffolds exceeding 4 m height, stairways are the safest means of access. The stairway shall conform to the following requirements:

- Treads and risers should be of uniform width and height in any one flight,
- Minimum width of stair should be 1.0 meter,
- Maximum angle of ascent 50 degrees,
- Stair railings on all open sides,
- Hand rails on all enclosed sides, and
- Standard railings and toe boards on all landings.

PROTECTION FROM FALLING BODIES

- To protect workers on lower platform against falling objects from higher levels, overhead protection should be provided on the scaffold. This protection should be not more than 3 meters above the platform/floor and should be planking or other suitable material.
- Where a scaffold is erected in an area where the construction activities may pose hazards to pedestrians or vehicular traffic nearby from the falling of objects, wire nets or screening nets should be used to envelope such scaffold.
- Supervisory staff, inspecting officials or such persons who have to go to the vicinity of the scaffolding should wear safety helmets within a zone of at least 10 meters to be protected from falling objects.

General safety requirement

- Scaffolding should be properly designed and braced by suitable horizontal members to ensure its stability. The following general safety measures should be taken;
- Scaffolds shall be used for all work that cannot be safely performed from the ground, or from solid construction. Every scaffold and every part thereof including supports shall be of good construction, suitable and sound material and having adequate strength for the purpose for which it is used. It shall be properly maintained. Construction and dismantling of every scaffold shall be done under the supervision of a competent authority. Boards and planks used for the platforms, gangways and runs shall be of uniform thickness, closely laid, and securely fastened in place.
- The erection, alterations and removal should be done only under the supervision of men who are thoroughly experienced in this work.
- The use of barrels, boxes, loose tile blocks or other unsuitable objects as supports for working platforms shall not be permitted.
- Every scaffold should be securely supported or suspended and shall where necessary be sufficiently and properly strutted or braced to ensure stability. The use of crosses braces or framework, as means of access to the working surface shall not be permitted.
- If scaffolds are to be used to a great extent or for a long period of time, a regular plank stairway wide enough to allow two people to pass shall be erected. Such stairways shall have handrails on both sides.

- Cantilever of scaffold planks should be avoided. Ledgers or putlogs should be erected to support the end of such planks.
- Men shall not be allowed to work from scaffolds during storms or high winds. After heavy rains or storm, the scaffolds should be inspected by the site-in-charge. Scaffolds should also be inspected every fortnight, during use, by him and again before starting use. Where the joints or members are found defective, the joint should be set right and member replaced.
- In case both light and heavy duty scaffolds are used in close vicinity, conspicuously placed notice boards shall indicate the light duty scaffolds and the limits on their usages.
- Scaffolds or other rigging involving- human safety, should be tested with a load at least three times that which it will carry in service.
- The safe working load and the number of workers to be employed in each bay of scaffold shall be displayed for the information of all workers employed at site.
- Access to fire alarms, cable tunnels, hydrants, etc, shall remain free at all times. Care should be taken for underground cables and equipment when parts of scaffolds or other fasteners have to be driven in the ground.
- Scaffolds on thorough fares shall be provided with warning lights, if general lighting is not sufficient to make it clearly visible.
- Care shall be taken to see that no part of a scaffold is struck by a truck or heavy moving equipment and no material shall be dumped against it.
- Care shall be taken against any possibility of timber scaffolds catching fire.
- The height of tower scaffold shall not be more than eight times of its base dimension and lashed to a building or a fix structure before use. No worker, tool or material shall remain on platform of scaffold when it is being shifted from one position to another position.
- Care shall be taken to see that no uninsulated electric wire exists within 3 meters of the working platform, gangways, runs, etc. of the scaffold.
- While carrying bars, rods or pipes of any kind conducting material of length greater than 3 meters, in the vicinity of electric wires, special care shall be taken that these do not touch the electric wires.
- Chains, ropes or lifting gears used for suspension of a scaffold shall be of adequate strength, made of sound material and suitable for the purposes of their use and maintained in good repairs.
- Trestle scaffold shall not be constructed with more than three tiers or if its working platform is more than 4.5 meters above the ground or floor or other surface upon which such scaffold is erected, such trestle scaffold shall be designed by professional engineer. Trestle scaffold shall not be erected on a suspended scaffold.
- No cantilever or jib scaffold shall be used unless it is adequately supported, fixed and anchored on opposite side of its support has out-riggers of adequate length and where necessary sufficiently supported and braced to ensure safety and stability of such scaffold.
- It shall be ensured that no suspended scaffold is raised or lowered by winches or climbers unless such scaffold is made of sound material, adequate strength and has been tested and certified safe for use of winches or climbers for such raising or lowering by a competent person before being taken into use.
- Suspended scaffold raised or lowered by the winces or climbers shall be provided at each of its suspension point with a safety rope with automatic safety device mounted on each of such rope.

16.7 Ladders Safety:

Every year in the construction industry more injuries are caused by ladder accidents. Many of these accidents involve falls resulting in serious injuries and fatalities. The following are major causes of accidents.

- **Missing the last step of the ladder when climbing down.**

  Exercise caution when climbing down a ladder. Always face the ladder when climbing up or down, and don't skip steps!

- **Overreaching while on the ladder.**

  When working from a ladder, keep your centre of gravity and body between the side rails. If you can't easily reach the project area once you have ascended the ladder, climb down the ladder and move the ladder closer to your project area.

- **The ladder was not the right size for the job.**

  One of the factors in determining the right ladder for the job is length. A good rule of thumb when selecting a ladder is to calculate a person's maximum reach height, which is approximately four feet higher than the height of the ladder.

- **The ladder was not on firm, level ground.**

  Clear trash, construction materials and other obstructions away from the base and top of the ladder. The base of the ladder should be safely secured to prevent accidental movement. You can also use a ladder with non-slip feet or add outriggers or levellers to the bottom of an extension ladder to increase the footprint.

- **Three points of contact were not used when climbing the ladder**

  Always maintain three points of contact – two hands and a foot, or two feet and a hand, when climbing up or down a ladder. This allows you to maintain your balance.

  Portable Ladders are used to give access to scaffolds and platforms..

Type of Ladders

1. **Single ladders**

   These are lean-to-ladders which have one section, their upper ends are supported by leaning against the walls or any rigid support.

2. **Extension ladders**

   These ladders have two or three sections and upper sections can slide in guides or brackets so arranged that the length can be varied as required.

3. **Step ladders**

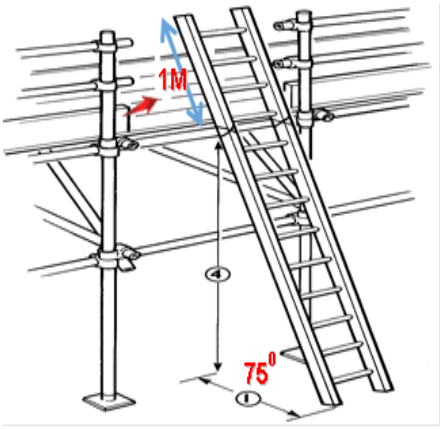
   These are self-supporting ladders hinged near the upper end with a spreader arrangement between the two sections.

4. **Rope ladders**

   These have ropes on either side instead of rigid side rails, pressing through bolts in the rungs, which are of planks.

Safety precautions to be observed

1. A ladder of sufficient length should always be selected for the work. In general the length should be such that the work can be performed from at least the fourth rung from the top.



2. Ladder should always be placed at the proper angle, which is indicated when the horizontal distance from the base of the ladder to a point directly below the upper support is about one fourth of the inclined length of the ladder i.e. ideally about 75 degree to the horizontal i.e., base to height ratio of 1:4.
3. Inspect ladder before use for any defect, cracks, dents, and missing rungs.
4. When using an extension ladder make certain that both locks are in good operating condition and engaged on to the rungs of the lower section.
5. Fall-arresting equipment such as ladder climbing devices or lifelines should be used when working from long fixed ladders or when climbing vertical fixed ladders.
6. Bottom end of the ladder is to be latched to a fixed object to prevent it from slipping. Otherwise another person should hold the base of the ladder while a man is at work on it. Latching upper end of the ladder to the structure will also prevent possible upset sidewise.
7. Metal ladders should not be used near exposed electrical equipment, including overhead distribution wires etc.
8. Short ladders should not be spliced to make a long ladder. While splicing is unavoidable, it should be done under supervision of competent person. Repairs / modification of the ladders should be carried out under supervision of a competent person.
9. Before use, ladders shall be tested for the loads they are intended to carry. No ladders having a missing/defective rung shall be used.
10. Stepladders should be used in fully open position and fixed with a safety-locking device.
11. The ladders should be of robust design and it should be inspected by a competent person from time to time. The defective ladders should never be allowed to be used.
12. Ladders should be stored on racks designed for their protection when not in use.
13. Do not use a make shift ladder
14. Do not stand a ladder on a drum, box or other unsteady base.
15. Do not support a ladder by its bottom rung or hang it by an upper rung
16. Do not allow more than one person on a ladder at a time.
17. Do not overreach from a ladder, move it to a more advantageous position.

Inspection and testing of ladders

- All ladders shall be carefully inspected, if incidentally dropped or otherwise damaged in use.
- Metal ladders shall be inspected at least once in three months and all parts checked for wear, corrosion and structural failure.
- Rope ladders shall be tested at least once a month.

Note: Ladder checklist annexed.

Note: Use of 'Bamboo or Wooden made ladders' at THDCIL construction sites is prohibited. Bamboo or Wooden made ladders should not be allowed for use in construction sites of THDCIL projects / plants.

Storage and maintenance

Ladders, if possible shall be stored under suitable cover, protected from weather in a dry location. They shall be exposed to good ventilation. Ladders shall be supported during storage so as to avoid sagging and permanent set.

Wooden ladders shall be periodically treated with a clear preservative such as varnish, shellac or linseed oil. Painting shall not be adopted as defects and cracks are likely to be covered up by the coating.

Metal rungs shall be cleaned to prevent accumulation of materials which may destroy non slipping properties. All fittings shall be carefully checked.

16.8 Working platform

A working space for persons, elevated above the surrounding floor or ground; such as a balcony or platform for the operation of machinery and equipment.

Every open-sided floor or platform 120 cm or more above adjacent floor or ground level shall be guarded by a railing on all open sides, except where there is entrance to a ramp, stairway, or fixed ladder. The railing shall be provided with a toe aboard beneath the open sides wherever:

a) persons may pass,

b) there is moving machinery, or

c) there is equipment with which falling materials could create a hazard.

Note: Bamboo / wooden Ladders are not allowed.

16.9 Fall arresting equipment

The fall arrest is the form of fall protection which involves the safe stopping of a person already falling. It is one of several forms of fall protection, forms which also include fall guarding (general protection that prevents persons from entering a fall hazard area e.g., guard rails) and fall restraint (personal protection which prevents persons who are in a fall hazard area from falling, e.g., fall restraint lanyards).

Fall arrest is of two major types: general fall arrest, such as safety nets; and personal fall arrest, such as lifelines. The most common manifestation of fall arrest in the workplace is the Personal Fall Arrest System, or PFAS ("lifeline").

Such a system must include 4 elements referred to as ABCDs of Fall Arrest:

A – Anchorage:

A fixed structure or structural adaptation, often including an anchorage connector, to which the other components of the PFAS are rigged.

B - Body Wear:

A full body harness worn by the worker.

C - Connector:

A subsystem component connecting the harness to the anchorage - such as a lanyard.

D - Deceleration Device:

A sub-system component designed to dissipate the forces associated with a fall arrest event.

Each of these elements is critical to the effectiveness of a personal fall arrest system. There are many different combinations of products that are commonly used to assemble a personal fall arrest system, and each must meet National Standards. The specific environment or application generally dictates the combination or combinations that are most appropriate.

16.10 Temporary stairs

On construction sites, temporary stairs are often put in place before the permanent stairs are built. However, when these stairs are improperly installed or poorly designed, it can be hazardous for workers and other visitors to the site.

The following potential hazards in use of temporary stairs shall be eliminated or addressed before using these stairs;

- Stairway not properly secured at the header and base may cause it to slip and slide when heavy weights are placed on the stairs.
- The stairs are too narrow.
- The stairway is too long or short to attach to the floor correctly.
- Stairs not in good condition (cracked or missing steps and grooves) may reduce the strength of structure and cause collapse when heavy weights are applied.
- Workers do not notice warning signs posted on temporary stairs that have not been installed properly. Spillage of oil compounds on the stairs causes a slip and fall hazard.

16.11 Suspended Jhoolas (Boatswain's Chair)

Jhoola means a seat to support a workman in a sitting position, supported by rope slings attached to a suspension rope.

Construction

Boaiswain's chair should be constructed with utmost care and thoroughly checked each time before it is put into use. The seat should be not less than 30 mm thick and should not be more than 600 mm long and 300 mm wide. Battens should be nailed to the under-side and they should project minimum 250 mm in front of the seat.

Suspenders should be not less than 5O mm manila ropes. They should be securely fastened to seat to prevent any tipping. If cutting torches or other open flames and acids are used, the suspenders should not be of fibre but should be of steel wire rope of not less than 10 mm diameter. Provision should also be made for use of safety belt with life line having a steel wire core.

General safety precaution

- Suspension ropes supporting Boatswain's chairs may either be fastened to a fixed overhead structure, beam, etc, or passed through an overhead block which is securely fastened. The free end of the rope should also be securely fastened to a fixed object.

- The hauling part of the rope used to raise or lower the chair, should always be within easy reach of the man using the Boatswain's chair,
- Every man working from a Boatswain's chair should be equipped with a safety belt which shall be securely fastened to the supporting tackle to prevent him from falling out.
- Boatswain's chairs should be tested as frequently as may be necessary to ensure that minimum safety factors are maintained. The test will be made by raising the working surface 300 mm above the ground and loading it with at least three times the maximum weight that will be imposed upon it. Testing should be done by a competent person at least once a fortnight and record of such tests should be maintained.

16.12 Floor openings & floor holes

Floor opening means an opening measuring 30 cm or more in its least dimension, in any floor, platform, pavement, or yard, through which persons may fall; such as hatchway, stair or ladder opening, pit, or large manhole (excluding floor opening occupied by elevators, dumb waiters, conveyors, machinery or containers).

Floor hole means an opening measuring less than 30 cm but more than 2.5 cm in its least dimension, in any floor, platform, pavement, or yard, through which materials but not persons may fall; such as a belt hole, pipe opening, or slot opening.

Guarding of floor openings and floor holes

- Every ladder way, floor opening or platform shall be guarded by a guard railing with toe board on all exposed sides (except at entrance to opening), with the passage through the railing either provided with a swinging gate or so offset that a person cannot walk directly into the opening.
- Every hatchway and chute, floor opening, shall be guarded by one of the following:
  - (a) Hinged floor opening cover of adequate strength equipped with railings or permanently attached thereto so as to leave only one exposed side. When the opening is not in use, the cover shall be closed or the exposed side shall be guarded at both top and intermediate positions by removable railings.
  - (b) A removable railing with toe board on not more than two sides of the opening and fixed railing with toe boards on all other exposed sides. The removable railings shall be kept in place when the opening is not in use and should preferably be hinged or otherwise mounted so as to be conveniently replaceable. Where operating conditions necessitate the feeding of material into any hatchway or chute opening, protection shall be provided to prevent a person falling through the opening.
- Every skylight, floor opening, and hole shall be guarded by a skylight screen or a fixed railing on all exposed sides.
- Every pit and trap-door floor opening, infrequently used, shall be guarded by floor opening cover of adequate strength which should be hinged in place. When the cover is not in place, the pit or trap opening shall be constantly attended by someone or shall be protected on all exposed sides by removable railings.
- Every manhole floor opening shall be guarded by a manhole cover which need not be hinged in place. When the cover is not in place, the manhole opening shall be constantly attended by someone or shall be protected by removable railings.
- Every temporary floor opening shall have railings, or shall be constantly attended by someone.

- Every floor hole into which persons can accidentally walk shall be guarded by either:
  (a) a railing with toe board on all exposed sides, or
  (b) a floor hole cover of adequate strength that should be hinged in place. When the cover is not in place, the floor hole shall be constantly attended by someone or shall be protected by a removable railing.
- Every floor hole into which persons cannot accidentally walk (on account of fixed machinery, equipment or walls) shall be protected by a cover that leaves no opening more than 2.5 cm wide. The cover shall be securely held in place to prevent tools or materials from falling through.
- Where doors or gates open directly on a stairway, a platform shall be provided, and the swing of the door shall not reduce the effective width to less than 50 cm.
- Regardless of height, open-sided floors, walkways, platforms, or catwalks above the adjacent to dangerous equipment, pickling or galvanizing tanks, degreasing units, and similar hazards shall be guarded with a railing and toe board.

Constructional details of safety measures

- A railing shall consist of top rail, intermediate rail, and posts, and shall be not less than 90 cm vertical height from upper surface of top rail to floor, platform, runway, or ramp level. The top rail shall be smooth surfaced throughout the length of the railing. The ends of the rails shall not overhang the terminal posts except where such overhang does not constitute a projection hazard.
- Floor opening covers may be of any material that meets the strength requirements of the surrounding floor.
- The mounting of handrails shall be such that the completed structure is capable of withstanding a load of at least 90 kg applied in any direction at any point on the rail.
- The sizes of handrails, when made of hardwood, shall be at least 5 cm in diameter. The length of brackets shall be such as will give a clearance between handrail and wall or any projection thereon of at least 7.5 cm.
- The height of handrails shall be not more than 85 cm measured vertically above pitch line; a handrail is required for all stairs, or ramp having rise of more than 60 cm.
- Where material is piled to such height that a toe board does not provide protection, paneling from floor to intermediate rail, or to top rail shall be provided.
- A toe board shall be 14 cm nominal in vertical height from its top edge to the level of the floor, platform, runway, or ramp. It shall be securely fastened in place and with not more than 6 cm clearance above floor level. It may be made of any substantial material either solid or with openings not over 2.5 cm in greatest dimension.
- The anchoring of posts and framing members for railings of all types shall be of such construction that the completed structure shall be capable of withstanding a point load of at least 90 kg applied in any direction at any point on the top rail.
- Where railings are likely to receive heavy stresses from crowds, trucking or handling materials, additional strength should be provided by use of heavier stock, closer spacing of posts, bracing or by other means.

16.13 Height Work Do's and Don'ts

Do's

- Before starting work at height, inspect PPEs carefully.
- Always wear PPE; viz. Full Body Safety Harness, Safety Helmet, Fall Arrestor System when you have to work above 2 M from the ground level.
- Always select an acceptable Anchoring Point.
- Always maintain 3-Point Contact while ascending or descending the ladder.
- Maintain the ladder in 1:4 ratio.
- Extend the top of the ladder at least 3 feet above the surface.
- Monkey ladder should be properly made and fitted with cages.
- Safety nets shall be used for prevention / arrest men and materials falling from height.
- Make sure there is adequate edge protection to minimize the risk of falling.
- Take extra care on fragile surfaces such as roof and make sure that surface is stable and strong enough to support both the man and material.
- Proper scaffold and working platform with top rail, mid rail and toe guard shall be provided.

Don'ts

- Don't try to reach too far when working on a ladder.
- Don't use ladder to do heavy work. Only use them to do light works and for reaching heights.
- Don't allow incompetent persons to work at heights.
- Don't place or lean the ladder on fragile surfaces.
- Don't stay quiet when you feel someone is compromising safety.
- Don't use conductive (Metallic) ladders on or near the electrical installations.
- Don't use the scaffold unless it is inspected by the competent person or Scaffold inspector.

Normative References

- *BOCW Act, 1996 and BOCW Central Rules, 1998.*
- *Central Electricity Authority (Measures Relating to Safety and Electric Supply) Regulations 2010*
- *Central Electricity Authority (Safety Requirements for Construction, Operation and Maintenance of Electrical Plants and Electric Lines) Regulations, 2011*
- *Factories Act, 1948*
- *IS 617 (1975): Aluminium and aluminium alloy ingots and castings for general engineering purposes*
- *IS 1084 (1983): Textiles - Manila Ropes*
- *IS 1410 (1983): Textile - Coir Ropes*
- *IS: 2750-1964: Steel Scaffoldings*
- *IS 3337: Ballies for general purposes*
- *IS 3696-1 (1987)_ Safety code of scaffolds and ladders, Part 1_ Scaffolds*
- *Occupational Safety, Health and Working Conditions Code and Central Rules, 2020*

Annexure

LADDER INSPECTION CHECKLIST

Date of Inspection: _____

Item to be Checked	Needs Repair	Condition O.K.
General		
Loose steps or rungs (considered loose if they can be moved at all with the hand).....	☐	☐
Loose nails, screws, bolts, or other metal parts	☐	☐
Cracked, split or broken uprights, braces, steps, or rungs.....	☐	☐
Slivers on uprights, rungs, or steps.....	☐	☐
Damaged or worn nonslip base.....	☐	☐
Rusted or corroded spots	☐	☐
Step Ladders		
Wobbly (from side strain).....	☐	☐
Loose or bent hinge spreaders	☐	☐
Stop on hinge spreaders broken.....	☐	☐
Broken, split, or worn steps	☐	☐
Loose hinges.....	☐	☐
Extension Ladders		
Loose, broken, or missing extension locks	☐	☐
Defective locks that do not seat properly when the ladder is extended.....	☐	☐
Deterioration of rope, from exposure to acid or other destructive agents.....	☐	☐
Trolley Ladders	☐	☐
Worn or missing tires	☐	☐
Wheels that bind	☐	☐
Floor wheel brackets broken or loose	☐	☐
Floor wheels and brackets missing.....	☐	☐
Ladders binding in guides.....	☐	☐
Ladder and rail stops broken, loose, or missing	☐	☐
Rail supports broken or section of rail missing.....	☐	☐
Trolley wheels out of adjustment.....	☐	☐
Trestle Ladders		
Loose hinges.....	☐	☐
Wobbly	☐	☐
Loose or bent hinge spreaders	☐	☐
Stop on hinge spreader broken	☐	☐
Centre section guide for extension out of alignment.....	☐	☐
Defective locks for extension.....	☐	☐
Sectional Ladders		
Worn or loose metal parts.....	☐	☐

Wobbly	☐	☐
Fixed Ladders		
Loose, worn, or damaged rungs or side rails	☐	☐
Damaged or corroded parts of cage	☐	☐
Corroded bolts and rivet heads on inside of metal stacks	☐	☐
Damaged or corroded handrails or brackets on platforms	☐	☐
Weakened or damaged rungs on brick or concrete slabs	☐	☐
Base of ladder obstructed	☐	☐
Fire Ladders		
Marking illegible	☐	☐
Improperly stored	☐	☐
Storage obstructed	☐	☐

Any other Observation:

_____

_____

_____

_____

_____

Signature:

Name & Designation of Inspector:

SCAFFOLD INSPECTION CHECKLIST

Construction Site & Scaffold Location:			
Contractor Name:	Date:		Time:
SAFETY CHECKS	**Yes**	**No**	**Comments**
Confirm that the scaffold is erected on a solid, level foundation capable of supporting the load.			
Scaffold components, planking/decking in good condition? Planks graded for scaffold?			
Are all scaffold components in place with no defects?			
Is Competent person in charge of erection/inspection?			
Base plates, mudsills, or other suitable means to provide proper support used.			
Screw jacks being used to level and plumb scaffold when required.			
Base plates and/or screw jacks in firm contact with mudsills and frame.			
Guardrails along all open sides Installed.			
Are components interlocked and secured correctly.			
Is scaffold level and plumb?			
Scaffold legs braced, with braces properly attached.			
Guard railing in place on all open sides and ends.			
Visual check to verify clamps secured in place.			
Scaffold secured to structure to prevent movement?			
Brackets, tube and clamp, and accessories properly placed with wedges tightened.			
Area around scaffold has been secured/roped off?			
Planks have minimum 12” overlap and extend 6” beyond supports?			
Toe boards properly installed.			
Proper access to get on and off the scaffold. Ladder secured in place.			
Scaffold control tag has been signed and approved for use?			
If inspection reveals scaffold is unsafe to use, has **“Do Not Use”** tag been placed at all access points?			

Scaffold Inspected by Signature:

Name & Designation:

17 Construction Safety

17.1 Role and Responsibility

- **Immediate Responsibility**

  Immediate responsibility to ensure safety in construction activities shall be of Site In-charge and Head of Executing Department.

- **Ultimate Responsibility**

  Ultimate responsibility to ensure safety in excavation and Tunnelling work shall be of the Occupier / Owner / Employer / Manager in case of Mines.

17.2 Legal provisions

- BOCW Act, 1996 and BOCW Central Rules, 1998.
- Indian Explosives act, 1884 and Explosives (Amendment) Rules, 2008
- Central Electricity Authority (Measures Relating to Safety and Electric Supply) Regulations 2010
- Central Electricity Authority (Safety Requirements for Construction, Operation and Maintenance of Electrical Plants and Electric Lines) Regulations, 2011
- IS-4756 (1978) : Safety Code for Tunnelling Work
- IS: 5121 (1969) : Safety code for piling and other deep foundations
- IS-17893 (2023) : Safety Work Permit – Code of practice
- Occupational Safety, Health and Working Conditions Code and Central Rules, 2020

17.3 Construction Safety - Introduction

Construction sites present many hazards to the workers when they perform construction-related activities. Keeping a construction site relatively clean of debris can further reduce hazards.

THDCIL is committed to ensure safety of building and other construction workers or the public by providing safe and healthy work environment that is free from recognized hazards that may cause or likely to cause death or serious physical harm to them. The Site In-charge of construction sites shall ensure compliance of all applicable legal requirements at construction sites.

Risk assessment of all the construction activity shall be done before starting the activity and efforts should be made to eliminate or minimize all non-tolerable risks by substitution, engineering controls and/ or administrative control measures and at last by using PPE (Personal Protective Equipment) suitable to protect workers from the hazard(s) to which the workers are likely to expose.

The following safety provisions of the BOCW Act, 1996 and Central Rules, 1998 are stated below for ready reference. For detail information BOCW Act, 1996 and Central Rules, 1998 may be referred.

Construction main activities include;

1. Excavation and tunnelling works

2. Demolition
3. Blasting
4. Concreting work
5. Asphalt working machinery
6. Screening and processing plant
7. Piling and other deep foundations
8. Structural steel erection

17.3.1 Safety in Excavation and Tunnelling Works

Legal provision: For further details refer BOCW Central Rule-146 to Rule-195.

Excavation works are essential for various construction projects, but they can be hazardous if not performed with proper safety measures. Adhering to safety rules is crucial to prevent accidents, injuries, and even fatalities.

1 Before undertaking any activity, the soil shall be tested and in case of availability of any explosive gas, necessary arrangements must be made to remove/dilute such gases and in case they are found to be toxic or poisonous, the workplace must be purged and continuous ventilation maintaining the contamination below the permissible level ensured.

2 To access information on the underground structures (such as water pipelines, sewers, gas mains, electrical conduit system and other civic facilities) is essential before doing the excavation work.

3 No excavation or earthwork below the level of any foundation of building structure shall be commenced or continued unless adequate steps are taken to prevent danger to any person employed, from collapse of the structure or fall of any part thereof.

4 Warning Signs and Cordoning Off

- Suitable warning signs required for the safety of building workers carrying out the work of an excavation or tunnelling, shall be displayed or erected at conspicuous places in Hindi and in language understood by the majority of building workers;
- The excavation area shall be cordoned off to prevent fall of person inadvertently.
- Adequate and suitable warning signs shall displayed at conspicuous places at the excavation work to avoid any person falling into the excavations or trenches. Warning signs shall be illuminated in the night hours to warn pedestrians and vehicular traffic.

5 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 all such checking, adequate protection shall ensure against slides and cave-in to prevent such hazard is provided.

6 Stockpiles of these materials shall be so located, as to provide easy access for withdrawing. These stockpiles shall not be located in the immediate vicinity of overhead power lines.

7 Arrangements shall be made to save other buildings/structures in the affected zone or in the vicinity of the area of excavation, from collapse, etc.

8 Any machinery used in excavation and tunnelling work shall be positioned and operated in such a way that such machinery will not endanger the operator of such machinery or any other person in the vicinity.

9 Safety helmets shall be worn by all persons entering trench where hazards from falling stones, timber or other materials exist.

10 Appropriate safety footwear (rubber boots, protective covers, etc) shall be worn by the workers engaged in work requiring such protection.

11 All trenches in soil more than 1.5 m deep shall be securely shored and timbered. All trenches in friable or unstable rock exceeding 2 m in depth shall be securely shored and timbered. These requirements do not apply in cases where the sides of the trenches are sloped to within 1.5 metres of the bottom. The slope that is provided for such purposes shall be inspected and certified as stable by the persons in charge of work in all cases.

12 All trenches in the soil, other than rock or hard compact soil more than 1.5 m deep into which men enter, shall be securely shored and timbered under the supervision of a competent person and only the trained workers shall be allowed to substantially alter or dismantle the shoring or timbering.

13 No person shall work in any excavation, shaft, or earthwork, unless all timbering and plant used therein are inspected by a responsible person before work is started and also after explosives has been used in or near the excavation, shaft or earthwork.

14 Excavated material shall be kept away from the edge of the trench to provide a clear berm of a width of not less than one third the final depth of excavation or as required by design.

15 In special cases, where the disposal area is limited or where the application of this requirement is impracticable, the person in charge may adopt a berm of reduced width in any case not less than 1 metre provided the material being excavated is sufficiently stable and the shoring is designed to carry the additional load. In all such cases substantial toe-boards shall be provided to prevent 'roll backs' into the trench.

16 Adequate and well anchored stop block shall be provided on the surface to prevent operating vehicles from falling accidently into excavation pit.

17 Reliable and effective means of communication such as telephone or walkie-talkie shall be used and maintained in working order for arranging better and effective communication at an excavation and tunnelling work at the following locations, namely- working chamber at the face of an excavation, intervals of 100 metres along the tunnel, compressor plant, first aid station, top of a shaft and at such other locations as may be necessary.

18 Petrol or liquefied petroleum gas or any other flammable substances shall not be used, stored inside the tunnel except with the prior approval of the project engineer. After the use of these item(s), all remaining quantity (s) shall be removed immediately from such tunnel.

19 Where inflammable substances are stored or present, all electrical installations shall be explosion proof. Portable lamps/flash lights, if required, shall be of approved explosion-proof type.

20 It shall be ensured that no harmful gases or fumes are present in the trench or tunnel to such a degree as may endanger the health or safety of persons working in them.

21 Air shall be considered unfit for workmen to breath if it contains any of the following :

- Less than 19 percent of Oxygen by volume,
- More than 1 percent of Carbon Dioxide by volume,
- More than 0.01 percent of Carbon Monoxide by volume,
- More than 0.002 percent of Hydrogen Sulphide gas by volume, and
- More than 0.002 percent of Nitrous Oxide by volumes.

Where presence of a harmful gas is established at a worksite, suitable arrangements be made to check the percentage of such a gas to ensure that the gas after ventilation is within safe limits. Such tests shall be carried out as frequently as necessary.

22 No internal combustion engine shall be operated in a trench/tunnel unless adequate provisions are made to ensure that the exhaust gases and fumes are rendered harmless or are discharged to a point sufficiently remote from the trench/tunnel to prevent their return to or accumulation in the trench/tunnel.

23 Supply lines to pneumatic tools used within a tunnel shall be fitted with water trap or safety wire.

24 Foundations, adjacent to and below which excavation is to be made, shall be supported by shoring, bracing or underpinning as long as the trench remains open.

25 Where there is likelihood of flooding or water rushing into a tunnel during a tunnelling work, arrangements shall be made for immediate starting of water pumps to take out water of such flooding or water rushing and for giving alert signals to the building workers and other persons to keep them away from danger.

26 All necessary measures shall be taken to ensure that no building worker is trapped in any isolated section of a tunnel when any bulkhead door of such tunnel is closed.

27 Adequate number of water outlets shall be provided on excavation or tunnelling work and are readily made accessible throughout the tunnel for fire-fighting purposes and such water outlets shall be maintained for effective fire-fighting.

28 An audible fire alarm shall be provided to warn the building workers whenever a fire breaks out in tunnelling work.

29 Adequate number and types of fire extinguishers, in accordance with IS: 2190, shall be provided and made readily available to fight any outbreak of fire at an excavation or tunnelling work;

30 Fire extinguishers with vaporising liquids and high pressure carbon dioxide shall not be used in tunnels or other confined spaces.

31 No fire hydraulic hoses other than fire resistant hydraulic hoses shall be used when hydraulically activated machinery and equipment is employed in tunnels.

32 The air intake points for all air compressors shall be located at places where such intake air does not get contaminated with dust, fumes, vapour and exhaust gases or other contaminants.

33 All portable electrical hand tools and inspection lamps used underground or in a confined space at an excavation or tunnelling work shall be operated at a voltage not exceeding twenty-four volts.

34 No exposed live wire in working areas at an excavation or tunnelling work which are accessible to building workers other than those authorised to work on such live lines.

35 Where a building worker is required to enter a shaft at an excavation or tunnelling work, safe means of access shall be provided for such entry.

36 Every shaft at excavation or tunnelling work shall be provided with a steel casing, concrete piping, timber shoring or other materials of adequate strength for the safety of building workers working in such shaft.

37 Arrangements shall be made to prevent external vibrations due to rail / road traffic.

38 Test the air for toxic gases and oxygen levels before workers enter underground excavation. Ensure proper ventilation if necessary.

39 Keep track of weather conditions as heavy rain can make soil unstable and increase the risk of cave-ins.

40 Shoring and timbering

Shoring is the process of temporarily supporting a building, vessel, structure, or trench with shores (props) when in danger of collapse or during repairs or alterations.

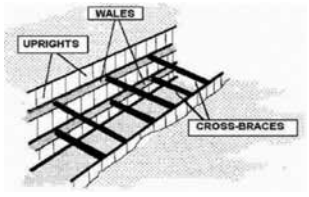
- Site of excavations, where workers are exposed to danger from moving ground, shall be made safe by maintaining due slope not exceeding the angle of repose of different types of soil or otherwise by shoring, portable shields or other effective means;
- All struts, braces and walls in excavation shall be adequately secured so as to prevent their accidental displacement;
- Trenches deeper than four feet must have safe access points, such as ladders or ramps, within 25 feet of workers.
- When open spaced sheathing is used, a toe-board shall be provided to prevent material rolling down the slope and falling into the excavated.

41 Sheathing

Sheathing is the supporting structure that acts as a cover for the surfaces of a building. The main function of sheathing is to provide a surface where other materials can be applied to, either on either floors, roofs, or walls of structures. It also provides additional structural integrity to buildings.

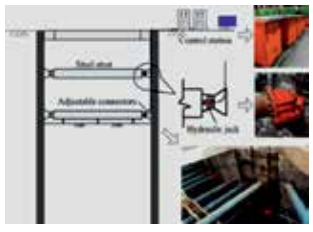
The sheathing should be placed against the side of the trench so that length of each piece of sheathing is vertical. It should be held securely in place against the wales by ensuring that sheathing is kept firmly pressed against the wall of the trench. Where the trench excavated is loose, sandy or soft soil or soil which has been previously excavated or soil which is under hydrostatic pressure, each piece of sheathing shall be driven into the bottom of the trench so as to firmly hold it in place.

42 Wales



Wales are horizontal members parallel to the bottom of a shoring system placed in the direction of the excavation face whose sides bear against the vertical members of the shoring system or earth (the uprights or sheeting)

43 Struts



Struts shall be horizontal and at right angles to the wales or sheathing supported thereby. Struts shall be of the proper length required to fit in tightly between the wales. Where necessary, the struts shall be held securely in place by wedges, driven between the struts and the wales.

a) Trenches deeper than 1.5 m, safe means of access and egress shall be provided at intervals of every 15 m. Where it is not possible to provide safe means of access and egress as above, ladders shall extend from the bottom of the trench to at least 90 cm above the ground;

b) If planks are used for raising walkways, runways or sidewalks, they should be parallel to the length of the walk and fastened together against displacement;

c) Lone worker shall not be allowed to work in the excavated area.

d) A competent person shall inspect every day and necessary measures shall be taken to safeguard against possible cave-ins or slide or collapse of the excavations.

44 Register of employment

The contractor shall ensure that at a construction site of a building or other construction work where an excavation or tunnelling work is being carried on, a register of employment of building workers carrying out such excavation or tunnelling work is maintained on day-to-day basis and produced on demand.

45 Where there is a danger of falling or sliding of material from the roof face or wall of a tunnel, adequate measures such as shoring, supporting by means of rock bolts, segments or steel sets shall be taken for the safety of building workers;

46 Illumination

All contractors carrying out excavation or tunnelling work at a construction site of a building or other construction work shall provide for emergency generators on such construction site to ensure adequate lighting / illumination of intensity as mentioned in IS-4756: 1978 (Safety Code for Tunnelling Work) at all work places where such excavation or tunnelling work is being carried out;

In case of power failure, all workplaces where excavation or tunnelling works are carried out shall be adequately illuminated

Minimum Illumination	**TUNNEL** (Ref. IS-4756: 1978, Safety Code for Tunnelling Work)
50 Lux	Minimum illumination at tunnel and shaft headings during drilling, mucking and scaling
30 Lux	When mucking is done by tipping wagons running on trolley trucks
10 Lux	Any area inside the tunnel or outside an approach road, etc.

17.3.2 Demolition

Legal provision: For further details refer BOCW Central Rule-Rule 108 to Rule 118.

Demolition of any old or existing civil structures could be necessary and the safety measures that are required to be followed in demolition are as important as in any construction work.

Hazards of demolition

Demolition work involves the dismantling and tearing down of structures, and it can be quite hazardous. Some most common hazards associated with demolition work are;

Falling debris

This is one of the most serious hazards of demolition work. As structures are taken apart, debris can fall from heights, injuring or killing workers below.

Structural collapse: Uncontrolled collapse of a structure can happen if it is not properly weakened or taken down in the right order. This can bury or crush workers beneath the rubble.

Exposure to hazardous materials

Many older buildings contain hazardous materials such as asbestos, lead, and mould. If these materials are disturbed during demolition, they can release harmful dust and fibers into the air, which can be inhaled by workers and cause serious health problems.

Noise and vibration

Demolition work often involves the use of heavy machinery, which can generate loud noise and vibration. This can damage workers' hearing and cause other health problems.

Electrical hazards

Live wires and other electrical hazards can be present in older buildings. Workers can be electrocuted if they come into contact with these hazards.

Slips, trips, and falls

Demolition sites can be uneven and cluttered, which can increase the risk of slips, trips, and falls.

Fires

Demolition work can create sparks and flames, which can ignite combustible materials on the site and start a fire.

Safety measures in demolition work

Demolition work shall be done under the supervision of a competent person experienced in demolition work.

The supervisor/competent person shall continuously inspect the progress of demolition work to detect and address developing hazards.

1. During demolition work all electrical cables and water, gas or steam pipes, glass or similar material or article in exterior openings should be removed and all water, steam, electric, gas or other similar supply lines shall be shall be disconnected / put-off and suitably capped except those that are used for the operation before commencing any demolition work.
2. Before starting demolition, obtain permission from the competent authority wherever required.
3. Examine adjacent structures to the structure to be demolished for checking of unsafe structure. If there is any reason to believe that any adjacent structure is unsafe, demolition activity affecting such unsafe adjacent structure shall not be performed unless and until remedial measures like sheet piling, shoring, bracing, or similar other means so as to ensure safety and stability to such unsafe adjacent structure from collapsing are taken.
4. Adjacent structures and the surrounding streets must be adequately protected from falling objects.
5. Traffic control shall be set up to facilitate the removal of rubbish.
6. Masonry should neither loosen nor permitted to fall in such masses or volume or weight as to endanger the structural stability of any floor or structural support.
7. Wall, chimney or other structure or part of a structure should not be left unguarded in such a condition that it may fall, collapse or weaken due to wind pressure or vibration.
8. debris, bricks and other materials or articles are removed--
   - by means of chutes;
   - by means of buckets or hoists;
   - through openings in the floors; or
   - by any other safe means.
9. Suitable barricades shall be provided so as to prevent materials or articles from sliding or rebounding into any space used by the building workers.
10. Warning signs and red lights shall be placed wherever there is a danger to public, and the structure under demolition shall be adequately barricaded and roads leading to the site of demolition shall be closed so that people are kept away from the hazardous areas.
11. Fire hoses shall be available. Access to the area and water shall be maintained for the fire department.

12. All steps shall be taken to prevent danger to persons employed from risk of fire of explosion due to gas, vapour or flooding due to water from water mains, sewers and culvert.

13. All practical steps shall be taken to avoid danger from collapse of the structure when any part of the framing is removed from a framed or partly framed structure which may endanger life of any person employed.

14. Before demolition is commenced and also during the progress of the work, precautions shall where necessary, be taken by adequate shoring or otherwise to prevent the accidental collapse of any part of the structure or any adjoining structure the collapse of which may endanger any person employed.

15. Do's and Don'ts to for personal protection against demolition hazards include:
    - Wearing proper personal protective equipment (PPE), such as hard hats, safety glasses, gloves, and respiratory protection.
    - Following safety procedures and guidelines.
    - Being aware of your surroundings and watching out for hazards.
    - Reporting any unsafe conditions to your supervisor.

Do's

- Demolition work under supervision of a competent person, who is experienced in demolition work.
- The supervisor shall continuously inspect the progress of demolition work to detect and address developing hazards.
- During demolition, all electrical cables, water, gas and/or steam pipelines should be removed.
- Adequately protect, adjacent structures and the surrounding streets by barricading from falling objects.
- When demolishing exterior walls or floors, the safest approach is to start at the top of the structure and work your way down to ground level.
- Keep workers and others out of unsafe areas.
- Protect against falling debris.

Don'ts

- Don't allow untrained or inexperienced operatives to operate the machine without adequate and supervision in place.
- Don't allow material to accumulate on floors as this may cause trip/ fire hazards.
- Don't travel on uneven ground with the boom raised.
- Don't use power tools on asbestos material as they create harmful dust.
- Don't place a board or solid sheet over a hole or floor openings void without marking the hazard and informing your site supervisor.
- Don't swing the bucket or attachment over the workers and never let the workers under the bucket or attachment.

17.3.3 Blasting

Legal provision: For details refer the following statutory provisions;

- Rule-212 and 213 of BOCW Central Rules, 1998
- Chapter-VII, Rule-35 and Rule-107 of Explosives (Amendment) Rules, 2008 under the Explosives Act, 1884.
- Schedule-I (34) of Regulation 5 of the CEA Regulations, 2011.

Introduction

Excavations of tunnels are common features in civil engineering projects. A greater proportion of world's annual tunnel advance is still achieved by drilling and blasting. In spite of inherent disadvantages of damaging the rock mass, drilling and blasting has an unmatched degree of flexibility and can overcome the limitations of machine excavations by Tunnel Boring Machine (TBM) or road headers. In spite of no major technical breakthrough, the advantages like low investment, availability of cheap chemical energy in the form of explosives, easy acceptability to the practicing engineers, the least depreciation and wide versatility have collectively made the drilling and blasting technique prevail so far over the mechanical excavation methods.

All provisions of Chapter-VII of the Explosive Rules 2008 shall be complied to ensure safety of persons in handling, storage and use of explosives for blasting operations. However some of the significant legal provisions are stated below for reference;

Restriction on conveyance of explosives to or at the blasting site

1. Explosives shall only be conveyed from the licensed storage premises to near the site in original unopened packages or in closed containers used solely for that purpose and securely locked. No manufacturer shall directly supply the cartridge explosives for charging of boreholes at the blasting site.
2. Explosives shall not be taken to a point nearer than fifty metres from any site until such site is ready for charging.
3. Explosives shall not be conveyed in any vehicle with any other materials, tools or implements other than that required for the purpose of blasting.
4. Explosives left over after the day's work shall be returned to the licensed premises from which the same was taken.
5. The carrying box used for carrying explosives from original packages shall be maintained thoroughly cleaned and dried and shall be kept closed when not in use. The containers shall be provided with either handles or carrying straps of adequate strength and shall be conspicuously marked with the word "Explosives".
6. Detonators shall be conveyed in special containers constructed of non-metal or nonconductive material and these shall not be carried with other explosives. Batteries, dry cells and other sources of electric energy shall not be carried in the vehicle carrying detonators.
7. No detonator shall be taken out from a case or container unless it is required for immediate use.

Explosives to be examined before use

- Explosives before use shall be visually examined for any visible defects and any defective explosive shall not be used.
- Any explosive showing signs of deterioration of any kind should be reported immediately to the licensing authority and such explosive set-aside for examination by such authority.
- Gunpowder, which is found to be caked owing to the moisture, shall not be used.
- Frozen nitro-glycerine explosives shall not be used until thawed under the supervision of experienced persons. Where freezing is likely to occur only low freezing explosives shall be used.

Precautions to be observed at site

a) The electric power at the blasting site shall be discontinued as far as practicable before charging the explosives.

b) No work other than that associated with the charging operations shall be carried out within fifteen metres of the holes unless otherwise specified to the contrary by the licensing authority.

c) When charging is completed, any surplus explosives, detonators or fuses shall be removed from the vicinity of the hole and stored at a distance which would prevent sympathetic detonation in the event of a charge detonating in any hole.

d) The holes, which have been charged with explosives, shall not be left unattended till the blasting is completed.

e) Care shall be taken to ensure that fuse or wires connected to the detonators are not damaged during the placing of stemming material and tamping.

Suitable warning procedure to be maintained

The licensee or an authorised person appointed by the licensee to be in charge of the use of explosives at the site shall lay down a clear warning procedure consisting of warning signs and audible signals and all persons employed in the area shall be made fully conversant with such signs and signals.

Precautions to be observed while firing

I. The end of the safety fuse should be freshly cut before being lighted.

II. The exploders shall be regularly tested and maintained in a fit condition for use in firing. An exploder shall not be used for firing a circuit above its rated capacity.

III. The electric circuit shall be tested for continuity before firing. All persons other than the shot firer and his assistants, if any, shall be withdrawn from the site before testing the continuity.

IV. For the purpose of joining, the ends of all wires and cables should have the insulation removed for a maximum length of 5 centimetres and should then be made clean and bright for a minimum length of 2.5 centimetres and the ends to be joined should be twisted together so as to have a positive metal contact.

Person in charge to be responsible

The licensee or a shot firer employed by him to be in-charge of blasting operations shall take all precautions against fire, accident, loss, pilferage etc., of explosives and will be personally held responsible for any contravention of the relevant provisions of the Act or Rules thereof.

Blasting Operation

A. Blasting operation shall be carried out by a shot firer holding valid certificate issued by the Controller.

B. A copy of the certificate shall be carried by the shot firer during blasting operations.

C. The shot firer shall take all due precautions in handling or charging or blasting operations.

Fuse Blasting

The length of fuse used for blasting shall as per approved design / standards or as decided by engineer In-charge.

Mud cap Blasting;

Mud cap blasting being inefficient and dangerous shall be avoided to the extent possible.

Inspection after Blasting (Misfire Drill)

a. Immediately after a blast has been fired, the firing line shall be disconnected from the blasting machine or other source of power.

b. After a blast has been fired, a careful inspection shall be made by the blaster to determine if all charges have been exploded. The blaster shall count the number of the exploding shots in blasting. Misfires in fuse blasting shall be examined as per basting standards by the certified blaster. Other persons shall not be allowed to return to the area of blast until an "All Clear" signal is given.

c. All wires shall be carefully traced and search made for any exploded cartridges by the person-in-charge of the blasting operation.

d. Loose pieces of rock and other debris shall be scaled down from the sides of the face of excavation and the area made safe before proceeding with the work.

Misfires

1. Misfired holes shall be placed in the charge of a competent person.
2. If broken wires, faulty connection, or short circuits are determined as the cause of a misfire, the proper repairs shall be made. The firing line reconnected & the charge fire. This shall be done, however, only after a careful inspection has been made of burdens remaining in such holes and no hole shall be so fired when other shoes have dangerously weakened the burden.
3. The charge of explosives from a misfired hole shall not be drilled, board or picked out.
4. Misfired charges tamped with solid material shall be detonated by the following method
   a) Float out the stemming by use of a water or air jet from hose until hole has been opened to within 60 cm. of charge :
   b) Water shall be siphoned off or pumped out.
   c) New charge shall be placed and detonated.

   Whenever this method is not practicable, than a new hole not nearer than 60 cm shall be drilled, loaded and detonated. A careful search shall be made of unexploded material in the debris of the second stage.

Safety in storage of explosives

Storage of explosives is regulated by the Indian Explosives act, 1884 and Explosives Rules, 2008. Some of the important safety measures are as follows.

1) The magazine shall at all times be kept scrupulously clean. High explosives like dynamite shall be stored in a dry, clean, well ventilated, bullet-proof and fire-proof building constructed in accordance with Indian Explosives Act, on an isolated site. The area around the magazine for a distance of 8 m shall be kept clear of all vegetation and combustible matter. There shall be barbed wire fencing and security lights around the magazine and security guards shall be posted for 24 hours.
2) No unauthorized person at any time is to be admitted into the magazine.
3) The person in charge of the magazine is to take care that the magazine is well and securely locked.
4) The magazine on no account is to be opened during or on the approach of a thunderstorm and no person shall remain in the vicinity of the magazine during such storm. Sufficient number of lightning conductors shall be provided on top of the magazine.
5) Magazine shoes without nail should be kept at all time in the magazine, and a wood tub or cement trough, about 30 cms high and 45 cms in diameter, filled with water should be fixed near the door of the magazine.
6) Person entering the magazine must put on the magazine shoes provided for the purpose and be careful not to allow the magazine shoes to touch the ground outside the clean floor.

7) Person with bare feet shall, before entering the magazine, dip their feet in water, and then step direct from the tub over the barrier (if there is one) on to the clean floor.

8) A brush or broom shall be kept in the lobby of the magazine for cleaning the magazine on each occasion it is opened for the receipt, delivery or inspection of explosives.

9) Light shall be obtained from an electric storage battery lantern. Electric light from the supplying main, taken through conduit wiring and properly earthed may be obtained with the approval of chief Inspector of Explosives.

10) No matches shall be allowed in a magazine.

11) No person having articles of steel or iron on him is to be allowed to enter a magazine.

12) Oily cotton rags, cotton waste and articles liable to spontaneous ignition shall not be taken into a magazine.

13) Workmen, sweepers etc. shall be examined before they enter the magazine to see that they have none of the prohibited articles. All other men entering a magazine shall not also have such articles in their possession.

14) No tools or implements other than those of copper, brass, gun metal or wood shall be allowed inside the magazine. Tools shall only be used with great gentleness and care.

15) Boxes of explosives shall not be thrown down or dragged along the floor and shall be stacked on wooden trestles. Where there are white ants, the legs of the trestles shall rest in shallow copper, lead or brass bowls, containing water.

16) Packages containing explosives shall not be allowed to remain in the sun.

17) The order of storing shall be such as to allow the oldest explosives to be used first. There shall be sufficient space between the stacks.

18) Empty boxes shall not be stored in the magazine nor let any packing material lie loose.

19) Blasting caps and electric blasting caps shall never be stored in the same box, magazine or building with other explosives.

20) The following shall be information shall be displayed conspicuously in the lobby of the magazine;

(i) A copy of these relevant rules;

(ii) A statement showing the stock in the magazine and;

(iii) Certificate showing the last date of testing of the lightning conductor.

17.3.4 Concreting Works

(A) Concrete Mixers and Batching Plant

1) All gears, chains and rollers of concrete mixers shall be adequately guarded to prevent danger.

2) Concrete mixer skips shall be protected by side railings to prevent workers from passing under them and operators shall make sure before lowering the skip that all space is clear of the workers.

3) Hoppers into which a person could fall and revolving plates of through or batch type mixers shall be adequately guarded by grating.

(B) Concrete Vibrators

- Vibrating unit shall be completely enclosed and belt transmitting the power to the unit adequately guarded.
- Vibrating needles of poker type vibrator shall be completely sealed against concrete.

- Electrically operated compaction vibrators shall be totally enclosed units.
- Air-operated type vibrators shall have arrangements to change the speed of rotating shaft and air motor to rotate the vibrating needle which shall be completely sealed against concrete.
- Power operated vibrators shall be provided with effective means of stopping the vibration (if possible by disengaging the vibrator from the engine/motor drive).
- Where possible, the vibrators shall be fitted with shock absorbing handles with rubber or other suitable grips for ease in handling.
- Electrically operated vibrators shall be protected against overloads by suitable overload relays and shall be effectively earthed; and where the operator has to be in direct contact with the vibrator during its operation, low voltage drive with suitable transformer is recommended.
- While starting the poker vibrators, the needle shall not be resting on a hard surface to avoid bouncing.
- Excessive bending of the flexible shafts of the poker vibrators while in operation shall be avoided.

Concrete Works Do's and Don'ts

Do's

- Wear appropriate PPEs like Safety helmet, safety shoe, safety goggles, dust mask, hand gloves, ear plug.
- Use proper lifting techniques to avoid back and musculoskeletal injuries.
- Avoid skin contact with wet concrete.
- Stay hydrated and take regular breaks.
- Barricade the working area and display warning signs.
- Towing trailer should have reverse horn.
- When working at height, always wear Full body safety harness.
- Hoppers into which a person could fall shall be adequately guarded by grating.

Don'ts

- The rotating parts of the trailer mounted concrete pump should not be left unguarded.
- The concrete pipeline should not be anchored with the working structure.
- Never open the pressurized pipeline.
- Don't stand near the pressurized pipeline bends.
- Don't remove the water box cover during stroking of water.

17.3.5 Asphalt working machinery

a) Piping for hot oil and asphalt shall be adequately inserted to protect workers from injury by burns and flexible piping shall be metal encased. The flexible pipe, when not in use, shall be left on the ground.

b) Operation of asphalt plant shall be under the supervision of a competent person and a competent person shall inspect the plant at periodical intervals.

c) Workers handling hot asphalt shall wear gloves, rubber boots, goggles and, if necessary, to prevent danger, suitable protective clothing.

d) No open light shall be used for ascertaining the level of asphalt and thinner shall not be heated over an open flame.

e) If burner goes out, the fuel supply shall be cut off and hot tube shall be thoroughly blown out by fan so as to prevent backfire.

f) Spilled asphalt shall be promptly cleaned up.

g) A chimney or other suitable exhaust arrangements shall be provided to remove the combustion gases and dust.

17.3.6 Screening and processing plant

1 Screening and processing plants shall be adequately designed to carry all loads and withstand all stresses placed upon them. All gears, belts, chain, and exposed shafts shall be equipped with guards. Rock crushers shall be screened to prevent flying chips of rocks for injuring persons in the vicinity.

2 All vibrating or rocker screens shall be equipped with sides and baffles to prevent cobbles from falling off the screen to the operating floor. Where materials are being processed dry, an exhaust system shall be installed to remove the dust, or respirators made available for the workmen.

3 All oil and grease cups, so far as possible shall be so located or extended that they can be serviced without the oilier exposing any part of his body to possible accident. On machinery where this is not practical, the machine shall be shut down while being oiled.

4 All walkways not permanently enclosed shall have guards rails with toe boards installed. All working platforms shall be thoroughly guarded. Access stairways and ramps shall have adequate guards.

5 Washing equipment, clarifiers, screw classifiers etc. shall have substantial guardrails.

6 All discharge chutes and all conveyor belts operating on steep slopes shall be equipped with sides of sufficient height, and baffles, if necessary, to prevent the spilling of material.

7 Suitable change house shall be provided for the use of men who work with cement or other substances which might be harmful to the skin, or who work in excessively dusty, hot, or humid places. Change houses shall be equipped with showers, and with dry ventilated lockers for clothing. Project officials may, according to the circumstances, establish rules requiring workmen to take a daily shower or bathe.

8 Storage bins and hoppers for sand, gravel etc. shall be adequately designed so as to withstand any load to which they may subject. When the discharge is by gravity through and opening in the bottom of the bin, the slopes of the sides shall be such that it will not be necessary of workmen to loosen the material or to force it through the outlet. If it shall become necessary for workman to enter any bin or hopper, he shall be properly tied off with a safety belt and rope and helper shall be on guard outside. Respirators and protective clothing shall be used a conditions may require.

17.3.7 Piling and other deep foundations

For further reference IS 5121:1969 standard may be referred.

The piling process is a crucial phase in construction that involves driving or drilling long columns of materials, such as concrete, steel, or timber, deep into the ground to provide structural support and stability for various types of structures, such as buildings, bridges, and retaining walls. Piles transfer the weight of the structure to deeper, more stable layers of soil or rock, effectively preventing settlement, subsidence, and structural failure. Piles are installed using specialized machinery, such as pile drivers or drilling rigs. The success of the piling process is contingent on accurate engineering assessments, proper material selection, and skilled execution to ensure the durability and safety of the constructed edifice.

General provisions for safety in piling work

- Safety requirements for piling and other deep foundations shall be followed as per IS: 5121 (1969) "Safety code for piling and other deep foundations" Standard.
- All pile driving equipment shall be of good design and sound construction, taking into account the ergonomic principles and properly maintained;
- A pile driver shall be firmly supported on a heavy timber sill, concrete bed or other secured foundation;
- In case a pile driver is required to be erected in dangerous proximity to an electrical conductor, all necessary precautions shall be taken to ensure safety;
- The hoses of steam and air hammer shall be securely lashed to such hammer so as to prevent them from whipping in case of connection or break;
- Adequate precaution shall be taken to prevent the pile driver from over turning and hammer from missing the pile;
- A responsible person for inspecting pile-driving equipment shall inspect such equipment before taking it into use and takes all appropriate measures as required for the safety of building workers before commencing piling work by such equipment;
- Where there is any question of stability of a structure for its adjoining areas to be piled, such structure shall be supported, where necessary, by underpinning, sheet pilling, shoring, and bracing or by other means to ensure safety and stability of such structure and to prevent injury to any person.
- Those engaged in mixing and checking of cement wax or any other material injurious to human body shall be provided suitable PPE for the purpose welders engaged in the work of welding work.
- Every crane driver or hoisting appliance operator shall be competent to the satisfaction of the engineer in-charge and no person under the age of 21 years shall allowed to operate any hoisting machine including scaffolding or give signals to operator.

Operator's Safety

The operator of every pile driving equipment shall be protected from falling objects, steam, cinders or water by substantially covering or otherwise or by other means.

Safety Instruction for supervisor and building workers working on Pile-Driving Equipment

Every building worker working on a pile driving equipment shall be given instructions through TBT every day before starting routine activity regarding safe work procedure to be followed in piling operation and shall be supervised by a responsible person throughout such work.

1. Restriction on entry of unauthorized person

The contractor shall ensure at a construction site that all piling areas where pile-driving equipment is in use are effectively cordoned off to prevent entry of unauthorized persons.

2. Inspection and Maintenance of Pile Driving Equipment

- Pile-driving equipment shall not be taken into use until it has been inspected by a responsible person and found to be safe for such use
- A responsible person for such inspection at suitable intervals shall inspect pile driving equipment in use to ensure safety to the building worker working on such equipment; and
- All pile lines and pulley blocks shall be inspected by a responsible person before the beginning of each shift of piling operations.

3. Operation of Pile-Driving Equipment

- Only experienced and trained building worker shall be permitted to operate pile driving so as to avoid any probable danger from such operation;
- Pile-driving operations shall be governed generally prevalent and accepted signals so as to prevent any probable danger from such operations;
- Every building worker employed in pile driving operation or in the vicinity of such pile driving operation shall wear ear protection and safety helmet or hardhat and safety shoes;
- Piles shall be prepared at a distance, at least equal to twice the length of the longest pile, from the place of pile-driving operations;
- When a pile driver is not in use, the hammer of such pile driver shall be blocked at the bottom of the heads of such pile driver.

4. Working Platform on Piling Frames

Where a structural tower supports the lead of a pile driver, leads at which it is necessary for the building workers to work and such platforms except on the hammer of such pile driver or lead sides of such platform and where such platforms cannot be provided with such railing and toe boards, a safety belt shall be provided to each such building worker.

5. Pile Testing

- The testing of pile shall be conducted under the supervision of a responsible person for such testing;
- All practicable measures like displaying of waning notices, barricading the area and other similar measures shall be taken to protect the area where the pile testing is carried out;
- Entry to a pile testing area shall be prohibited to general public to ensure safety

17.3.8 Structural steel erection

1 The erection of structural steel requires skill and is inherently a hazardous work. Heavy members must be manoeuvred into places, but the short time required to make the erection joint at any connection does not ordinarily justify the erection of a rigid scaffold. When scaffold and ladders are necessary for use of the welders, riveters or erectors, the safety rules and regulations laid down in the manual shall be followed.

2 The rivet heater shall be located as near the riveting gang as practicable.

3 All employees working in places where they are exposed to falling hazards shall use safety belts.

4 Wherever workmen are exposed to unusual falling hazards from which it is impracticable to prevent them by temporary floors or scaffolds, a safety net shall be suspended below the place where men are working. Such nets shall be of 10 cms mesh and shall be made of Manila rope of at least 20 mm diameter, with an outside or border rope of 18 mm diameter. The borders shall be provided with loops so that the nets can be attached to the structure or to each other.

5 Hardhats shall be worn by employees working on or around erection operation and shall be worn with chin straps fastened.

6 Gloves of a suitable type shall be worn by all employees when handling steel cables or other rough or sharp edged materials.

7 Goggles shall be worn when grinding, chipping, scrapping, caulking, cutting and heating rivets.

8 Good footwear shall be worn by all employees and the soles shall be kept free from mud and grease. Safety toe shoes shall be worn at all times.

9 Steel shall be stacked properly so that there is no danger of rolling or sliding on to men hooking up for hoisting.

10 Workmen shall stand in clear when derrick is sorting for shifting steel beams. The signalman and the operator shall check to see that all men have cleared out before lifts are made.

11 If several light pieces are to be hoisted together each piece must be secured to the bundle.

12 No material shall be landed on steel that has not been permanently connected as it may cause the collapse of the structure.

13 Air hoses and welding leads shall be placed where they are not a tripping hazard. Fire extinguishers shall be available.

14 Workmen shall not stand, walk or work beneath suspended loads.

15 When guiding a beam, it shall be so held that the hands do not get jammed against other objects.

16 When lifting an object in a group, one person shall be designated to give the signal for all to lift or set the objects down in unison.

17 When lifting legs shall be bent, body kept straight and leg muscles used for the lift.

18 There shall be neither riding on steel that is being hoisted, no riding on overhauling weights, hooks, cables or slings, nor sliding down on ropes or cables.

19 Public or workers in other trades operating close to steel erectors shall be safeguarded at all times.

20 They shall be cautioned and instructed on any exposure condition existing or that may arise and result in accident.

21 They shall be advised to wear hard hats when required to work close by.

22 They shall be instructed not to operate directly underneath scaffolds that are being used.

23 Red flags or warning signs shall be strategically posted to assist in cautioning and instruction others.

24 When receiving or unloading steel on job site, adequate protection such as barricades, sign flags and watch-man shall be provided to protect the public.

Normative References

- *BOCW Act, 1996 and BOCW Central Rules, 1998.*
- *Indian Explosives act, 1884 and Explosives (Amendment) Rules, 2008*
- *Central Electricity Authority (Measures Relating to Safety and Electric Supply) Regulations 2010*
- *Central Electricity Authority (Safety Requirements for Construction, Operation and Maintenance of Electrical Plants and Electric Lines) Regulations, 2011*
- *IS-4756 (1978) : Safety Code for Tunnelling Work*
- *IS: 5121 (1969) : Safety code for piling and other deep foundations*
- *IS-17893 (2023) : Safety Work Permit – Code of practice*
- *Occupational Safety, Health and Working Conditions Code and Central Rules, 2020*

18 Safety in Hydroelectric Project

18.1 Role and Responsibility

- Immediate Responsibility

  The immediate responsibility to ensure compliance of above regulations shall be of the concerned In-charge of construction site/activities / Section Head.

- Ultimate Responsibility

  The ultimate responsibility to ensure safety at workplaces shall be of the Department Head.

18.2 Statutory provision

- Rule-119 to 168 of the BOCW Central Rules, 1998;
- Part (B) of Schedule-1 under Rule-5 of the CEA Regulations, 2011

18.3 Safety in construction of dams

- The activities related to construction, alteration and dismantling of dam shall be supervised by a competent person.
- All diving equipment shall be inspected periodically.
- Air pump, airlines and diving helmets shall be thoroughly examined for any defect every time before they are put to use.
- In all diving operation, efficient signalling system to enable the diver to be in communication with his attendant shall be maintained.
- No person shall be employed under water as a diver unless he is certified fit for diving by THDC Medical Officer.
- Sufficient quantities of suitable filter materials, rock fill, gravel and sand shall be stored and suitably protected at strategic location of the dam for use in emergency conditions.
- Safety precautions specified under Chapter-17 shall also be applicable for construction activities.

18.4 Safety in waterways by boat

In order to ensure safety in waterways by boat, following guidelines should be followed:

4.1 Powerboat operator should possess a competency certificate from a competent authority, experience of boat operation and swimming.

4.2 Regular preventive maintenance schedule should be followed.

4.3 Following safety equipment should be carried and checked before boating:

- Suitable type adequate number of fire extinguishers
- Signal devices like flashlight, rockets or flares, flag and whistle or horn
- Tools necessary for minor repairs

- Anchor and extra anchor line
- Portable drain pump with related accessories and auxiliary source of power for pump
- Drinking water
- Communication media
- First aid kit
- GPS system, Compass and map of the area
- Adequate number of 'Life jackets' and 'Life buoy' for the passengers
- Any other safety equipment required as per the situation.

4.4 Do not over load the boat. Ensure that everyone in the boat is properly seated before boat movement.

4.5 Boat-In charge shall maintain records of passengers, purpose of sailing etc. in a Logbook before permitting for sailing.

4.6 Watch for signs of water change and avoid foul weather and rough boating.

4.7 Stop the engine whenever passengers are boarding and/or de-boarding the boat. Shifting the drive unit into neutral is not sufficient.

4.8 Ensure that every passenger wears "Life Jacket" before boarding the boat.

4.9 Communicate do's and don'ts to passengers before sailing the boat.

4.10 Never be under the influence of alcohol or drugs while boating.

4.11 Train boat attendant about the important basic operations like starting and operating the engine, boat handling, operating system of auxiliary supply, drain of water from the boat during emergency.

4.12 Know your boating area and avoid hazardous locations.

4.13 The operator must have an unobstructed view particularly to the front.

4.14 Any near miss incident/accident while sailing should be reported by the boat operator to the Boat-Incharge .

4.15 Proper ventilation arrangement should be made on boat.

18.5 Rescue equipment for prevention from drowning

- Where there is a risk of fall and drowning of any person in water, suitable rescue equipment and trained staff shall be kept and maintained in ready to use condition and steps to promptly rescue such person shall be taken.
- The rescue equipment shall include properly maintained lifesaving skiffs (Boats) with life vests and life buoys of approved by competent authority and rope attachments etc.
- Walkways and structures extending over or immediately adjacent to water shall be provided with ring buoys.
- All persons shall wear Life preservers, vests or jacket while working on;
- Floating pipeline, pontoons, rafts, float stages etc.
- Open deck-floating plant not equipped with bulwarks, guardrails or other lifelines;
- Structures extending over or adjacent to water except where proper guardrail or safety belts and life lines are provided; and
- Skiffs, small boats or launches except when working inside of enclosed cabin or cockpit.

18.6 Working in gassy tunnels

- The ventilation in gassy tunnels shall be properly designed after analysis of the gases observed inside the tunnel.
- While fans are operating in series, it shall be ensured that all the fans in a duct line are working. In case of stoppage of any fan, there must be some arrangement to warning about failure.
- The welding and cutting by gas shall not be allowed inside the gassy tunnel.

18.6.1 Safety measures explained in Chapter-17 shall also be followed.

18.7 Control of dust, silica and noxious gases in underground works (including ventilation in underground works)

- The purpose of ventilation in underground works is to make the working space safe for workers by keeping the air fresh and respirable and by eliminating harmful and obnoxious dust, dynamite fumes and other gases.
- Mechanical ventilation shall be adopted where necessary to force the air in or exhaust the air out from the working face to the portal through a pipe to achieve the safety as laid down.
- The concentration of various gases in atmosphere inside the underground works by volume shall be as follows:
- Oxygen - not less than 19.5 percent.
- Carbon monoxide - not more than 0.005 percent.
- Carbon dioxide - not more than 0.5 percent.
- Nitrogen fumes - not more than 0.000 5 percent.
- Methane - not more than 0.5 percent at any place inside the tunnel, for example, in a cavity in the roof, etc.
- Hydrogen sulphide - not more than 0.001 percent.
- Aldehyde - as formaldehyde not more than 0.000 2 percent.
- Testing - The tests shall be carried out once every 24 hours but, in any case, after every blast or a major rock-fall. In case any of the gases mentioned above are detected to have crossed the threshold value indicated therein, the workmen shall be withdrawn immediately till the percentage is brought down well below the threshold value by improving the ventilation or by other effective measures.
- Test records of gases, temperature and ventilation measurements shall be maintained.
- Adequate steps shall be taken to prevent the liberation, accumulation and the propagation of air-borne dust. Only wet drilling shall be permitted inside the underground works. Besides wet drilling, there shall be adequate ventilation for dust control and periodical medical check-up of the workers, working in underground works shall be done to check up their physical fitness. Such check shall be at least once in three months and the results recorded in the registers provided for the purpose.
- The air-borne dust concentration at the working face shall be tested once a month and if the air-borne concentration of total dust exceeds 10 mg/m3, ventilation shall be adequately improved. If required water spraying of the air-borne dust will be resorted to. (It is assumed that the air-borne dust is mainly nuisance dust containing not more than 1 percent free Silica and also does not contain other toxic impurities.)

- Ventilation and exhaust system for underground works shall be of sufficient capacity to maintain an adequate supply of uncontaminated pure air at all points in underground works. The design of ventilation system shall provide for size and design of diesel engines to be used as well as for safe hygienic limits for exposure of employees to the multiple toxic and objectionable gases in the underground works.

18.8 Safety in grouting, guniting, shotcreting

- Many of the hazards of grouting, guniting and shotcreting operations are similar to other construction activities and are, therefore, covered in Chapter-17 of Construction Safety.
- All opening of grout mixture shall be adequately guarded. All flywheels and all other moving parts including compressor driver belts shall likewise be fully guarded.
- All Pipes and hose used to convey grout shall be of proper size and strength to safely withstand the maximum operating pressures. Pumps shall not be operated at pressures above their rated capacity. Cleaning of pipe line shall be carefully done.
- All hose couplings shall be of standard types, and makeshift wire connections shall not be used. Pipes or hoses lay along ladder ways, catwalks, or ramps, shall be located at one side or the travel way in order to prevent tripping hazard.
- Proper tools for the work to be done shall be used and maintained in good condition. Only wrenches with jaws in proper condition shall be used. In using a wrench it shall always be so placed that the pull tends to force the jaws further on the nut, and the user shall make sure that his footing is secure before applying force to the wrench.
- Wherever feasible, a telephone system shall be used to provide positive and quick method of communication between all control locations or grout operations.
- All galleries or shaft, where grouting is in progress, shall be adequately lighted and ventilated and reasonably free from water. All unused shafts, vertical stairwells or other opening in galleries shall be barricaded.
- Worker working in elevated position shall use suitable PPEs or other safety devices. All workmen in the vicinity of sand blasting or guniting operations shall wear goggles and respirators.
- Only experienced worker shall be employed for guniting and shotcreting, which is a special type of concrete work. The nozzle man and the helper shall be provided with cup type safety goggles and shall use them protection against rebound material. The nozzle man shall operate the nozzle so as to keep the rebounds at a minimum and care must be taken not to trap the rebound on cleaning men in the blast.

18.9 Safety against landslides

- Avoid building houses near steep slopes, close to mountain edges, near drainage ways or along natural erosion valleys.
- Avoid going to places affected by debris flow. In mud flow areas, build channels to direct the flow around buildings.
- Stay alert and awake. Many deaths from landslides occur while people are sleeping.
- Listen for unusual sounds that might indicate moving debris, such as trees cracking or boulders knocking together.
- Move away from the landslide path or debris flow as quickly as possible.
- If you are near a stream or channel, be alert for any sudden increase or decrease in water flow and notice whether the water changes from clear to muddy.

- Go to designated public shelter if you have been told to evacuate.
- Stay away from the slide area as there may be danger of additional slides.
- Check and assist injured and trapped persons near the slide, without entering the direct slide area.

18.10 Working in rainy and foggy seasons

- Thunder and lightning
  - Stay away from broken power lines and report immediately.
  - Do not lie on concrete / marble floors and do not lean against walls.
  - Avoid contact with electrical equipment's or cord, unplug all electrical / electronic equipment / appliance well before the storm arrives.
  - Remember, rubber soled shoes and rubber tires provide no protection from lighting.
- Cold Wave
  - Protect yourself, from frostbite and hypothermia by wearing warm, loose fitting, lightweight clothing in layers.
  - Maintain proper ventilation when using heaters or coal oven to avoid toxic fume.

18.11 Safety measures to minimize the effect of mishaps resulting on account of geological surprises

- Earthquake
  - ✶ If outdoors, move to an open area away from all structures, especially buildings, bridges, and overhead power lines.
  - ✶ If inside, stay inside. DUCK, COVER & HOLD! Duck under firm furniture. Cover as much of your head and upper body as you can. Hold on to the furniture. Move to an inside wall and sit with your back to the wall, bring your knees to your chest and cover your head. Stay away from mirror and window. Do not exit the building during the shaking.
- Flood
  - Do not get into water of unknown depth and current.
  - Turn off the main electric power supply. Do not use electrical appliances, which have been in flood water.
  - Be careful of snakes, as snake bites are common during floods.
  - If area is flood prone, everybody should know the safe routes to nearest shelter. Keep dry food, drinking water and clothes ready. Drink preferably boiled water.


20.09.10

19 Dock Safety

19.1. Role and Responsibility

- Immediate Responsibility

  (a) The immediate responsibility to ensure of dock used for VIP Boat, Barge and surveillance Boat shall be of the HOD-Dam

  (b) Project Head THDCIL.

19.2. Legal Provision

The Dock Workers (Safety, Health and Welfare) Act, 1986

The Dock Workers, (Safety, Health and Welfare) Rules, 1990

19.3 Boat Safety Rules

Boat safety rules are essential for ensuring the well-being of everyone on board and for preventing accidents or mishaps on the water. Here is some fundamental boat safety rules:

1. Checklist to ensure availability of following safety equipment before sailing:

SL. NO.	CHECK AVAILABILITY OF FOLLOWING EQUIPMENT IN GOOD WORKING CONDITION BEFORE SAILING	Tick (✓)	
		OK	NOT OK
1	Boat operator has valid boating license or certification of jurisdiction.		
	Tools necessary for minor repairs are available.		
2	Anchor and extra anchor line available.		
3	Portable de-watering pump with related accessories and auxiliary source of power for pump available		
4	Ensure availability of Drinking Water, Communication Media, First aid kit with trained first-aider, GPS system, Compass and Map of the area.		
5	Adequate number of Life jackets and Life buoy or personal flotation devices (PFDs) on board for every passenger.		
6	Ensure regular preventive maintenance is done and boat have valid fitness Certificate of Govt. Approved competent person / agency.		
7	Ensure that insurance cover of passengers and hull and machine is valid.		
8	Availability of emergency stock of diesel in the boat before sailing.		
9	Dos and don'ts are communicated to passengers before sailing and sensitize them about emergency plan and their role and responsibility during emergency.		
10	Emergency support contact numbers are displayed in the boat.		
11	Records of passengers on board, purpose of sailing etc. is maintained in a Logbook before sailing.		
12	Check the engine, fuel system, navigation lights, and other critical components.		

2. Dos

2.1 Ensure that every passenger including children wear life jackets at all times while on board on the boat.

2.2` Have essential safety equipment on board, including a first aid kit, fire extinguisher, distress signals, flashlight, whistle, and a throwable flotation device.

2.3 Check weather forecasts before heading out and be aware of changing weather conditions before sailing. Avoid boating in severe weather conditions like storms, high winds, or fog.

2.4 Obey boat safety rules displayed on the boat.

2.5 Regularly inspect and maintain the boat to ensure it is in good working condition. This should include checking the engine, fuel system, navigation lights, and other critical components.

2.6 Operate boat at a safe speed, especially in crowded or narrow waterways. Be aware of speed limits and adjust your speed according to conditions such as visibility, traffic, and water depth.

2.7 Ensure that everyone in the boat is properly seated before boat movement.

2.8 Understand and follow navigation rules and regulations, including right-of- way rules, buoy markers, and navigation lights, to avoid collisions and maintain safe navigation.

2.9 Always stay alert while operating a boat and be mindful of other vessels, swimmers, and obstacles in the water.

2.10 REMEMBER, SAFETY IS EVERYONE'S RESPONSIBILITY

2.11 Know what to do in case of emergencies, such as man overboard situations, engine failure, or taking on water. Have a plan in place and know how to use safety equipment and emergency communications devices.

2.12 Train boat attendant about the important basic operations like starting and operating the engine, boat handling, operating system of auxiliary supply, draining of water from the boat during emergency.

2.13 Stop the engine whenever passengers are boarding and/or de-boarding the boat. Shifting the drive unit into neutral is not sufficient.

2.14 Know your boating area and avoid hazardous locations.

2.15 Report any near miss incident/accident while sailing to the Boat Operator / In-charge.

3. Don'ts

3.1 Don't allow to board on boat without wearing a properly fitted life jacket.

3.2 Do not sail above the recommended speed.

3.3 Never dive headfirst into unknown or shallow waters. Always check the depth first.

3.4 Operate a boat under the influence of alcohol or drugs. Boating while impaired significantly increases the risk of accidents

4. Rescue equipment for prevention from drowning

4.1 Where there is a risk of fall and drowning of any person in water, suitable rescue equipment and trained professional staff shall be available on boat for immediate rescue operation.

4.2 The rescue equipment shall include properly maintained lifesaving skiffs (Boats) with life vests and life buoys approved by competent authority and rope attachments etc.

4.3 Walkways and structures extending over or immediately adjacent to water shall be provided with ring buoys.

4.4 All persons shall wear Life preservers, vests or jacket while working on;

- Floating pipeline, pontoons, rafts, float stages etc.
- Open deck-floating plant not equipped with bulwarks, guardrails or
- other lifelines;
- Structures extending over or adjacent to water except where proper guardrail or safety belts and life lines are provided.

20 Machine Safety, Welding / Cutting & Grinding Safety

20.1 Role and Responsibility

- **Immediate Responsibility**

  Immediate responsibility to ensure Machine Safety, Welding / Cutting and Grinding Operations shall be of the Site In-charge / Engineer In-charge and Contractors.

- **Ultimate Responsibility**

  Ultimate responsibility shall be of the Owner / Occupier / Employer / Manager Mines and Project Manager of the Contractor.

20.2 Legal provisions

- Building and Other Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996 and Central Rules, 1998
- Central Electricity Authority (Safety Requirements for Construction, Operation and Maintenance of Electrical Plants and Electric Lines) Regulations, 2011 (2022) Factories Act, 1948 and State Factories Rules made there under.
- Gas Cylinder Rules 2004 (2015)
- ISO-45001 (2018): Occupational Health and Safety Management Systems Requirements with guidance for use.
- Occupational Safety, Health and Working Conditions Code 2020 and (Central) Rules 2020

20.3 Introduction Machine Safety

Machine safety is of paramount importance in any industrial or manufacturing environment where machines are used. It aims to protect workers from potential hazards associated with the operation and maintenance of machinery. Ensuring machine safety not only minimizes the risk of accidents and injuries but also improves productivity, reduces downtime, and enhances the overall safety culture within an organization.

20.3.1 Hazards associated with machines

Several types of hazards can be associated with machines, including:

Mechanical : Entanglement, crushing, shearing, cutting, impact.

Electrical : Electric shock, arc flashes, and explosions.

Chemical : Exposure to hazardous chemicals, fumes, and dust.

Ergonomic : Repetitive strain injuries, awkward postures, and fatigue.

Noise : Excessive noise levels leading to hearing damage.

20.3.2 Key Principles of Machine Safety

There are several key principles that guide the implementation of machine safety:

- Risk Assessment to identifying and analyse potential risks associated with the machines before they are used.
- Eliminate and Minimize Hazard by applying engineering controls and safety devices to eliminate or reduce risks to the greatest extent possible.
- Safeguarding by installing physical barriers, interlocks, and other safeguards for protection against hazards of moving parts.
- Providing adequate training and awareness to workers on the safe operation, maintenance, and emergency procedures for specific machines. · Supervision and monitoring through regularly inspection and maintenance of machines to ensure they are functioning safely and implementing safe work practices.

20.3.3 Benefits of Machine Safety

Implementing effective machine safety measures can offer numerous benefits, including:

- Reduced risk of accidents and injuries and improved workers health and well- being, lower medical costs, and fewer lost man-days.
- Increased productivity, Safe working environments lead to increased worker morale, motivation and engagement, resulting in improved productivity.
- Implementing safety standards and regulations ensures compliance with legal and statutory requirements.
- Demonstrating a commitment to safety strengthens company's reputation and fosters trust with stakeholders.

20.4 Introduction Welding, Cutting and Grinding Operations

Welding, cutting, and grinding are essential processes in industries, including metal fabrication, construction, and manufacturing. These operations involve high temperatures, sparks, and sharp edges, necessitating proper training, safety precautions, and knowledge of techniques.

Welding Process

Welding is the process of joining two or more pieces of metal by melting the materials at the joint and allowing them to fuse together. Heat for welding can be generated by various sources, including:

Electric arc: An electric arc is created between an electrode and the workpiece, generating intense heat. This is the common method of welding.

Gas flame: A gas flame, typically created by burning oxygen and acetylene to heat the metal.

Laser : Lasers can be used to provide a precise and concentrated heat source for welding.

Each welding/cutting method has its advantages and limitations, making them suitable for different applications, materials, and working conditions. Here are some common types of welding:

1. **Shielded Metal Arc Welding (Electric Arc Welding):**

   Involves using a consumable electrode coated in flux to create the arc and protect the weld from atmospheric contamination.

2. **Metal Inert Gas (MIG) Welding:**

   Uses a continuous wire electrode and a shielding gas to protect the weld from the surrounding air.

3. **Tungsten inert Gas (TIG) Welding:**

   Uses a non-consumable tungsten electrode and a shielding gas, often used for precise and high-quality welds.

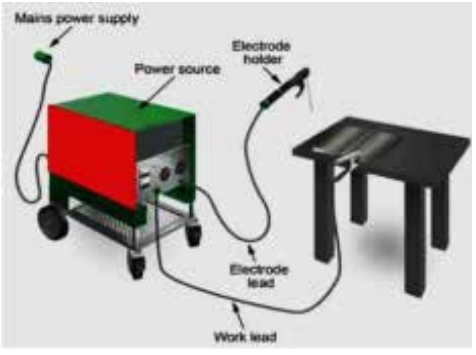
4. Spot Welding:

Joins metal sheets by applying pressure and passing a current through two electrodes, creating a spot weld.

5. Plasma Arc Welding (PAW)

Utilizes a constricted arc and a high-velocity ionized gas stream to weld metals. The potential common hazards associated with welding, cutting and grinding process includes handling of compressed gases, exposure to electricity, fumes, gases, noise, radiation, fire and explosion.

20.4.1 Electric Arc Welding and cutting



1. Arc Welding a. The frame or case of the welder shall be properly grounded.
2. A safety-type disconnecting switch or controller shall be located near the machine.
3. The welder or welders shall be protected by a properly sized fuse or circuit breaker on an independent circuit.
4. Welding shall be done with adequate ventilation.
5. Welding shall not be done outdoors while raining
6. Welding shall not be done on a wet ground/floor.
7. Welding cable joints shall be made appropriately using ferrules and the joints shall be insulated with heat resistant tapes.
8. Welding Cables shall not be laid along with other power cables.
9. Area shall be cleared of Flammables and combustibles before commencing welding.
10. Rebar or other materials shall not be used in place of welding return cable. 11. Safety Shoes, Hand gloves, Welding Shield, Apron, Leg Guard, and Hand guard shall be used while doing welding work.
12. Arc welding and cutting operations that are carried on at places where persons other than the welders are working or passing should be enclosed by means of suitable stationary or mobile screens.
13. Electric arc-welding equipment should not be left unattended with current switched on.

Safety while welding and cutting in confined Space

When welding or cutting is to be carried out in a confined space the following additional precautions shall be taken.

a. The confined space must have been cleaned and tested gas free. b. Adequate ventilation must be provided.

c. Equipment to continuously measure the oxygen content of the atmosphere shall be placed in the confined space.

d. The equipment shall give an audible warning if the oxygen becomes depleted.

e. Consideration shall be given to the use of breathing apparatus by people working inside the confined space.

f. All gas cylinders must be kept outside the confined space.

Electrical Hazards

a. The human body is unlikely to be harmed under normal dry conditions by voltages of 110 for direct current and 42 for alternating current.

b. Voltages shall be kept to the minimum required to perform the task. The return cable shall be clamped to the work-piece close to the weld location. The clamp shall be clean and rust free and shall be bolted firmly in place.

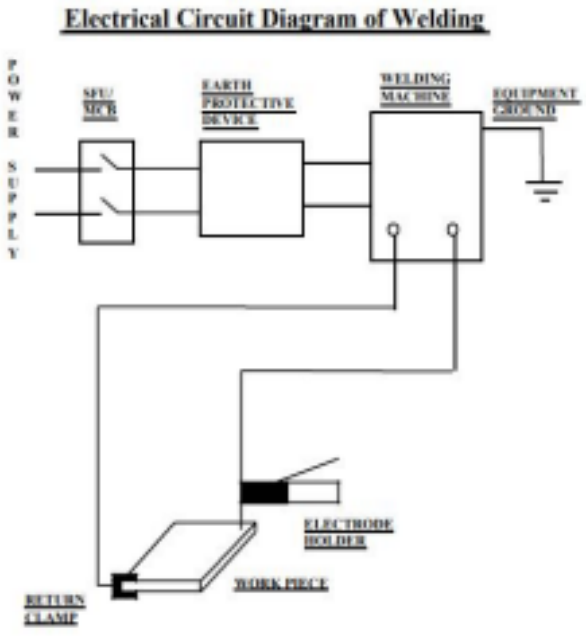
c. The cables shall be inspected before use to ensure that the insulation is in good condition. Any bare conductor could result in sparks occurring in a hazardous area. This can result in a serious fire or explosion.

d. Cables shall not be in contact with or near to wires on cranes, derricks, winches and guy wires to stacks to avoid damage to these installed items.

e. Welding shall not be carried out on plant equipment suspended from a crane in view of the hazard of stray currents causing damage to the crane lifting wires.

f. Frames of arc welding machines should be effectively earthed.

g. Connections to welding terminals should be made at distribution boxes, socket outlets, etc. by bolted joints.



h. Return conductors should be taken directly to work and securely connected mechanically and electrically to it or to the work bench, floor etc. and to an adjacent metallic object (Borrowed Neutral).

i. Welders should take adequate precautions to prevent:

- Any part of their body from completing an electric circuit;
- Contact between any part of the body and the exposed part of the electrode, or electrode when in contact with metal; and
- Wet or damaged clothing, gloves and boots from touching any live part.

Annexure: Arc Welding and Arc Cutting Checklist

Health Hazard of welding fumes and prevention

- The inhalation of metal oxides in excess of recommended safe levels can produce a temporary fever known as metal fume fever. It is a temporary illness, which passes off within a few hours. However, inhalation of high concentrations of metal oxides may cause prolonged fever, permanent impairment or even death. Fumes containing lead, cadmium, manganese, antimony and copper are particularly toxic and require special care.
- Welding on painted or contaminated metal can also give rise to toxic fumes. Adequate ventilation must be provided to protect the welder. Local fume extraction ducts positioned to remove fumes from the welders breathing zone are normally used in workshops. Forced ventilation shall be considered for tented areas to remove dangerous fumes.

20.4.2 Gas Welding and Cutting Operation

Safety in gas cylinders storage

- The number of gas cylinders in stock should be kept as low as possible.
- Cylinders should be kept upright in racks fitted with a chain to prevent accidental fall of cylinder.
- Cylinders should be stored in a well-ventilated, covered, secure area. Empty cylinders shall be segregated from full ones.
- Storage areas should be located away from sources of ignition, heat and traffic hazards. Storage areas should be kept clean.
- Cylinders should be used in FIFO rotation (in order they are received from suppliers).
- When cylinder is not in use, cylinder caps should always be in place.
- The contents of cylinders should be identified by both colour coding and a written description.
- When gases of different types are stored at the same location, cylinders shall be grouped by types of gas (e.g. flammable, toxic, inert or corrosive).

Safety in handling and gas welding and cutting

- Gas cylinders should be inspected, stored, handled and transported in conformity with the Gas Cylinders Rules, 2016.
- Cylinders should be moved from one place to another through specially designed trolleys or baskets. They shall always be kept upright.
- When in use, cylinders should be held in upright positions in gas cylinder trolley and straps, collars or chains.
- Do not apply oil or grease on oxygen cylinders and their regulators to avoid explosion hazard.
- All gas cylinders must be fitted with a suitable and standard regulators before use. Before fitting the regulator make sure that there is no dirt or oil in the valve or connection.
- A valve key should be chained to the rack or trolley where cylinders are stored / used.
- Cylinders containing Acetylene require careful handling as the gas is dissolved in solvent. Acetylene is an unstable chemical which shall easily explode. Cylinder pressures are low, if the pressure exceeds 17 kg/cm^2 do not put the cylinder into service.
- Flash back arrestors shall be used on hose connections.
- Gas cylinders should not be taken into confined spaces. If cutting or burning is to be done inside a vessel the cylinders should be stored outside the vessel.
- Hoses should be regularly inspected to prove them to be in good condition..

Regulators

1. Regulators should be used only for the type of gas indicated by the supplier and should be of the correct pressure rating for the gas supply.
2. Regulators used on gases used for process, maintenance or laboratory purposes should be overhauled and tested every 2 years. This work shall be carried out by an approved maintenance company. The date of the next test shall be engraved on a label on the regulator.

3. Do not allow oil or grease to be on regulators used on oxygen. Do not use brass or copper materials on regulators which are to be used on acetylene.

Hose

- Especially designed 'Hose' for welding and cutting operations should be used to connect an oxy-acetylene torch to gas outlet;
- Hose lines for oxygen and for oxy-acetylene should be of different colours.
- Care should be taken that hose does not become kinked or tangled, stepped on or run-over or otherwise damaged.
- Hose in which a flashback has burned, should be discarded.
- No hose with more than one gas passage should be used.
- Only soapy water should be used for testing of hose for gas leaks..

General Safety Requirements

Wear fire resistant protective clothing and equipment such as fire resistant aprons, Welder's Shield / Helmet & Safety Goggles with suitable filter lenses.

a. Shut off the blowpipe when not in use. Do not leave a lighted blowpipe on a bench or the floor as the force of the flame may cause it to move.

b. Clamp the work-piece, do not hold it by hand.

c. Keep hoses away from the working area to prevent contact with flames, heat, sparks or hot spatter.

To prevent fire

- Move the work-piece to a safe location for carrying out the hot work process;
- Remove any combustible materials (such as flammable liquids, wood, paper, textiles, packaging or plastics) from within about 10 M away from the work;
- Use guards or covers to prevent hot particles passing through openings in floors and walls (doorways, windows, etc.).
- Maintain a continuous fire watch during the period of the work, and for at least an hour afterwards;
- Keep fire extinguishers nearby for emergency use. .

To prevent leaks

- Keep hoses clear of sharp edges and abrasive surfaces or where vehicles can run over them.
- Do not allow hot metal or spatter to fall on hoses.
- Always turn the gas supply off at the cylinder when the job is finished;
- Maintain all equipment and keep in good condition;
- Regularly check all connections and equipment for faults and leaks.
- Always provide adequate ventilation during welding and cutting operations;

Backfire hazard

A backfire is when the flame burns back into the blowpipe often with a sharp bang. This may happen when the blowpipe is held too close to the work piece, or if the nozzle is blocked or partly blocked. The flame may go out or it may re-ignite at the nozzle. Sometimes the flame burns back into the blowpipe, and burning continues at the mixing.

If a backfire does occur

- Shut off the blowpipe valves, oxygen first and then the fuel gas.
- Shut off the oxygen and fuel gas cylinder valves.
- Cool the blowpipe with water, if necessary.
- The blowpipe, hoses, regulators, flashback arresters and other components may have been damaged. Check carefully and replace if necessary before reuse.

To prevent flashbacks

1) Use the correct lighting up procedure. Purge the hoses before lighting the blowpipe to remove any potentially explosive gas mixtures. Use a spark igniter and ignite the gas quickly after turning it on.
2) Ensure the blowpipe is fitted with spring-loaded non-return valves to prevent a backflow of gas into the hoses;
3) Use the correct gas pressures and nozzle size for the job.

Cutting

Cutting is the process of separating materials into smaller pieces. Several methods are used for cutting metal, including:

Oxyfuel cutting

Oxyfuel cutting uses a torch that burns oxygen and a fuel gas to heat the metal to its melting point. Once molten, the metal is blown away by an oxygen jet.

Plasma cutting

Plasma cutting uses a high-velocity jet of ionized gas to cut through metal.

Mechanical cutting

Mechanical cutting uses saws, shears, and other tools to separate metal.

Laser cutting

Laser cutting uses a powerful laser beam to vaporize metal, resulting in a precise and clean cut.

Safety Precautions during welding and cutting

Welding, cutting, and grinding are potentially hazardous operations. It is essential to follow proper safety precautions to avoid injuries:

- Always wear appropriate Personal protective equipment (PPE) such as eye protection, gloves, and respiratory protection, when performing these operations.
- Ensure adequate ventilation to remove fumes and smoke.
- Have appropriate fire extinguishers readily available for emergency use.
- When using electric welding equipment, ensure it is properly grounded and ELCB is provided.
- Ensure proper training of welders before attempting welding, cutting, or grinding operations.
- In case of gas welding / cutting operations, ensure that 'Flash Back Arrestors' are provided at both side i.e. near regulator and the torch.
- Ensure that 'Pressure Gauge' of the regulators are working properly.
- Gas Cylinders are kept in a trolley or securely supported in vertical position.

20.5 Grinding Process

Grinding is the process of removing material from a workpiece using a rotating abrasive wheel. Grinding can be used for various purposes, including:

Shaping : Grinding can be used to shape metal to desired dimensions.

Smoothing : Grinding can be used to smooth rough surfaces.

Deburring : Grinding can be used to remove sharp edges from metal.

Sharpening : Grinding can be used to sharpen tools.

20.5.1 Hazards in grinding process

The grinding process, despite its widespread use and versatility, presents numerous potential hazards to workers. These hazards can be categorized into the following main types:

Physical Hazards

❖ **Abrasive Wheel Breakage**

Grinding wheels are susceptible to breakage due to various factors, including improper mounting, excessive pressure, and internal flaws. When a wheel breaks, it can shatter into pieces, launching them at high speeds, potentially causing severe injuries to the operator and bystanders.

❖ **Flying Debris:**

Grinding operations generate a significant amount of flying debris, including sparks, metal chips, and grinding dust. This debris can strike the operator's eyes, face, and other exposed body parts, causing burns, cuts, and abrasions.

❖ **Flying debris in grinding**

Contact with Rotating Parts: Grinding machines have several rotating parts, such as the grinding wheel and the spindle. Accidental contact with these parts can result in serious lacerations, amputations, and even death.

❖ **Health hazards due to inhalation of grinding dust**

Grinding dust contains fine particles of metal, abrasive material, and other contaminants. Inhaling this dust can cause respiratory illnesses, including silicosis, pneumoconiosis, and lung cancer.

❖ **Fire and Explosion Hazards:**

Grinding operations generate sparks that can ignite flammable materials, leading to fires and explosions.

❖ **Electrical Hazards:**

Grinding machines operate on electricity, and contact with live parts can cause electrical shock. Faulty electrical equipment can lead to electrical fires and explosions.20.5.

20.5.2 Safety measures for personal protection

Before Starting:

- Always wear appropriate Personal Protective Equipment (PPE) such as:
  - Safety glasses with side shields or a face shield for eyes and face protection.
  - Dust mask or respirator suitable for the grinding dust for respiratory protection.
  - Earplugs or Earmuffs for hearing protection, if required.

- Leather or other heavy-duty gloves to protect hands.
- Long sleeves and pants clothing to protect skin from sparks and debris.

- Inspect to ensure that grinding machine is in good condition, with no cracks, loose parts, or frayed cables.
- Inspect to check that there is no cracks, chips, or damage in grinding wheel. Conduct 'Ring Test' of the grinding wheel for soundness before loading on the machine.
- Select the correct rpm wheel size with respect to the grinding machine rpm.
- Mount the wheel properly and follow manufacturer›s instructions for safe and secure mounting.
- Ensure that guard is are properly positioned and adjusted to provide adequate protection.
- Remove any flammable materials or debris from the area.

During Operation:

- Maintain a secure grip, hold the grinder firmly with both hands.
- Stand firmly, keep a stable footing and maintain good posture.
- Allow the wheel to reach full speed before contacting the material.
- Apply gentle pressure, use minimal pressure to avoid wheel breakage and excessive dust.
- Move the grinder steadily, avoid jerky movements or excessive force.
- Never force the wheel, if the wheel binds, stop the grinder and identify the cause.
- Be aware of sparks and debris, keep your face and body away from the path of sparks and debris.
- Never leave the grinder unattended, turn off and unplug the grinder when not in use.

20.6 Do's and Don'ts in Hot Work (Includes Welding, Cutting and Grinding)

Do's

- Remove all combustible/ flammable materials away from the area.
- Ensure Work Permit is obtained before executing hot work.
- Keep the right type of Fire Extinguisher near the hot work.
- Barricade the work area and display warning signage to prohibit entry of unauthorized people.
- Wear proper PPEs viz. Leather Glove, Welding Helmet / Welding Shield / Safety Goggles, Aprons, Safety Shoes, etc.
- Ensure safety guard is provided on the Grinding / Cutting Machine.
- Ensure welding machine is properly earthed and grounded.
- Protect nearby gas lines/ equipment from falling sparks.
- Cover the floor opening / grating with Fire blanket to prevent the spread of sparks from one level to another level.
- Tool Box Talk (TBT) shall be given to the workers before executing the job.
- Close the Work Permit after completion of work.
- Carry out proper housekeeping after finishing the work.
- Use Flashback arrestors in Gas Welding / Cutting torch and at the ends of DA gas cylinder to stop the flame or reverse flow of gas back into the equipment.
- Always use trolley for transporting cylinders from one place to another.

- Power supply shall be given through only 30 mA ELCB/ RCCB.
- Grinding or Cutting wheel RPM should be greater than the machine RPM.
- Cylinder valves must be protected with safety valve caps in place.
- Stop the machine before oiling, cleaning or repairing.
- In case of leakage from regulators, valves or other fittings of the gas cylinders, the cylinders should be removed immediately to a safer place and inform the supplier.
- Close the cylinder valve before moving from one place to another.

Don'ts

- Don't use damaged cables and hoses.
- Don't use normal glasses for welding work.
- Don't join the welding cables, use single length cables.
- Don't cool the electrode holders by immersing them in water.
- Never try to shut off the gas supply by folding/ crimping the hose.
- Don't do the hot work with flammable materials such as oils, paints, etc., in the vicinity.
- Don't place cables or pipes in the hallway to avoid tripping.
- Don't cut or weld the empty paint or chemical drum.
- Don't keep the cylinder in horizontal position.
- Don't roll/ lift the cylinders for transporting.
- Don't try to invert the position of the gas cylinders.
- Don't wear loose clothes, rings or watches while working on any rotating machinery.
- Never leave machine in motion unattended. Isolate the main switch before leaving the place.
- Don't store Oxygen gas cylinders near cylinders containing flammable gases like Hydrogen, Acetylene, etc.
- Don't use domestic LPG cylinders for Gas welding and cutting purpose.

Annexure

Annexure-1: Welding Machine Safety Checklist.

Annexure-2: Machine Safety Checklist.

Normative References

- *Factories Act,1948 and rules made thereunder*
- *Gas Cylinders Rules 2016*
- *Electricity Act, 2003*
- *Indian Electricity Rules-2005*
- *Mine Act, 1952 & Mine Rescue Rules, 1985*
- *Occupational Safety, Health and Working Conditions Code 2020 and Central Rules 2020*
- *Schedule-XXXII Welding Process and any Work Incidental thereto or connected therewith of Uttar Pradesh Occupational Safety, Health and Working Condition Code Rules, 2021*

Doc. No: SG/08, Rev no: 00

Checklist for Arc Welding and Cutting

Sl. No.	Points	Yes	No	NA
1.	Is work permit issued to working agency before start of the job?			
2.	Is the additional work permit issued to the agency if the job is to be carried out at height (more than 2 meter)/ confined space/ gaseous hazardous area/ near electrical installations?			
3.	Do all the manual transformer based welding machines contain manufacturer's name & detail technical specifications?			
4.	Are the falling of spatters from height prevented by proper barricading?			
5.	Are all welding & cutting cables completely insulated, flexible type and capable of handling the maximum current requirement of the work?			
6.	Are all the exposed portion of the cable protected by suitable rubber and friction tape or other equivalent insulation?			
7.	Are all frames of arc welding and cutting machines grounded properly?			
8.	Is the wesguard safety device put in place, where required?			
9.	Are the fire extinguishers available in the working area with readiness for use?			
10.	Is there proper ventilation system in place, when the welding & cutting job is performed in confined space?			
11.	Is the flammability test conducted if welding or cutting to be done on the surface covered by preserve coating?			
12.	Is the working area free from all inflammable materials?			
13.	Are all the work permits for hot job recorded?			
14.	Is there an arrangement for collecting spatters at the source?			
15.	Is IR (Insulation, Resistance) value of the welding machine > 2M-Ohm, measured with 500 Volt Megger?			
16.	Is the welding machine connected with separate circuit breaker or Switch Fuse Unit (SFU)?			
17.	Is the earth leakage protective device used?			

Machine Safety Inspection Checklist

ANNEXURE

Machine Name / ID

Date of Inspection

Inspector Name

INSTRUCTIONS:

This checklist is designed to assess the safety of machines in the workplace. Carefully review each item and mark the corresponding checkbox to indicate compliance or note any observations and areas for improvement. Use the "Notes/Observations" section to provide additional details, necessary repairs, and any required follow-up.

MACHINE GUARDS

Guards in Place: Check that all required machine guards are in place during operation.	☐ Yes	☐ No	☐ NA
Guards Securely Attached: Verify that guards are securely fastened and cannot be easily removed.	☐ Yes	☐ No	☐ NA
Interlock Systems: Check if interlock systems are working correctly with the guards.	☐ Yes	☐ No	☐ NA

Observations / Notes / Corrective actions, if any:

EMERGENCY STOP BUTTONS

Emergency Stops Functionality: Test the emergency stop buttons for quick and proper activation.	☐ Yes	☐ No	☐ NA
Location and Visibility: Ensure that emergency stop buttons are easily accessible and clearly labeled.	☐ Yes	☐ No	☐ NA
Functionality Test: Verify that the emergency stop stops the machine as expected.	☐ Yes	☐ No	☐ NA

Observations / Notes / Corrective actions, if any:

CONTROL PANELS AND LABELS

Control Panel Labels: Check that control panels are properly labeled with clear instructions.	☐ Yes	☐ No	☐ NA
Control Panel Accessibility: Ensure that control panels are easily accessible to authorized personnel only.	☐ Yes	☐ No	☐ NA
Safety Labels: Verify that safety labels and warnings are present as required.	☐ Yes	☐ No	☐ NA

Observations / Notes / Corrective actions, if any:

POWER SOURCES

Power Supply: Check if machines are properly connected to the power supply.	☐ Yes	☐ No	☐ NA
Power Cords and Wiring: Inspect power cords and wiring for damage or wear.	☐ Yes	☐ No	☐ NA
Overcurrent Protection: Verify that overcurrent protection devices are in place and functional.	☐ Yes	☐ No	☐ NA

Observations / Notes / Corrective actions, if any:

MACHINE OPERATION

Safety Devices Functionality: Test any safety devices, sensors, or light curtains for proper operation.	☐ Yes	☐ No	☐ NA
Sequence of Operation: Ensure that the machine operates as intended in a safe sequence.	☐ Yes	☐ No	☐ NA
Limit Switches: Check if limit switches are working correctly to prevent overtravel.	☐ Yes	☐ No	☐ NA

Observations / Notes / Corrective actions, if any:

MAINTENANCE AND LUBRICATION

Maintenance Schedule: Verify that machines are on a regular maintenance schedule.	☐ Yes	☐ No	☐ NA
Lubrication: Check that machines are properly lubricated as required.	☐ Yes	☐ No	☐ NA
Maintenance Records: Ensure that maintenance records are available and up to date.	☐ Yes	☐ No	☐ NA

Observations / Notes / Corrective actions, if any:

TRAINING AND QUALIFICATIONS

Operator Training: Review operator training records to ensure proper machine operation.	☐ Yes	☐ No	☐ NA
Authorized Personnel: Ensure that only authorized personnel operate and maintain the machines.	☐ Yes	☐ No	☐ NA
Certification: Verify that qualified personnel conduct maintenance and repairs.	☐ Yes	☐ No	☐ NA

Observations / Notes / Corrective actions, if any:

MACHINE STABILITY

Leveling: Check if machines are properly leveled and stable during operation.	☐ Yes	☐ No	☐ NA
Secure Mounting: Verify that machines are securely mounted to prevent vibrations or movement.	☐ Yes	☐ No	☐ NA
Anti-Tip Devices: Ensure that machines with a risk of tipping have proper anti-tip devices.	☐ Yes	☐ No	☐ NA

Observations / Notes / Corrective actions, if any:

ADDITIONAL NOTES/OBSERVATIONS

[Insert any additional notes or Machine Safety checklist observations made during the inspection]

STATEMENT OF INSPECTION

I hereby certify that I have conducted the above Machine Safety Inspection checklist and that the machines have been assessed for safety compliance. Any identified issues have been documented, and necessary corrective actions have been recommended.

Inspector's Name :

Date :

Signature :

APPROVED BY

Name :

Date :

Signature :

21 Material Handling and Lifting Machines

21.1. Role and Responsibility

Immediate Responsibility

Immediate responsibility for safety in material handling and lifting machines shall be of the Site In-charge / Engineer In-charge and Contractors.

Ultimate Responsibility

Ultimate responsibility shall be of the Owner / Occupier / Employer / Manager Mines / Project Manager of Contractor.

21.2. Legal Provisions

- The Factories Act, 1948 and the State Factories Rules;
- The BOCW Central Rules, 1998;
- The CEA Regulations, 2011

General safety provisions in handling and storage

- ☐ Materials shall be stored in racks, blocks, interlocked or otherwise secured safely to prevent sliding, falling or collapse and in an orderly manner. Passageway at the place of work shall always be kept free from obstructions. Piles of materials shall be stored or stacked in such a manner as to ensure their stability;
- ☐ Maximum safe load limits of floors within buildings and structures in kg/cm² shall be conspicuously posted in all storage areas, except for floor or slab on gradient. Material or equipment shall not be stored upon any floor or platform in such quantity as to exceed its safe load carrying capacity;
- ☐ Ailes and passageways shall be kept clear to provide for the free and safe movement of material handling equipment or persons;
- ☐ When a difference in road or working levels exist, means such as ramps, blocking or grading shall be used to ensure the safe movement of vehicles between two levels;
- ☐ Material stored inside buildings under construction shall not be placed within 2 m of any hoist way or inside floor openings nor within 3.2 m of exterior wall which does not extend above the top of material stored;
- ☐ Persons employed required to work on stored material in silos, hoppers and similar storage areas shall be equipped with lifelines and safety belts;
- ☐ Non-compatible materials shall be segregated in storage;
- ☐ Bagged materials shall be stacked by stepping back the layers and cross- keeping the bags at least every 10 bags high;
- ☐ Materials shall not be stored on scaffolds or runways in excess of supplies needed for immediate use;

- ☐ Bricks stacks shall not be more than 2.2 m in height. When a loose brick stack reaches a height of 1.3 m it shall be tampered back 5 cm in every foot of height above the 1.25 m level;
- ☐ Material or equipment shall not be stored or placed so close to any edge of a floor or platform as to endanger the safety of persons below or working in the vicinity. Where stacking, unshackling, stowing or unstaring of construction material or article, or handling in connection therewith cannot be safely carried out unaided, reasonable measures to guard against accident or dangerous occurrences shall be taken by shoring or otherwise to prevent any danger likely to be caused by such handling;
- ☐ The material or articles shall not be stacked against partition or walls of a warehouse or stores unless it is known that such partition or the wall is of sufficient strength to withstand the pressure of such materials or articles;
- ☐ The materials or articles shall not be stacked to such a height and in such a manner as would render the pile of such stack unstable and cause hazards to the building workers or the public in general;
- ☐ Where the building workers are on stack exceeding one point five meters in height, safe means of access to the stack shall be provided;
- ☐ All stacking or unshackling operations shall be performed under the supervision of a responsible person for such stacking or unstacking;
- ☐ The stacking of construction materials or articles shall not be made near the site of excavation, shaft, pit or any other such opening;
- ☐ Stacks that may lean heavily or become unstable or collapse are barricaded shall be avoided;
- ☐ Structural steel, poles, pipe, bar stock and other cylindrical materials, unless racked, shall be stacked and blocked so as to prevent sliding, spreading or tilting.

21.3. Safety in use of Powered Industrial Trucks

Powered industrial trucks, commonly referred to as forklifts are widely used for material handling in industries and construction sites. However, they also are involved in many injuries resulting in sprains and strains, physical injuries and fatalities.

21.3.1 Only trained and authorized personnel should be permitted to operate a forklift. Training should cover the safe operation of the forklift, as well as the specific hazards of the workplace.

21.3.2 Every day before operating a forklift, it should be inspected for any defects or damage. This includes checking the tires condition, brakes, steering, etc.

21.3.3 Always wear PPE, such as a hard hat, safety glasses, and steel-toed safety shoes, when operating a forklift.

21.3.4 When operating a forklift, be aware of your surroundings such as other workers, pedestrians, and obstacles, road condition; slop or steep height and pot holes, Head space and HT lines etc.

21.3.5 Operate the forklift at a safe speed approved by the management. Never exceed the posted speed limit.

21.3.6 Use the horn and lights when necessary to warn others of your presence. 3.7 Before loading material do the proper assessment of item to be moved for its size, shape and the route for any obstruction such as narrow passage, rough road conditions, weather condition etc.

21.3.8 Never overload the forklift. Overloading can cause the forklift to tip over or the load to fall.

21.3.9 The load should be balanced on the forks. An unbalanced load can cause the forklift to tip over.

21.3.10 Never drive with the load raised. The load should be lowered to the ground before driving. The load should not be lifted higher than the operator's eye level.

21.3.11 Never drive over uneven surfaces. Uneven surfaces can cause the forklift to tip over.

21.3.12 Never drive on ramps. Ramps should be driven up forwards and driven down in reverse.

21.3.13 Never leave the forklift unattended with the load raised. Always lower the load and set the parking brake before leaving the forklift.

21.3.14 The forklift should be parked in a designated area.

21.3.15 Report any near-miss of defect to supervisor / engineer In-charge immediately. 3.16 Ensure preventive maintenance of forklifts for breakdown free service. 3.17 When a forklift is parked, the forks should be placed flat on the floor. Do not allow any person to stand or walk under elevated forks.

21.4. Stacking of cement and bags containing other materials

21.4.1 The cement or other material in bags shall be stacked in a header and stature- wise in rows alternately in not more than 10 numbers and there will be circulation of space of at least 600 mm in between two such rows;

21.4.2 While removing bags from the stack pile the stability of such stack pile shall be ensured;

21.4.3 Bags containing cement or lime shall be stored on a firm ground;

21.4.4 The materials like bricks, tiles or blocks shall also be stored on a firm ground; 4.5 Reinforcing steel shall be stored according to its shape, size and length and stack of reinforcing steel kept as low as possible;

21.4.5 No pipe shall be stored on rack or in stack where such pipe is likely to fall by rolling;

21.4.6 The angle of repose shall be maintained where loose materials are stacked; 4.8 When dust laden material is to be stored or handled, measures shall be taken to suppress the dust produced by such storing or handling and suitable personal protective equipment supplied to and used by the building workers working for such storing or handling.

21.5. Disposal of debris and waste material

21.5.1 It shall be ensured that debris is;

a) Handled and disposed of by a method, which does not cause danger to the safety of a person and not allowed to accumulate so as to constitute a hazard;

b) Kept sufficiently moist to bring down the dust under control;

c) Not thrown inside or outside from height of such building or other construction work;

21.5.2 Brought down by suitable means chutes provided for the purpose and on completion of work, leftover building material, article or other substance or debris shall be disposed of as soon as possible to avoid any hazard to any traffic or person;

21.5.3 Whenever materials are dropped more than 6 m to any point lying outside the exterior walls of the building an enclosed chute of wood, or equivalent material shall be used;

21.5.4 When debris is dropped through holes in the floor without the use of chutes, the area where the material is dropped shall be completely enclosed with barricades not less than 1.1 m high and not less than 1.9 m back from the edge of the opening above. Signs warning of the hazard of falling material shall be posted at each level;

21.5.5 All scrap lumber, waste material and rubbish shall be removed from the immediate work area as the work progresses:

21.5.6 Disposal of waste material or debris by burning shall be done under guidance of the Engineer in-charge;

21.5.7 All solvent wastes, oil rags and flammable liquids shall be kept in fire resistant covered containers until removed from the work site.

21.6. Safety in handling gas cylinders

For lifting the cylinders, cage of suitable size shall be used and all cylinders shall be horizontally positioned in it. Such cage shall have fencing in such a way that there is no possibility of fall of cylinders from this cage.

21.7 Manual Material Handling

Potential manual material handling hazards for workers;

Workers frequently cite the weight and bulkiness of objects that they lift as major contributing factors to their injuries. Bending, followed by twisting and turning, were the more commonly cited movements that caused back injuries. Other hazards include falling objects, improperly stacked materials and various types of equipment. Ensure that employees are aware of potential injuries that can occur when manually moving materials including the following: -

- ❖ Strains and sprains from lifting loads improperly or from carrying loads that are either too large or too heavy;
- ❖ Fractures and bruises caused by being struck by materials or by being caught in pinch points, and
- ❖ Cuts and bruises caused by falling materials that have been improperly stored or by incorrectly cutting ties or other securing devices

The following safety measures shall be implemented for manual material handling:

1. Employees shall be trained in safe handling of materials.
2. For manual material handling, use of kinetic way of lifting materials.

Steps for Manual Lifting

1. Keep feet apart to give a balanced and stable base for lifting
2. Bend the knees so that the hands are as near to the waist as possible
3. Keep the back straight, chin tucked-in, lean over the load if necessary [Shoulders in same direction as hips]
4. Try to keep the arms within the boundary formed of the legs
5. Carry out lifting smoothly without jerk
6. Then adjust if precise positioning is necessary and then move

3. The loads, its shape and size etc. should be assessed before lifting of materials.
4. Materials shall be stacked in such a manner as not to constitute a hazard to passers-by.
5. Aisles and passage ways shall be kept clear to provide obstruction free and safe movement of material handling equipment or persons.
6. Dos and Don'ts of Manual Material Handling

21.8 Safety in Material Handling

21.8.1 Suitable type of material handling equipment (e.g. trolley for the handling of Oxy- acetylene Cylinders) shall be used for the movement of heavy objects.

21.8.2 Provided help to move awkward shaped objects and bulky objects etc.

21.8.3 Lumber piles shall not exceed 6 m in height provided that lumber is handled manually, shall not be stacked more than 5 m height. Lumber shall be so stacked as to be stable and self-supporting.

21.8.4 The cement or other material in bags shall be stacked in a header and stature- wise in rows alternately in not more than 10 numbers and there will be circulation of space of at least 600 mm in between two such rows.

21.8.5 No pipe shall be stored on rack or in stack where such pipe is likely to fall by rolling.

21.8.6 Gas cylinders shall not be lifted on bare slings. For lifting the cylinders, cage of suitable size shall be used and all cylinders shall be horizontally positioned in it. Such cage shall have fencing in such a way that there is no possibility of fall of cylinders from this cage.

21.8.7 Rigging equipment for material handling shall be inspected prior to use in each shift to ensure that it is safe for use. Rigging equipment shall not be loaded in excess of its recommended safe working load.

21.8.8 It shall be ensured that debris is:

- o disposed regularly, Do not allowed to accumulate so as to constitute a hazard;
- o kept sufficiently moist to bring down the dust under control;
- o not thrown inside or outside from any height of building or other construction work;

21.9. Safety in lifting machines and tackles

21.9.1 All chains, ropes and lifting gears shall be examined / tested by a competent person authorized by the State Government at least once in a period of 12 months to ensure for compliance of statutory requirement.

21.9.2 Check all elements of lifting machines and tackles etc. before every use and confirm the following conditions:

- Lifting machines and tackles shall be of good mechanical construction,
- sound material, and adequate strength, free from defect.
- Every rope used in raising or lowering materials or as a means ofsuspension,
- shall be of durable quality and adequate strength and free from defect.
- Identification Number and SWL (Safe Working Load) shall be plainly marked
- on every lifting machine and chain, ring, hook, shackle, swivel and pulley block etc.
- Crane operator of lifting appliances shall be competent, trained and
- physically fit. Only competent and physically fit person should be engaged to give signals to the crane operator.

21.9.3 Buckets Motors, gearing transmission, electric wiring and other dangerous parts of lifting appliances, shall be provided with efficient safe-guards. Lifting appliances shall be provided with such means as will reduce to the minimum the risk of accidental descent of the load.

21.9.4 Adequate precautions shall be taken to cordon of the area to reduce the risk of fall of material / suspended load becoming accidentally fall.

21.9.5 No person shall be allowed to walk or stand under a suspended or swinging load by lifting equipment. Guide rope must be attached to the load to prevent its swinging.

21.9.6 Do not use crane for dragging a load.

21.9.7 No chain which is joined to another chain by means of bolt and nut shall be used for rising/ lowering or suspending any load.

21.9.8 Before lifting the load, it must be ensured that the crane hook is properly centred, load balanced and safety latch is properly closed.

21.9.9 Adequate precautions shall be taken to see that the boom of mobile crane does not come in contact with overhead electric transmission lines.

21.10 Material Handling Dos and don'ts

Dos

- Train Employees in safe handling of materials.
- Use suitable type of material handling equipment for the movement of heavy objects.
- Keep aisles and passageways clear to provide obstruction free and safe movement of material handling.
- Use cage of suitable size for lifting the cylinders and all cylinders shall be vertically positioned in it.

Don'ts

- Don't stack materials in such a manner to constitute hazard to passer-by.
- No pipe shall be stored on rack or in stack where such PPE is likely to fall by rolling.
- Gas cylinders shall not be lifted on bare slings.

21.11 Dos and Don'ts - Lifting / Erection Work

Dos

- ☐ Make sure that the crane used for lifting has a valid third-party inspection certificate of a competent person for its lifting capacity and fitness.
- ☐ Allow only one competent person to signal the crane operator.
- ☐ The Safe Working Load (SWL) must be clearly marked on the lifting equipment.
- ☐ Barricade the work area before lifting the material / equipment.
- ☐ Outriggers shall be used while lifting.
- ☐ One end of the guide rope shall be tied with the load and the other end shall be held by the person to control the swinging motion of the load. .

Don'ts

- ➢ Don't use uncertified/ defective lifting tools & tackles for lifting.
- ➢ Don't walk or stand under the suspended load.
- ➢ Don't move the crane within 3 M of overhead power lines.
- ➢ Don't manually lift the object that is too heavy.
- ➢ Don't pull a load if you can push it.

Normative References

- *Building and Other Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996 and Central Rules, 1998*
- *Factories Act,1948 and Rules made there under*
- *Mine Act, 1952 & Mine Rescue Rules, 1985*
- *Occupational Safety, Health and Working Conditions Code 2020*
- *Occupational Safety, Health and Working Conditions (Central) Rules 2020*
- *Occupational Safety, Health and Working Condition Code Rules, 2021*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22 Safety in Use of Hand and Power Operated Tools

22.1 Role and Responsibility

➢ **Immediate Responsibility**

Immediate responsibility to ensure safety in use of hand tools and power operated tools lies especially on Site Engineer / Contractor / Supervisor and Maintenance Technicians / Mechanics and Electricians.

➢ **Ultimate Responsibility**

Ultimate responsibility to ensure compliance of safety in use of hand tools and power operated tools shall be of the Occupier / Owner / Employer / Manager in case of Mines and Project Manager of Contractor.

22.2 Legal and Statutory Requirement

- Rule-40,47 & 133 of the building and other construction workers (regulation of employment and conditions of service) Central Rules 1998
- Section-7A of the Factories Act, 1948 and rules made thereunder;
- Rule-2 and 19 of Central Electricity Authority (Measures Relating to Safety and Electric Supply) Regulations, 2010
- Section-18(2f) of the Occupational Safety, Health and Working Conditions Code, 2020

22.3 Introduction

Hand tools and portable hand tools safety is crucial to prevent accidents, injuries and to ensure safe work environment. These tools are widely used for various industrial activities almost in every industry, and without proper safety measures, they can pose significant risks. Mishandling or improper use of hand tools can lead to cuts, abrasions, punctures, and even more severe injuries like fractures or amputations. Moreover, hand tool accidents also result in loss of productivity, increased medical expenses, and potential legal liabilities for employers.

To ensure safety in use of hand and power tools, following safety rules should be followed;

22.4 General Provisions

- All hands and power tools and similar equipment, shall be maintained in safe and good working condition.
- Use right tool for the job.
- Wear appropriate PPE (Personal Protective Equipment)
- Always check tools for any damage before use.
- Keeping the work area clean and organized (Good Housekeeping)
- Make sure the work area is well-lit and free of clutter.

- Belts, gears, shafts, pulleys, sprockets, spindles, drums, fly wheels, chains and other reciprocating, rotating or moving parts of the equipment shall be guarded;
- Personnel using hand and power tools and exposed to the hazard of falling, flying, abrasive, and splashing objects, or exposed to harmful dusts, fumes, mists, vapours, or gases shall be provided with the particular personal protective equipment necessary to protect them from the hazards;

22.5 Hand Tools

- All hand tools should be checked before use. Defective or damaged hand tools should not be used.
- Tools should always be used as per their design intent.
- Use of unsafe hand tools shall not be permitted;
- Impact tools such as drift pins, wedges and chisels shall be kept free of mushroomed heads;
- The wooden handles of tools shall be kept free of splinters or cracks and shall be kept tight on the tools.

22.6 Power Operated Tools

- Power operated tool shall be tested each day before loading to see that the safety devices are in proper working condition. The method of testing shall be accordance with the manufacturer's recommended procedure;
- Electric power operated tools shall be either of the approved double-insulated type or shall be grounded;
- Pneumatic power tools shall be secured to the hose or whip by some positive means to prevent the tool from becoming accidentally disconnected;
- Safety clips or retainers shall be securely installed or maintained on pneumatic impact (percussion) tools to prevent attachments from being accidentally expelled;
- All pneumatically riveting machine staplers and other similar equipment provided with automatic fastener feed, which operate at more than 7 kg/cm2 pressure at the tool a safety device on the 46 muzzle to prevent the tool from ejecting the fasteners unless the muzzle is in contact with the work surface;
- Compressed air shall not be used for personal cleaning purposes.
- Only personnel who has been trained in the operation of the particular tool shall be allowed to operate power-actuated tools;
- Any tool found not in proper working order, or that which develops a defect during use, shall be immediately removed from service and not used until properly repaired;
- Neither loaded nor empty tools are to be pointed at any other person;
- Power tools shall be grounded properly to prevent electrical shock, which can be fatal.
- Power tools can cause cuts, bruises, and other injuries if they come into contact with skin.
- Some power tools are very loud, which can cause hearing damage. Always use Ear Muff or Ear Plug;
- Read the suppliers' manual carefully before using any power tool. This will help you to understand the tool's operation and safety features.
- Do not use a power tool if it is damaged or malfunctioning.
- Keep your hands away from moving parts and sharp edge tools.

- ❖ Loaded tools shall not be left unattended, turn off the power tool when not in use.
- ❖ Only non-sparking tools shall be used in an explosive or flammable atmosphere.

22.7 Abrasive Wheels and Tools

- ➢ Grinding machines shall be equipped with suitable safety guards;
- ➢ Maximum angular exposure of the grinding wheel periphery and sides shall not be more than 900, except that when the work requires contact with the wheel below the horizontal plane of the spindle, the angular exposure shall not exceed 1200. In either case, the exposure shall begin not more than 650 above the horizontal plane of the spindle. Safety guards shall be strong enough to withstand the bursting of the wheel;
- ➢ Floor and bench-mounted grinders shall be work-rests, which shall have rigidly supported and readily adjustable. Such work-rests shall be kept at a distance not to exceed 5 mm from the surface of the wheel;
- ➢ When safety guards are required, they shall be mounted as to maintain proper alignment with the wheel and the guard and its fastening shall be adequate strength to retain the fragments of the wheel in case of accidental breakage. The maximum angular exposure of the grinding wheel periphery and sides shall not exceed 1800;
- ➢ Portable abrasive wheel used for internal grinding shall be provided with suitable safety flanges;
- ➢ All abrasive wheels shall be closely inspected and ring tested before mounting to ensure that they are free from cracks or defects;
- ➢ Grinding wheels shall fit freely on the spindle and shall not be forced on. The spindle nut shall be tightened only enough to hold the wheel in place;
- ➢ Employees using abrasive wheels should use Safety Goggle / Face shield for personal protection.

Normative References

- ➢ *Building and Other Construction Workers (Regulation of Employment and Conditions of Service) Central Rules, 1998*
- ➢ *Central Electricity Authority (Safety Requirements for Construction, Operation and Maintenance of Electrical Plants and Electric Lines) Regulations, 2010 and Regulation, 2011*
- ➢ *Factories Act, 1948 and State Factories Rules made thereunder.*
- ➢ *Occupational Safety, Health and Working Conditions Code 2020 and (Central) Rules 2020*

23 Safety in Thermal Power Generating Plant

23.1 Role and Responsibility

- **Immediate Responsibility**

  Immediate responsibility for boiler operation safety shall HOD-Boiler, Boiler Engineer and Boiler Attendant.

- **Ultimate Responsibility**

  Ultimate responsibility to ensure compliance of all applicable legal and other requirement of boiler's safety shall be of the Occupier / Owner / Employer.

23.2 Legal and Statutory Requirements

- As per the Central Electricity Authority Advisory for Thermal Power Generating Utilities vide Letter No. CEA-TH-17-13/13/2020-TETD Division of 2022EA, the following provisions shall be required to implement, copy annexed.

  Annexure: *CEA Advisory for Thermal Power Generating Plants, Letter No. CEA-TH-17-13/13/2020-TETD Division 2022.*

- Central Electricity Authority (Safety Requirements for Construction, Operation and Maintenance of Electrical Plants and Electric Lines) Regulations, 2011
- Central Electricity Authority (Measures relating to Safety and Electric Supply) Regulations, 2010
- Rule-10 of the Manufacture, Storage, and Import of Hazardous Chemicals Rules, 1989.
- Boiler Act, 1923 and Boiler (Amendment) Act, 2007
- Boiler Operation Rules, 2021
- IS: 1646 - Code of Practice for Fire safety of buildings (General): Electrical installations
- IS: 3034 - Fire safety of industrial buildings: Electrical generating and distributing stations - Code of Practice.

23.3 General Safety and Fire Safety

23.3.1 Ensure a separate budget head in its overall budget provisions to adequately fund safety related activities.

23.3.2 Detailed safety manual complying with the statutory requirements and manufacturers' recommendations must be available with power plant.

23.3.3 Safety awareness drives must be conducted amongst plant personnel as well as the employees deployed by the contractors, periodically for the compliance of provisions of safety manuals and to imbibe the safety culture.

23.3.4 The Safety Officer shall be appointed and safety committee shall be constituted in thermal power plant as per the statutory requirement. Safety Committee meetings shall be held regularly and Head of Plant shall chair these meetings. The output of these Safety Committee meetings should be implemented.

23.3.5 Ensure that 'Safety Performance' KPA (Key Performance Area) for employees is linked with Annual Performance Assessment for officers at various levels to instil a safety-compliant behaviour.

23.3.6 Keep an updated inventory of safety related PPEs and also provide the tasks specific PPE kits to all the workers / staff.

23.3.7 All major / minor incident/accidents must be properly investigated and analysed to find the Root Cause of incident/accident before implementing CAPA (Corrective Action and Preventive Action).

23.3.8 Implement procedures for reporting of accidents by the concerned Power Station to CEA in line with the provisions of the CEA Safety Regulations.

23.3.9 Emergency Response & Disaster Management Plan (ER&DMP) both On-site & Off-site shall be prepared by power plant.

23.3.10 Ensure that a functional proper Public Address system is in place and also Walkie Talkie' should be mandatorily adopted in the power plant.

23.3.11 Plant must be certified for ISO: 45001 'Occupational Health & Safety Management System'.

23.3.12 Ensure that all fire safety procedures are followed and fire-fighting system, its operation, installations are well maintained and upkeep of various sub-components is reviewed at regular intervals to make sure their proper response during emergencies. These shall include but not be limited to the following:

1) Fire Water pump house must be maintained in proper healthy condition. There should be no obstructions in the pathways and approaches to equipment should be hindrance free.

2) All fire hydrant pumps and jockey pumps must be maintained in healthy condition. The Fire Hydrant pumps need to be operated in 'Auto Mode' & Sequential starting system should be in place. The reliability & availability of the Pumps are to be checked at frequent intervals and records maintained.

3) Fire-fighting crew along with some identified regular employees must go through hands-on firefighting training including rescue and disaster handling to enhance effectiveness of firefighting & safety crew.

4) Manual call points (MCPs) must be provided at all the strategic locations of the power station and must be integrated with the Fire Control Room for effective monitoring and to ensure timely and quick response from fire-fighting crew.

5) Mock drills should be conducted at regular intervals and also at odd hours for various emergencies scenarios & debriefing session should be conducted after each mock drill. The gaps observed are to be analysed and mitigation measures need to be taken. The mock-drill observations should be recorded in a register.

6) Fire Marshalls/firefighting crew should be trained for actual emergencies scenarios.

7) Each Power Station shall have a Fire Emergency Plan formulated so as to facilitate organized actions (in case of fire) by employees at various levels, during day as well as night and shall also contain the instructions on fire prevention measures and the firefighting organization.

8) Fireboxes with hose reels at fire hydrant points must be available.

9) Non-sparking tools and flame-proof electric fittings should be mandatorily used at all places where flammable materials like oils and gases are stored / used. Also static electric charge dissipater should be provided at the entry gate of such systems which are prone to catch fire easily.

23.3.13 'Emergency Exit Path / Route' marking should be done for safe evacuation of personnel during emergency conditions. Emergency telephone numbers must be prominently displayed at

prominent locations in the plant, such as at TG floor, Unit Control Room and Emergency Exit points etc. Display of Do's & Don'ts should be done in large fonts for better visibility. All such Display Boards should have a DC backlit display.

23.3.14 Lock Out & Tag Out (LOTO) system for maintenance management should be fully implemented for safe operation of the power plants and a proper Permit to Work (PTW) system must be followed and there should be seamless integration between LOTO & PTW System (and also to ERP system, if available). Proper Job Safety Analysis (JSA) should be carried out before issuance of each PTW.

23.3.15 Accumulated and unwanted scrap/ dismantled machinery etc. should be removed from working areas such as boiler structure, TG floor etc. and stored at designated places. Measures should be taken to remove wild vegetation growth in switchyard.

23.3.16 Excessive accumulation of coal/ lignite dust in some of the vulnerable areas like Crusher house, transfer points, coal / lignite Bunker house, etc. must be avoided.

23.3.17 Preventive measures such as anti-corrosion painting and regular maintenance should be done for support structures and various equipment.

23.3.18 Rotating parts of various equipment should be covered with proper safety guards.

23.3.19 SOPs (Standard Operating Procedure) for various plant equipment to be prepared and made available for ready reference to working personnel at workplaces.

23.4 Boiler, Turbine and Generator (BTG) Safety

23.4.1 As per IBR Regulations, periodic Remnant Life Assessment (RLA) should be carried out.

23.4.2 Annual overhauling, Capital overhauling and Renovation & Modernization works must be done on time as these prevent equipment failures. Overhauling work should be monitored comprehensively.

23.4.3 The boilers must be operated by Boiler Operating Engineers (BOEs) in compliance with the provisions of IBR. Utilities with shortage of BOEs are advised to take immediate and urgent steps to ensure that sufficient number of engineers should be qualified BOEs.

23.4.4 Boilers having box type column-beam structure are prone to accumulation of coal/ash dust if there are openings in the boiler structure. Coal dust accumulated in such confined structure may lead to fire/explosion. All such openings in such kind of structure must be closed. Also, cleaning must be ensured before closure.

23.4.5 Thermal insulation of Boiler, Turbine, associated sub-systems and all other critical equipment & lines must be ensured and maintained in good health. Regular thermal survey for surface temperature should be done. It is recommended to do insulation of.

23.4.6 Pulverized fuel leakage in mills, pipes, joints etc., if any, should be arrested on immediate basis.

23.4.7 The closeness of steam lines with other components/structure of Boiler or adjacent civil structure must be avoided.

23.4.8 All Boiler expansion indicators must be fitted properly to measure vertical movement as well as horizontal movement.

23.4.9 Mandatorily carry-out tool tagging to have effective inventory management and thus ensure timely availability of all tools & tackles. Tagging and marking date of last load testing of all O&M tools & tackles must be ensured.

23.4.9 Illumination measurement should be carried out as per IS: 6665 and it needs to be improved in the plants wherever necessary.

23.4.10 Take measures to ensure that ambient noise levels around equipment like Turbine-Generator, Boiler etc. auxiliaries are in desired limits.

23.4.11 Regular ash level monitoring in ESP hoppers must be done by providing Ash Level Indicators (ALI). Timely steps must be taken for regular evacuation of ash. Also, ensure that ash hopper heaters are in healthy condition so that fluidity of ash is not hampered.

23.4.12 Safety Valves and Electromatic Relief Valves (ERVs) must be maintained in healthy condition and operative.

23.4.13 Vibration levels of machines such as TG set, fans, pumps, etc. must be monitored on regular basis and machines should not run beyond the recommended vibration limits prescribed by OEM.

23.4.14 Compulsorily carry out turbine over speeding test as per OEM recommendations.

23.4.15 Regularly perform checks for functionality of all the Protection & Interlocks (P&I) for various equipment and system.

23.5 Balance of Plant Safety

23.5.1 Chlorine leak sensor probes must be provided for all chlorine cylinder bays at proper locations. Water sprinkler system need to be installed in chlorination plant to neutralize chlorine leak in addition to the extant system.

23.5.2 Dust suppression system in operating condition to prevent coal / lignite dust accumulation in areas such as coal / lignite yard, Crusher house, transfer junctions / points, coal / lignite conveyor, coal / lignite Bunker etc.

23.5.3 Battery Room is properly lined with 'Acid resistance tiles' up to the height of 'Battery Bank'. It is suggested to provide Flame-proof lighting in the Battery room. It is also to be ensured that the Eye-wash system is located at a place nearby to the Battery Room.

23.5.4 Cable gallery/ racks must be maintained in healthy conditions with proper illumination levels, exhaust system and the cable dressing in the racks should be done properly. All entry & exit of cables must be sealed properly for preventing progression of fire and toxic gases to adjacent rooms.

23.5.5 Insulating floor or mat conforming to IS: 15652 of appropriate voltage level shall be provided in front of the panels for the safety of operating personnel.

23.5.6 Regularly measure and maintain proper records of Resistance value of Earth pits and monitor Tan-Delta value of Current Transformers (CT) and all other oil-filled electrical equipment.

23.5.7 Oil soak pits of transformers should be kept free of waste material.

23.5.8 Manuals and Standard Operating Procedures (SOPs) for Ash Bund/Dyke Maintenance should be prepared by Power Plant. Emergency Plan should be prepared to deal situations of Ash Dyke breach and should be made available to the Site engineers.

25.6 Safety Do's and Don'ts for Thermal Power Projects

Follow following Do's and Don'ts safety tips to prevent injuries / accidents in thermal power plant;

Do's

- Always wear appropriate personal protective equipment (PPE), such as hard hats, safety glasses, steel-toe boots, and gloves.
- Be aware of your surroundings and be on the lookout for potential hazards.
- Follow all statutory safety requirement, company's safety procedures and protocols.
- Report unsafe conditions or incidents and unsafe acts of persons to supervisor / engineer immediately.

- Induction safety training of workers before putting on the job for operating any equipment or performing any tasks.
- Use Lockout / Tagout procedures for isolation of electrical energy before working on electric lines and equipment to prevent accidental energization of equipment.
- Be aware of the location of emergency exits and fire extinguishers.
- Care about whether condition to carryout outside electrical works.

Don'ts

- Don't work alone in confined spaces.
- Don't operate equipment without proper training and authority.
- Don't bypass or disable safety devices.
- Don't work under the influence of alcohol or drugs.
- Don't take shortcuts or ignore safety procedures.
- Don't enter a confined space until it has been properly purged, ventilated and tested for safety.
- Don't work on energized electrical equipment.
- Don't lift heavy objects without proper assistance.

25.7 Safety tips

- Be aware of the high temperatures and pressures present in the plant.
- Be careful when working with hazardous materials, such as coal, ash, and chemicals.
- Be aware of potential for fire and explosions.
- Be careful when working with rotating machinery.
- Be careful when working in confined spaces.

Annexure: Central Electricity Authority Advisory to Thermal Power Generating Units (Ref. F. No. CEA-TH-17-13/13/2020-TETD Division)

Normative References

- *CEA (Measures Relating to Safety and Electric Supply) Regulations 2010.*
- *Central Electricity Authority (Safety Requirements for Construction, Operation and Maintenance of Electrical Plants and Electric Lines) Regulations, 2011.*
- *Factories Act, 1948 and rules made thereunder.*
- *IS: 1646 - 1997; Code of Practice for Fire Safety of Buildings (General): Electrical Installations.*
- *IS: 3034 - 1993 (RA 2002); Fire safety of industrial buildings: Electrical generating and Distributing Stations - Code of practice.*
- *IS: 3043 - 1987 (RA 2006); Code of Practice for Earthing.*
- *IS: 15652 - 2006; Insulating Mats for Electrical Purposes — Specification.*
- *Manufacture, Storage and Import of Hazardous Chemical Rules, 1989.*
- *National Building Code 2016.*

File No.CEA-TH-17-13/13/2020-TETD Division

I/21918/2022

ANNEXURE

भारत सरकार
Government of India
विद्युत मंत्रालय
Ministry of Power
केंद्रीय विद्युत प्राधिकरण
Central Electricity Authority
तापीय अभियांत्रिकी एवं प्रौद्योगिकी विकास प्रभाग
Thermal Engineering & Technology Development

सेवा में / To,

सभी ताप विद्युत उत्पादन संयंत्र / All Thermal Power Generating Plants/Utilities

विषय/Subject: Safety Advisory to all Thermal Power Generating Utilities.

महोदय/महोदया / Sir/Madam,

You may be aware that Hon'ble National Green Tribunal vide its Order dated 22.12.2020 in O.A. No. 108/2020 with O.A. No. 130/2020 had directed that "*Secretaries, Ministry of Power and Coal, Government of India, in coordination with such other Departments/ Institutions, as may be necessary, to undertake Safety Audits of similarly placed thermal power stations throughout the country expeditiously preferably within six months to avoid recurrence of such incidents in future*".

In compliance to the aforesaid order, a Safety Audit Committee under the chairmanship of the undersigned was constituted by Central Electricity Authority (CEA) comprising representatives from Ministry of Coal, Central Boiler Board (CBB), Director General Fire Safety (DGFS), NTPC Ltd., NLC India Limited (NLCIL), Bharat Heavy Electrical Limited (BHEL) and other experts. The above Committee carried out the safety audit of different coal/lignite based Thermal Power plants across the country during the period of August to November 2021.

A safety advisory based on the broad deficiencies observed during above safety audits of the thermal power stations is enclosed at Annexure-I for your kind information and needful actions. However, safety of plant and personnel is not limited to these findings only. Utilities/plants may also continue to take regular safety measures as per the extant Rules and Regulations in this regard.

संलग्नक/Enclosure: यथोपरि/As above

भवदीय/Yours Sincerely,

(धीरज कुमार श्रीवास्तव / Dhiraj Kumar Srivastava)
मुख्य अभियंता / Chief Engineer

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Annexure-I

Safety Advisory to all Thermal Power Generating Utilities

(A) General Safety and Fire Safety

1. Implement the requisite provisions of (1) Central Electricity Authority (Safety Requirements for Construction, Operation and Maintenance of Electrical Plants and Electric Lines) Regulations, 2011 (2) Central Electricity Authority (Measures relating to Safety and Electric Supply) Regulations, 2010 (3) Statutory requirement under Factories Act and other related Acts such as Manufacture, Storage, and Import of Hazardous Chemicals (MSIHC) Rules, 1989 – entrusted functions and Response Rules (4) IS:1646 - Code of Practice for Fire safety of buildings (general): Electrical installations (5) IS:3034 - Fire safety of industrial buildings: Electrical generating and Distributing stations - Code of Practice.
2. Internal Safety Audits must be carried out once a year through cross functional teams/ internal trained staff and records must be maintained. Further, External Safety Audit must be carried out through registered Agencies at a regular periodicity of 2 years and Action Taken Report (ATR) must be prepared & monitored to ensure early closing of pending recommendations.
3. Ensure a separate budget head in its overall budget provisions to adequately fund safety related activities. Detailed safety manual complying with the statutory requirements and manufacturers' recommendations must be available with power plant.
4. Safety awareness drives must be conducted amongst plant personnel as well as the employees deployed by the Contractors, periodically for the compliance of provisions of safety manuals and to imbibe the safety culture.
5. The safety officer shall be appointed and safety committee shall be constituted by thermal power plant as per the statutory requirement. Plants shall hold Safety Committee meetings regularly and Head of Plant shall chair these meetings. The output of these Safety Committee meetings should be implemented.
6. Ensure that 'Safety Performance' KPA (Key Performance Area) for employees is linked with Annual Performance Assessment for officers at various levels to instill a safety-compliant behavior.
7. Keep an updated inventory of safety related PPEs and also provide the tasks specific PPE kits to all the workers/ staff.
8. All major/ minor accidents must be properly investigated and analyzed to find the Root Cause of incident/accident.
9. Implement procedures for reporting of accidents by the concerned Power Station to CEA in line with the provisions of the CEA safety regulations.

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10. Emergency Response Disaster Management Plan (ERDMP) both On-site & Off-site shall be prepared by all power plants.
11. Ensure that a functional proper Public Address system is in place and also 'Walkie/ Talkie' should be mandatorily adopted in the power plants.
12. Plants must be compliant/ certified as per ISO: 45001 'Occupational Health & Safety Management System'.
13. Ensure that all fire safety procedures are followed and fire-fighting system, its operation, installations are well maintained and upkeep of various sub-components is reviewed at regular intervals to make sure their proper response during emergencies. These shall include but not be limited to the following:
    i. Fire Water pump house must be maintained in proper healthy condition. There should be no obstructions in the pathways and approaches to equipment should be hindrance free.
    ii. All fire hydrant pumps and jockey pumps must be maintained in healthy condition. The Fire Hydrant pumps need to be operated in 'AUTO MODE' & Sequential starting system should be in place. The reliability & availability of the Pumps are to be checked at frequent intervals and recorded.
    iii. Fire-fighting crew along with some identified regular employees must go through hands-on firefighting training including rescue and disaster handling to enhance effectiveness of firefighting & safety crew.
    iv. Manual call points (MCPs) must be provided at all the strategic locations of the power stations and must be integrated with the Fire Control Room for effective monitoring and to ensure timely & quick response from fire-fighting crew.
    v. Mock drills should be conducted at regular intervals and also at odd hours for various emergencies scenarios & debriefing session should be conducted after each mock drill. The gaps observed are to be analyzed and mitigation measures need to be taken. These details should be recorded in a register.
    vi. Fire Marshalls/ firefighting crew should be trained for actual emergencies scenarios.
    vii. Each Power Station shall have a Fire Emergency Plan formulated so as to facilitate organized actions (in case of fire) by employees at various levels, during day as well as night and shall also contain the instructions on fire prevention measures and the firefighting organization.
    viii. Fireboxes with hose reels at fire hydrant points must be available.
    ix. Non-sparking tools and flame-proof electric fittings should be mandatorily used at all places where flammable materials like oils and gases are stored/ are in use. Also, static electric charge dissipater should

be provided at the entry gate of such systems which are prone to catch fire easily.

14. Emergency exit path marking should be made available for safe evacuation of working personnel during emergency conditions. Emergency telephone numbers must be prominently displayed at prominent locations in the plant, such as at TG floor, Unit Control Room & emergency exit points etc. Display of DO's & DON'Ts should be done in large fonts for better visibility. All such Display Boards should have a DC backlit display.
15. Lock Out & Tag Out (LOTO) system for maintenance management should be fully implemented for safe operation of the power plants and a proper Permit to Work (PTW) system must be followed and there should be seamless integration between LOTO & PTW System (and also to ERP system, if available). Proper Job Safety Analysis (JSA) should be carried out before issuance of each PTW.
16. Accumulated and unwanted scrap/ dismantled machinery etc. should be removed from working areas such as boiler structure, TG floor etc. and stored at designated places. Measures should be taken to remove wild vegetation growth in switchyard.
17. Excessive accumulation of coal/ lignite dust in some of the vulnerable areas like Crusher house, transfer points, coal/ lignite Bunker house, etc. must be avoided.
18. Preventive measures such as anti-corrosion painting and regular maintenance should be done for support structures and various equipment.
19. Rotating parts of various equipment should be covered with proper guards.
20. SOPs for various plant equipment to be prepared and made available to working personnel.

(B) Boiler, Turbine and Generator (BTG) Safety

1. As per IBR Regulations, periodic Remnant Life Assessment (RLA) should be carried out.
2. Annual overhauling, Capital overhauling and Renovation & Modernization works must be done on time as these prevent equipment failures. Overhauling work should be monitored comprehensively.
3. The boilers must be operated by Boiler Operating Engineers (BOEs) in compliance with the provisions of IBR. Utilities with shortage of BOEs are advised to take immediate and urgent steps to ensure that sufficient number of engineers should be qualified BOEs.
4. Boilers having box type column-beam structure are prone to accumulation of coal/ash dust if there are openings in the boiler structure. Coal dust accumulated in such confined structure may lead to fire/explosion. All such openings in such kind of structure must be closed. Also, cleaning must be ensured before closure.

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5. Thermal insulation of Boiler, Turbine, associated sub-systems and all other critical equipment & lines must be ensured and maintained in good health. Regular thermal survey for surface temperature should be done. It is recommended to do insulation of.
6. Pulverized fuel leakage in mills, pipes, joints etc., if any, should be arrested on immediate basis.
7. The closeness of steam lines with other components/structure of Boiler or adjacent civil structure must be avoided.
8. All Boiler expansion indicators must be fitted properly to measure vertical movement as well as horizontal movement.
9. Mandatorily carry-out tool tagging to have effective inventory management and thus ensure timely availability of all tools & tackles. Tagging and marking date of last load testing of all O&M tools & tackles must be ensured.
10. Illumination measurement should be carried out as per IS:6665 and it needs to be improved in the plants wherever necessary.
11. Take measures to ensure that ambient noise levels around equipment like Turbine-Generator, Boiler etc. auxiliaries are in desired limits.
12. Regular ash level monitoring in ESP hoppers must be done by providing Ash Level Indicators (ALI). Timely steps must be taken for regular evacuation of ash. Also, ensure that ash hopper heaters are in healthy condition so that fluidity of ash is not hampered.
13. Safety Valves and Electromatic Relief Valves (ERVs) must be maintained in healthy condition and operative.
14. Vibration levels of machines such as TG set, fans, pumps, etc. must be monitored on regular basis and machines should not run beyond the recommended vibration limits prescribed by OEM.
15. Compulsorily carry out turbine over speeding test as per OEM recommendations.
16. Regularly perform checks for functionality of all the Protection & Interlocks (P&I) for various equipment and system.

(C) Balance of Plant (BoP) Safety

1. Chlorine leak sensor probes must be provided for all chlorine cylinder bays at proper locations. Water sprinkler system need to be installed in chlorination plant to neutralize chlorine leak in addition to the extant system.
2. Dust suppression system must be in operating condition to prevent coal/ lignite dust accumulation in areas such as coal/ lignite yard, Crusher house, transfer junctions/ points, coal/ lignite conveyor, coal/ lignite Bunker etc.
3. Battery Room is to be properly lined with 'Acid resistance tiles' up to the height of 'Battery Bank'. It is suggested to provide Flame-proof lighting in the Battery

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room. It is also to be ensured that the Eye-wash system is located at a place nearby to the Battery Room.

4. Cable gallery/ racks must be maintained in healthy conditions with proper illumination levels, exhaust system and the cable dressing in the racks should be done properly. All entry & exit of cables must be sealed properly for preventing progression of fire and toxic gases to adjacent rooms.
5. Insulating floor or mat conforming to IS:15652 of appropriate voltage level shall be provided in front of the panels for the safety of operating personnel.
6. Regularly measure and maintain proper records of Resistance value of Earth pits and monitor Tan-Delta value of current transformers (CT) and all other oil-filled electrical equipment.
7. Oil soak pits of transformers should be kept free of waste material.
8. Manuals and Standard Operating Procedures (SOPs) for Ash Bund/ Dyke Maintenance should be prepared by Power Plant. Emergency Plan should be prepared to deal situations of Ash Dyke breach and should be made available to the Site engineers.

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THDCIL

24 Safety in Wind Power Generation Plant (WTG)

24.1 Role and Responsibility

- **Immediate Responsibility**

  Immediate and primary responsibility for compliance of all applicable legal and other requirement and implement safety management system in Wind Power Generation Power Plants and Sub-stations shall be of the Main Contractor of THDCIL. The Nodal Officer of THDC responsible for administrative control of WTG Plants shall be responsible to ensure compliance of all OH&S related applicable legal and other requirements and implement safety management system.

- **Ultimate Responsibility**

  The Ultimate responsibility to ensure compliance of all OH&S related applicable legal and other requirement on WTG shall be of the Occupier / Owner / Employer of the Agency / Organization in O&M Contract of THDCIL, WTGs. However being a principal employer, the occupier of THDC WTG projects shall also be responsible for the safety of WTGs and the workers engage in O&M of WTGs.

24.2 Introduction about Wind Power Generation (WTG)

Wind power generation and distribution offer numerous environmental and economic advantages, including the reduction of greenhouse gas emissions, minimal water usage, and a virtually inexhaustible energy source. It plays a pivotal role in mitigating climate change and reducing our dependence on fossil fuels.

THDC India Limited has two WTG Projects (i) 50 MW WTG at Patan, comprises of 25 WTG of 2.5 MW Capacity each and (ii) 63 MW WTG at Devbhumi Dwarka comprises of 30 WTG of 2.1 MW Capacity each in Gujarat State.

24.3 Hazards associated with Wind Power Generation

- Electrical hazards; Wind turbines generate electricity at high voltages, which poses electrical shock and fire hazards. Arc flashes can also occur, which can cause serious burns and injuries.
- Fall hazards; Wind turbines are tall in structures, and there is a risk of falls for workers from height. Wind turbine maintenance and repair work often require workers to ascend to great heights, introducing the risk of falls and other accidents.
- Fire Hazards; Wind turbines can be susceptible to fires caused by electrical faults, lightning strikes, or even flammable materials used in their construction. These fires can be challenging to extinguish, especially in remote locations or at great heights.
- Mechanical hazards: Wind turbines are complex machines, and there is a risk of injury from rotating blades, moving parts, and heavy equipment.
- Structural Failures; Wind turbine towers and foundations must withstand significant mechanical stress. Structural failures can occur due to design flaws, manufacturing defects, or extreme weather conditions.

- Blade Failure; Wind turbine blades are subjected to extreme forces, including high winds and mechanical stresses. Over time, wear and tear can lead to blade damage or failure, which can result in catastrophic accidents if not addressed promptly.
- Lightning Strikes; Wind turbines are tall structures and can attract lightning strikes, potentially causing damage to equipment and starting fires.
- Weather hazards; Wind turbines can be damaged by strong winds and snow fall. There is also a risk of lightning strikes, which can cause fires and damage to wind turbines.
- Wildlife hazards; Wind turbines can kill birds and bats, and there is a risk of collisions between wildlife and wind turbine blades. Wind turbines are generally installed in remote area where there is risk of wild animal attack and snake bite etc.
- Noise pollution; Wind turbines can be noisy, and this can be a nuisance to people who live near wind farms.
- Corrosion and Salt Exposure; Offshore wind farms are exposed to saltwater environments, which can accelerate corrosion in turbine components, increasing maintenance costs and decreasing equipment lifespan
- Resource Uncertainty; Wind power generation depends on the availability and consistency of wind resources. Variability in wind patterns can affect energy production, potentially leading to supply shortages or energy imbalances.
- Wind Turbine Ice Throw; in cold climates, ice can accumulate on the blades and be thrown from the rotating turbine, posing a risk to nearby structures and people. This hazard necessitates appropriate setbacks and safety precautions to protect both the public and workers.
- Transportation and Installation Hazards; the transportation and installation of tall and heavy in structures. Of wind turbine components involve oversized loads, specialized transport, and heavy equipment. Accidents during these phases can result in injury and damage to infrastructure.
- Resource Uncertainty; Wind power generation depends on the availability and consistency of wind resources. Variability in wind patterns can affect energy production, potentially leading to supply shortages or energy imbalances.

24.4 Safety measures to mitigate the hazards of wind power generation

To mitigate the hazards of wind power generation, comprehensive risk assessments, regular maintenance, and ongoing monitoring are vital components of wind power generation and distribution to ensure the safety of workers, the public, and the environment. As the industry continues to grow and evolve, addressing these hazards is a top priority.

Following safety measure shall be taken to ensure safely of workers and WTGs;

24.5 Periodical medical examination for wind power generation workers is crucial for following reasons;

Regular medical check-ups help identify and mitigate health risks early, ensuring a healthier workforce.

- Wind power generation often requires employees to work at heights and in adverse weather conditions. These factors increase the likelihood of accidents and injuries. Periodic medical assessments will ensure that workers are physically fit and capable of safely performing their duties, reducing the risk of accidents.
- The equipment and machinery used in wind power generation emits noise and vibrations which can lead to hearing loss and other health issues, if ear protectors are not used. Hearing tests and evaluations will detect any problem and allow for timely intervention.

- In addition, wind power facilities are often located in remote areas, making access to medical care more challenging. Periodical medical exams help address any emerging health concerns, ensuring that workers receive the necessary treatment in a timely manner.

24.6 Safety training

Safety training is important for wind power generation workers because they are exposed to a variety of hazards, such as:

- Falls from heights
- Electrical shock
- Electric arc flashes
- Crush injuries
- Extreme weather conditions

Proper safety training help workers to identify and avoid these hazards, and to take steps to protect themselves in the event of an incident. Safety training should cover topics such as:

- Proper selection and use of 'Personal Protective Equipment' (PPE)
- Proper use of fall protection devices
- Electrical safety
- Emergency procedures
- Weather safety

Workers should also be trained on the specific hazards of the wind farm where they are working to create a safe work environment. Safety training and re-training of employees will help them to protect themselves and their co-workers from accidents and injuries and also to improve productivity and morale.

1. TBT (Toolbox Talk) should be done every time before carrying out maintenance activity.
2. All maintenance activities should be done under 'Work Permit' system.
3. Use of LOTO (Lockout and Tagout) should be ensure before carrying out maintenance work.
4. Ensure availability of 'Fire Extinguisher' and trained 'Fireman' before doing hot work in Nacelle.
5. An 'Emergency Preparedness and Response Procedure (EP&RP)' should be prepared and communicated to workers. Periodical mock-drills should be conducted to assess the adequacy of EP&RP and training needs of emergency response team members.
6. Standard Operating Procedure (SOP) should be prepared in regional language for all critical activities and workers should be communicated to ensure compliance accordingly.
7. Offshore wind farms are exposed to saltwater environments, which accelerate corrosion in turbine components, increase maintenance costs and decrease equipment lifespan. It is therefore important to provide robust corrosion protection measures should be taken for offshore installations.
8. Lightning strikes is a potential hazard for wind turbines. Due to their tall structures Lightning strikes cause damage to equipment and fires. Effective safety measures should be taken for 'Lightning Protection System' by ensuring proper 'Grounding' to safeguard both the turbines and personnel.
9. To ensure safe transportation and installation of wind turbine components proper planning for selection of specialized transport vehicle and skilled drivers should be done for safe transportation of heavy equipment of WTG.

10. Maintenance and / or repair of WTG should not be done in adverse weather conditions.
11. Wind turbine operators should monitor weather conditions and take steps to shut down wind turbines in the event of strong winds, ice, or snow. This will help to prevent damage to wind turbines and injuries to workers.
12. Ensure availability of well-maintained 'First-aid' Box in every WTG Machine. All maintenance persons should be trained in first-aid.
13. Earth Pits' resistance should be checked periodically and maintain records.
14. Wind turbines can be susceptible to fires caused by electrical faults, lightning strikes. These fires can be challenging to extinguish, especially in remote locations or at great heights. The provision of proper fire detection and suppression systems should be ensured and checked regularly to minimizing the fire hazard.
15. Compliance of all Occupational Health & Safety related applicable legal and other requirements should be ensured.
16. Contractor shall report all undesired incidents (Near-miss incident, minor or major incidents) immediately to the THDC Project Head of WTG Site. Written report of the same along with the preliminary investigation report on probable root cause of the incident and recommendation to prevent recurrence shall be submitted by the contractor within 24 hours of the occurrence of the incident.

24.7 Safety Do's and Don'ts for Wind Turbine Generation Projects

The follow following Do's and Don'ts safety tips to prevent injuries / accidents in WTG plant;

Do's

- Always follow Buddy system when working on WTGs.
- Ensure weather condition is safe before taking up any maintenance / repair activity on WTG and be prepared to evacuate if necessary.
- Always wear appropriate personal protective equipment (PPE), such as safety helmet with chin strap on, safety glasses, steel-toed safety shoes, etc. as per the job requirement. Inspect, Fall Protection Device and Full body harness safety belt for any damage before climbing the tower.
- Be aware of your surroundings and be on the lookout for potential hazards, such as falling objects, rotating blades, and electrical hazards.
- Follow all safety procedures and protocols.
- Get proper training before operating any equipment or performing any tasks.
- Always maintain 3 Point contact while ascending and descending the tower.
- Obtain, 'Confined Space - Work Permit' before taking any work in nacelle of WTG.
- Ensure Proper illumination in Nacelle.
- Ensure that WTG structure is properly earth at two places from two distinct Earth Pits.
- Ensure that WTG lift which is being used for reaching the height, is examined and certified by the competent person approved by state Govt.
- Ensure first-aid firefighting equipment is available in nacelle and workers are trained in their safe use.
- Before taking any work on the WTG, ensure that power is isolated and LOTO is applied to prevent accidental activation of energy.

- Check whether “Emergency Rescue Kit” is in good working order and readily available in WTG for emergency use.
- Check whether employees are trained in safe use of emergency kit.
- Be aware of the location of emergency exits and fire extinguishers.
- Report any unsafe conditions or incidents to your supervisor immediately.

Don’ts

- Don’t climb the tower unless you are medically fit to work at height.
- Don’t work in adverse weather conditions, such as high winds or heavy rains.
- Don’t use slippery or greasy shoes while climbing the tower to reach nacelle.
- Don’t use defective / uncertified fall arrestor or safety harness by competent person.
- Don’t carry tools while climbing on the ladder.
- Don’t work alone in confined spaces.
- Don’t operate equipment without proper training.
- Don’t bypass or disable safety devices.
- Don’t work under the influence of alcohol or drugs.
- Don’t take shortcuts or ignore safety procedures.
- Don’t enter a confined space until it has been properly ventilated and tested for safety.
- Don’t work on energized electrical equipment.
- Don’t lift heavy objects without proper assistance.

Safety Tips

- Be aware of the high winds and turbulent air conditions that can be present around wind turbines.
- Be careful when working on or near rotating blades.
- Be aware of the potential for electrical hazards.
- Be careful when working at heights.
- Have a communication plan in place in case of an emergency.
- Use proper lifting and rigging techniques when moving heavy objects.
- Be careful when working with hazardous materials, such as lubricants and hydraulic fluids.
- Be aware of the potential for noise pollution and take steps to protect your hearing.

Normative References

Guidelines of Ministry of New and Renewable Energy (MNRE), Government of India

25 Safety in Solar Power Generation

25.1 Role and Responsibility

➢ **Immediate Responsibility**

Immediate and primary responsibility for implement safety management system in Solar Power Generation Plant is of the contractor of THDC India Limited. It shall be their responsibility to issue explicit working instructions and will ensure safe working by effective use of approved safety equipment.

➢ **Ultimate Responsibility**

Ultimate responsibility for ensuring the implementation of Occupational Health and Safety (OH&S) Management System and OH&S related applicable legal and other requirement on solar power generation shall be of the Occupier / Owner / Employer.

25.2 Introduction about Solar Power Generation

Solar power generation is the process of converting sunlight into usable electrical energy. It is a renewable and sustainable source of energy that harnesses the power of the sun to produce electricity for various applications. The Photovoltaic (PV) System of Solar Energy Generation;

o Photovoltaic systems, often referred to as solar panels, use semiconductor materials (typically silicon) to directly convert sunlight into electricity.

o When sunlight strikes the photovoltaic cells within a solar panel, it excites electrons, creating an electric current.

o This direct current (DC) is then converted into alternating current (AC) by an inverter, making it compatible with the electrical grid or usable in homes and businesses.

Solar energy generation has several advantages, including its sustainability, abundance, and environmental benefits. It produces no greenhouse gas emissions, reduces dependence on fossil fuels, and can contribute to reducing electricity bills and mitigating climate change.

THDC India Limited has also kept a pace in solar power generation and installed one 50 MW Solar Power Plant at Kasaragod Solar Power Project, Kerala.

25.3 Hazards associated with Solar Power Generation

While solar power generation is generally considered a safe and environmentally friendly energy source, there are still safety hazards associated with the installation, operation, and maintenance of solar energy systems. These hazards may vary depending on the type of solar technology used and the specific circumstances. Some common safety hazards associated with solar power generation are as follows;

➢ **Electrical Hazards**

- Solar panels and associated wiring can carry high-voltage DC electricity, which can pose a risk of electric shock if not handled properly.

- Solar panels are connected to an electrical system, so there is always a risk of electrical shock if the system is not properly maintained or if there is a fault. Arc flash is a type of electrical explosion that can occur when there is a sudden surge in current. It can cause serious burns and other injuries.

➢ **Fire Hazards:**

Electrical issues can lead to fires within solar power systems.

➢ Structural Hazards

➢ Falling hazards

During installation or maintenance, workers are exposed to fall from height hazard, if proper fall protection systems is not used.

➢ **Roof integrity**

The weight of solar panels and the installation process can affect the structural integrity of rooftops. Poorly installed systems may cause roof leaks or collapses.

➢ **Chemical Hazards (Solar Thermal)**

Heat transfer fluid

Solar thermal systems use heat transfer fluids that can be hot and potentially hazardous if not handled carefully.

Corrosive materials

Some solar thermal systems use corrosive materials in their operation, which can be dangerous if they leak or spill.

➢ **Maintenance Hazards:**

Working at heights

Maintenance tasks on solar panels or associated equipment often involve working at heights, which carries the risk of falls.

➢ **Heat stress**

Solar panels can heat up to very high temperatures, so there is a risk of heat stress for workers who are exposed to them for extended periods of time.

➢ **Toxic materials**

Solar panels contain some toxic materials, such as lead and cadmium. These materials can be released into the environment if the panels are damaged or disposed of improperly.

25.4 Safety measures to mitigate hazards associated with solar power generation

The following safety measures should be taken to maintain safety in solar farms;

➢ Always follow the manufacturer's instructions when handling, installing or maintaining solar panels.

➢ Standard Operating Procedure (SOP) should be prepared in regional language for all critical activities and workers should be communicated to ensure compliance accordingly.

➢ Safety training and re-training of workers is of paramount importance because they are exposed to a variety of hazards, such as:

➢ Electrical shock

➢ Electric arc flashes

- Physical injuries
- Falls from heights
- Extreme weather conditions
- Safety training will help workers to work safely to protect themselves and co-workers. Safety training should cover topics such as:
- Proper selection and use of 'Personal Protective Equipment' (PPE)
- Electrical safety
- Safety in material handling
- Emergency procedures
- Weather safety
- First-aid
- Maintenance and / or repair of solar farm should not be done in adverse weather conditions.
- Ensure availability of well-maintained 'First-aid' Box at solar farm. All maintenance persons should be trained in first-aid.
- Earth Pits' resistance should be checked periodically and maintain records.
- Use of appropriate personal protective equipment, such as electrical safety gloves, canvas / chrome leather gloves, goggles, safety shoes and safety helmet etc.
- Use of LOTO (Lockout and Tagout) should be ensure before carrying out electrical maintenance work.
- All maintenance activities should be done under 'Work Permit' system.
- Lightning strikes is also a potential hazard in solar farms. Effective 'Grounding' of 'Lightning Arrestors' should be ensured through separate/independent 'Earth Pits".
- Ensure proper care while transporting, loading / unloading and installing solar panels.
- Once in six month medical examination for workers engaged in solar power generation should be done and maintain records.
- TBT (Toolbox Talk) should be done every time before carrying out maintenance activity.
- An 'Emergency Preparedness and Response Procedure (EP&RP)' should be prepared and communicated to workers. Periodical mock-drills should be conducted to assess the adequacy of EP&RP and training needs of emergency response team members.
- Compliance of all Occupational Health & Safety related applicable legal and other requirements should be ensured.
- Contractor shall report all undesired incidents (Near-miss incident, minor or major incidents) immediately to the THDC Project Head of Solar Power Site. Written report of the same along with the preliminary investigation report on probable root cause of the incident and recommendation to prevent recurrence shall be submitted by the contractor within 24 hours of the occurrence of the incident.

25.5 Safety Do's and Don'ts of Solar Power Plant

Do's

- Monitor the weather as extreme weather conditions, such as heavy snow, hail, or high winds, can impact the integrity of solar panels.
- Ensure regular cleaning of panels especially in dusty or polluted environments. Accumulation of

dust; dirt, and debris on the surface of solar panels can reduce their efficiency. Use gentle stream of water to clean them.

- Ensure that the area around the solar panels is clear of obstructions and debris. This will help maintain proper airflow and prevent heat build-up.
- Ensure that all electrical connections, including wiring and junction boxes, are secure and free from corrosion. Loose or damaged connections can lead to power losses and pose safety risks.
- Inspect regularly solar panels for physical damage, like cracks or hot spots. These issues can reduce efficiency and, if left unchecked, may lead to more extensive problems.
- Trim nearby trees, bushes and vegetation regularly as trees and other obstructions can cast shadows on solar panels, reducing their efficiency.
- Keep the surrounding area free from dry grass and bushes, to minimize the fire risk.
- Inspect ladder before using and take defective one out of use.
- Use non-conductive ladders near power sources.
- Maintain safe distance from power lines.
- Ensure Test circuits are de-energized before working on PV panel.
- Use cotton glove while lifting solar panels to improve grip and protect finger.
- Make sure entire PV system is properly grounded to prevent electrical shock and injury.
- Use insulted tools when working on the PV system.
- Use LOTO (Lockout – Tagout) for electrical isolation.
- Work with 'Safety Work Permit' to carryout maintenance / repair work electrical lines / equipment.

Don'ts

- Don't walk on the panels.
- Never place tools or metal components on Batteries.
- Never disconnect PV Module Connectors or other associated PV Wiring when it's under load.
- Never smoke or do hot work near batteries.
- Don't wear metallic jewellery when working on PV System, as it may pose potential hazard of electric shock.

25.6 Safety Tips

- When testing solar panels, use a multi meter to test the voltage and current output of each panel.
- When replacing solar panels, be careful not to drop them or damage them. Use proper lifting and rigging techniques to move the panels.
- When inspecting solar panels, look for signs of damage, such as cracks, chips, and discoloration. If you find any damage, report it to your supervisor immediately.

Normative References

Guidelines of Ministry of New and Renewable Energy (MNRE), Government of India

26 Material Safety Data Sheet (MSDS)

A Material Safety Data Sheet (MSDS), also known as a Safety Data Sheet (SDS) or Product Safety Data Sheet (PSDS), is a document that provides detailed information about the potential hazards associated with a particular chemical, product, or mixture.

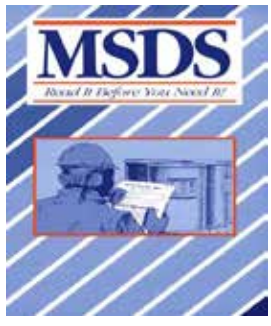
26.1 Legal Provision

- Schedulr-9 of Rule-17 of Manufacturing, Storage and Import of Hazardous Chemical Rules-1989

26.2 MSDS typically contains the following important information about chemical:

Role of MSDS (Material Safety Data Sheet) in chemical Safety

A Material Safety Data Sheet (MSDS) is also known as a Safety Data Sheet (SDS), provides crucial information about the safe handling, use, storage, and disposal of hazardous materials. MSDS provides following important information about the chemicals which helps in safe handling, storage and use of chemicals;



1. Chemical Identity
2. Physical and Chemical Data
3. Fire and Explosion Hazard Data
4. Reactivity Data
5. Health Hazard Data
6. Preventive Measures
7. Emergency and First Aid Measure
8. Additional Information / References
9. Manufacturer / Supplier Details and Contact inf.
10. Disclaimer

Here are some key points of safety information typically found in MSDS/SDS:

1. Chemical Identity

Material Name:	Formula:
Synonyms:	HAZCHEM Number:
C.A.S. Number:	UN Number:
Hazardous Waste ID Number:	

2. Physical and Chemical Data

Boiling Rang / Point (0c):	Physical State: Gas/Liquid/Solid
Appearance:	Melting/Freezing Point:
Vapor Pressure:	Odor:
Vapor Density (Air=1):	Specific Gravity (Water=1):
Solubility in Water at 3000c:	pH:

3. Fire and Explosion Hazard Data

Flammability: Yes /No	LEL: %	Flash Point 0C:
Auto ignition Temp.:	0C TDG Flammability	UEL %
Flash Point 0C:	Hazardous Combustion: Explosion Sensitivity to Impact:	
Explosion Sensitivity to Static Electricity: Product Hazardous Polymerization:		
Combustible Liquid	Explosive Material	
Corrosive Material Flammable Material		Oxidizer
Others	Pyrophoric Material	Organic Peroxide

4. Reactivity Data

Chemical Stability

Incompatibility with other material

Reactivity

Hazardous Reaction

Product

5. Health Hazard Data

Route of Entry

Effects of Exposure / Symptoms

Emergency Treatment

TLV (ACGIH)	ppm	mg/m3	
STEL	ppm	mg/m3	Permissible
Exposure Limit			
LD50 (Oral Rat)	ppm	mg/m3	
Odor-	ppm	mg/m3	
Threshold			
LD50			
NFPA	Hazard	Health	Flammability
Stability Special	Signals		

6. Preventive Measures

(a) Personal Protective Equipment

(b) Handling and Storage Precautions

7. Emergency and First Aid Measure

Fire	Extinguishing Media
	Fire Special Procedures
	Unusual Hazards
Exposure	First Aid Measures
	Antidotes / Dosages
Spills	Steps to be taken
	Waste Disposal Method

8. Additional Information / References:

9. Manufacturer / Supplier Details and Contact inf.

Name of Firm	Contact Person in Emergency
Mailing Address	Local Bodies Involved
Telephone/Telex Nos.	Standard Packing
Telegraphic Address	TREM Card Details/Ref Other

10. Disclaimer

Remember, always refer to the MSDS provided by the manufacturer for accurate and up-to-date safety information

26.3 MSDS of chemical used in THDC India Limited

The MSDS of following main chemicals used in THDC India Limited is given below

CHEMICAL NAME
Ammonia
Chlorine
CO2 (Carbon Dioxide)
HCl (Hydrochloric Acid)
HSD (High Speed Diesel)
Hydrogen
H2SO4 (Sulfuric Acid)
SF6 (Sulfur Hexafuoride)

27 Safety In Use Of Earth Moving Equipment At Construction Sites

27.1 Role and Responsibility

The responsibility to ensure safety in use of 'Earth Moving Equipment' at construction sites shall be;

Immediate Responsibility

- Main Contractor for his own earth moving equipment and also for the earth moving equipment hired by him from other agencies and used at THDC construction sites; and
- Project Manager of contractor;
- THDC Site In-charge / Site Engineer of construction site;

Ultimate Responsibility

THDC Project Head of construction site.

27.2 Legal Provisions

Rule-48 of the Building and Other Construction Workers' (Regulation of Employment and Conditions of Service) Central Rules, 1998

27.3 Earth Moving Equipment commonly used in construction works

27.3.1 Excavator

Excavators are heavy construction equipment consisting of a boom, dipper (or stick), bucket and cab on a rotating platform known as the "house". The house sits atop an undercarriage with tracks or wheels. All movement and functions of a hydraulic excavator are accomplished through the use of hydraulic fluid, with hydraulic cylinders and hydraulic motors.

27.3.2 Backhoe Loader

A backhoe loader is a heavy equipment vehicle that consist of a tractor-like unit fitted with a loader-style shovel/bucket on the front and a backhoe on the back. Due to its small size and versatility, backhoe loaders are very common in urban engineering and small construction projects.

27.3.3 Trencher

A trencher is used to dig trenches, especially for laying pipes or electrical cables, for installing drainage, or in preparation for trench warfare. Trenchers may range in size from walk-behind models, to attachments for a skid loader or tractor, to very heavy tracked heavy equipment.

27.3.4 Bulldozer

A bulldozer is a tractor equipped with a substantial metal plate / blade used to push large quantities of soil, sand, rubble, or other such material during construction or conversion work and typically equipped at the rear with a claw-like device (known as a ripper) to loosen densely compacted materials.

27.3.5 Motor Grader

A motor grader, is a construction machine with a long blade used to create a flat surface during the grading process. Modern graders contain an engine, so are known, technically erroneously, as "motor graders". Typical models have three axles, with the engine and cab situated above the rear axles at one end of the vehicle and a third axle at the front end of the vehicle, with the blade in between. Most motor graders drive the rear axles in tandem, but some also add front wheel drive to improve grading capability.

27.3.6 Loader

A loader is a heavy equipment machine used in construction to move aside or load materials such as asphalt, demolition debris, dirt, snow, feed, gravel, logs, raw minerals, recycled material, rock, sand, woodchips, etc. into or onto another type of machinery. There are many types of loader, which, depending on design and application.

27.3.7 Power Paver

A power paver (paver finisher, asphalt finisher, paving machine) is a construction equipment used to lay asphalt on roads, bridges, parking lots and other such places. It lays the asphalt flat and provides minor compaction before it is compacted by a roller.

27.3.8 Compactor

A compactor machine is used to reduce the size of material such as waste material or biomass through compaction. A landfill compactor is used to drive over waste deposited by waste collection vehicles.

27.4 Safety in use of Earth Moving Equipment

Earth moving equipment is powerful and essential for many construction and landscaping tasks, but its size and power also make it potentially dangerous. Have a plan in place for emergencies and ensure everyone on site is familiar with it.

By observing following safety tips and procedures, risk of accidents and injuries can significantly be reduced when using earth moving equipment;

27.5 General safety precautions

- Ensure all operators are adequately trained and certified in the specific equipment they will be using.
- Before starting, conduct a thorough walk-around inspection to identify any potential hazards or mechanical issues.
- Wear appropriate Personal Protective Equipment (PPE) including hard hats, safety glasses, ear protection, gloves, and high-visibility clothing.

- Safety precautions during Operation:
  - Maintain a safe distance from other workers and bystanders.
  - Use hand signals or a spotter when visibility is limited.
  - Be aware of overhead power lines and avoid working near them.
  - Operate at safe speeds and avoid sudden stops or turns.
  - Never carry passengers on the equipment.
  - Secure loads properly and avoid overloading.
  - Be cautious when working near edges of excavations or slopes.
  - Follow designated traffic patterns and signage on the site.
- Park the equipment on a level surface, engage the parking brake, and shut down the engine before dismounting.

For Everyone on Site:

- Clearly mark work zones and restrict access to authorized personnel only.
- Maintain clear communication between operators, spotters, and other workers on the site.
- Be aware of your surroundings and potential hazards in the work area.
- Adhere to all established company's safety rules and procedures.

Additional Considerations:

- Ensure equipment is properly maintained and serviced according to the manufacturer's recommendations.
- Conduct thorough risk assessments before starting any work and implement appropriate safety measures.

Remember, safety is everyone's responsibility on a construction site.

27.6 Precautions for power shovels and excavators

- A shovel or an excavator whether operated by steam or electric or by internal combustion, shall be constructed, installed, operated, tested and examined as per approved standards;
- Excavator equipped for use as a mobile crane shall be examined and tested in accordance with the requirements for such mobile cranes as laid down by the manufacturer and fitted with an automatic safe working load indicator.
- Buckets or grabs of power shovels shall be propped to restrict the movement of such buckets or grabs while being repaired or while the teeth of such buckets or grabs are being changed.

27.7 Precautions for bulldozers and scrapers

- ✶ Operator of bulldozer before leaving the bulldozer shall take the following steps:
  - ➢ Apply the brakes;
  - ➢ Lower the blade and sipper and
  - ➢ Put the shift lever into neutral;
- ✶ A bulldozer shall be parked on a level ground at the close of the work.
- ✶ The blade of a bulldozer shall be kept low when such bulldozer is moving uphill;
- ✶ The bulldozer blades shall not be used as brakes except in an emergency.

27.8 Precautions for mobile asphalt and finishers

- A mixture elevator shall be located within a wooden or sheet metal enclosure with a window for observation, lubrication and maintenance.
- Bitumen scoops shall have adequate covers.
- When asphalt plants are working on public road, adequate traffic control shall be established on such road and the building workers working with such plant shall be provided with reflective jackets.
- A sufficient number of fire extinguishers shall be kept in readiness at such workplace where fire hazards may exist.
- The materials shall be loaded on the elevator after the drying drain has warmed up of such elevator
- No open light shall be used for ascertaining the level of asphalt.
- Inspection opening shall not be opened till there is a pressure in the boiler, which may cause injury to building workers.

27.9 Precautions for pavers and road rollers

- Pavers shall be equipped with guards suitable to prevent building workers from walking under the skip of such pavers.
- Before a road roller is used on the ground, such ground shall be examined for its bearing capacity and general safety, especially at the edges of slopes such as embankment on such grounds and shall not be moved downhill with the engine out of gear.

27.10 Road Safety Signs

27.11 Safety in work adjacent to transport facilities

27.11.1 Work adjacent to rail tracks

1) Nobody should try to cross under the standing train or on the track where wagons are parked. None should cross through the gap between buffers of wagons.

2) Nobody should take rest on rail-tracks or sit underneath stationary wagons.

3) Before crossing any un-manned level crossing, one should stop, look, listen and make sure that no Engine or Train is approaching from either direction.

4) Contractors / Site In-charge shall ensure that no material belonging to them is stacked close or high along the rail track area.

5) No One should get on to locomotive or wagon unless he is an authorized person to travel or he has to go there in the performance of his duties.

6) While crossing the railway track, do not step on the track rail. Always cross over it through foot over bridge. Short-cuts and crossing across the corners should be avoided.

7) All work must be conducted to avoid damage to trains, tracks and not to interfere with the movement of trains or damage to rail track ballast.

27.11.2 Work adjacent to live road

1) During the hours of darkness all public sidewalks and walkways shall be adequately illuminated and warning lights shall be placed in proper sites to ensure safety of pedestrians and the vehicular traffic.

2) In busy or otherwise risky locations a flagman with a red flag shall be posted to warn the public and the approaching trucks and to guide them in proper direction.

3) All vehicles used at construction site shall comply with the requirements of the Motor

Vehicle Act, 1988 (59 of 1988) and the rules made there under and driver of a vehicle shall hold a valid driving license under the Motor Vehicle Act, 1988.

Normative References

- *Building and Other Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996 and Central Rules, 1998*
- *Central Motor Vehicles Rules, 1989*
- *NHAI Road safety Rules*
- *Occupational Safety, Health and Working Conditions Code 2020*
- *Occupational Safety, Health and Working Conditions (Central) Rules 2020*
- *U.P. Occupational Safety, Health and Working Condition Code Rules, 2021*

28 Environmental Management System

28.1 Role and Responsibility

The role and responsibility to ensure compliance of 'Environmental Management System' shall be of the;

Immediate Responsibility

- All HODs for the implementation of all environmental related acts and rules applicable to their areas.
- All contractors

Ultimate Responsibility

- Projector Manager of main contractor
- THDC Project Head of construction site

28.2 List of 'Environmental Management System' related applicable acts and rules

Air (Prevention and Control of Pollution) Act, 1981

Air (Prevention and Control of Pollution) Rules, 1982

Biological Diversity Act, 2002

Bio Medical Waste Management Rules, 2016 (2019)

Environment (Protection) Act, 1986

Environment (Protection) Rules, 1986

Forest Conservation Amendment Act, 1923

Forest (Conservation) Rules, 2022

Hazardous and Other Wastes (Management &Transboundary Movement) Rules, 2015

Indian Forest Act, 1927

Manufacture, Storage and Import of Hazardous Chemical Rules, 1989

Noise Pollution (Regulation and Control) Rules, 2000

National Green Tribunal Act, 2010

Public Liability Insurance Act, 1991

Public Liability Insurance Rules, 1991

Water (Prevention and Control of Pollution) Act, 1974

Water (Prevention and Control of Pollution) Rules, 1975

Wildlife Protection Act, 1972

28.3 Definitions

Environment

Surrounding in which an organization operates, including air, water, land, natural, resources, flora, fauna, humans and their interrelation

Environmental Aspect

Element of an organization's activities or products or Services that can interact with the environment

Environmental Impact

Any change to the environment, whether adverse or beneficial, wholly or partially resulting from an organization's activity on environment

Environmental policy

Overall intentions and direction of an organization related to its environmental performance and commitment to protect environment.

28.4 Introduction about environmental management system

THDCIL Corporate Office and Projects are ISO 14001-2015 Certified Company and has a vision – to develop sustainable power with commitment to environment, ecology and social values. THDCIL strategy on environmental sustainability is to optimize use of energy and water, to reduce carbon footprint and to protect/reconstruct Biodiversity.

28.5 EMS Policy

THDCIL is committed to provide sustainable power with commitment for protection of Environment and to minimize pollution.

THDCIL aims to achieve continual improvement in Environmental performance by setting objectives, reviewing progress and communicating results.

For reduction of organization's environmental footprints, THDCIL shall-

- Comply with applicable legal requirements, laws, regulations and follow best practices;
- Communicate THDCIL Environment Policy to all stakeholders, including THDC employees;
- Facilitate THDC employees, contractors, sub-contractors, suppliers and consultants to fulfil their environmental obligations with respect to THDC business operations and activities;
- Strive to conserve resources, reduce waste and mitigate environmental risks that may be associated with THDCIL activities;
- Review and continually improve environmental management systems in line with ISO 14001 and integrate the same into THDCIL business processes.

Annexure: EMS policy signed by the General Manager - Social & Environment.

28.6 Biomedical Waste Management

28.7 Definitions

Bio-medical Waste

As per the Bio-medical Waste Management Rules, 2016 (2019) "bio-medical waste" means any waste, which is generated during the diagnosis, treatment or immunisation of human beings or animals or research activities pertaining thereto or in the production or testing of biological or in health camps, including the categories mentioned in Schedule I appended to these rules.

Management

"Management" includes all steps required to ensure that bio- medical waste is managed in such a manner as to protect health and environment against any adverse effects due to handling of such waste;

Occupier

"Occupier" means a person having administrative control over the institution and the premises generating bio-medical waste, which includes a hospital, nursing home, clinic, dispensary, veterinary institution, animal house, pathological laboratory, blood bank, health care facility and clinical establishment, irrespective of their system of medicine and by whatever name they are called.

28.8 Duties of the Occupier shall be to-

(a) Take all necessary steps to ensure that bio-medical waste is handled without any adverse effect to human health and the environment and in accordance with these rules.

(b) Provide training to all its health care workers and others, involved in handling of bio medical waste at the time of induction and thereafter at least once every year and the details of training programmes conducted, number of personnel trained and number of personnel not undergone any training shall be provided in the Annual Report;

(c) Immunise all its health care workers and others, involved in handling of bio-medical waste for protection against diseases including Hepatitis B and Tetanus that are likely to be transmitted by handling of bio-medical waste, in the manner as prescribed in the National Immunisation Policy or the guidelines of the Ministry of Health and Family Welfare issued from time to time;

(d) Conduct health check up at the time of induction and at least once in a year for all its health care workers and others involved in handling of bio- medical waste and maintain the records for the same;

(e) Maintain and update on day to day basis the bio-medical waste management register and display the monthly record on its website according to the bio-medical waste generated in terms of category and colour coding as specified in Schedule

28.9 Segregation of Biomedical Wastes

Schedule-I under Rules 3 (e), 4(b), 7(1), 7(2), 7(5), 7 (6) and 8(2), Part-1 Biomedical wastes categories and their segregation, collection, treatment, processing and disposal options

28.10 Authorization

As per Rule-10, for handling bio-medical waste, irrespective of the quantity shall make an application in Form II to the prescribed authority i.e. State Pollution Control Board and Pollution Control Committee, as the case may be, for grant of authorisation and the prescribed authority shall grant the provisional authorisation in Form III and the validity of such authorisation for bedded health care facility and operator of a common facility shall be synchronised with the validity of the consents.

28.11 Noise Monitoring

Noise means any unwanted sound.

28.11.1 Legal provision for 'Workplace Noise Monitoring'

As per Schedule XXIV of State Factories permissible noise level for the 'Operating Operations Involving High Noise Levels'.

In every plant/factory suitable engineering control or administrative measures shall be taken to ensure, so far as is reasonably practicable, that no worker is exposed to sound levels exceeding the maximum permissible noise exposure levels specified in Table-1 and Table-2.

Table 1
Permissible exposure in cases of continuous noise

Total time of exposure (continuous or a number of short-term exposure) per day, in hours	*Sound pressure level in dBA*
8	90
6	92
4	95
3	97
2	100
1 ½	102
1	105
¾	107
½	110
¼	115

Notes.- (1) No exposure in excess of 115 dBA is to be permitted.

(2) For any period of exposure falling in between any figure and the next higher or lower figure as indicated in Column 1, the permissible sound pressure level is to be determined by extrapolation on a proportionate basis.

Table 2
Permissible exposure levels of implosive or impact noise

Peak sound pressure level in dB	*Permitted number of impulses or impacts per day*
140	100
135	315
130	1,000
125	3,160
120	10,000

Notes. - (1) No exposure in excess of 140 dB peak sound pressure level is permitted.

28.12 Ambient Air Quality Monitoring with respect to Noise

Legal Provision

Schedule-III of Rule-3 of the Environment (Protection) Rules, 1986

AMBIENT AIR QUALITY STANDARDS IN RESPECT OF NOISE

AREA CODE	CATEGORY OF AREA	LIMITS IN DB(A) DAY TIME	Leg. NIGHT TIME
(A)	Industrial Area	75	70
(B)	Commercial Area	65	56
(C)	Residential Area	55	45
(D)	Silence Zone	50	40

28.13 Illumination Standards for excavation and tunnelling works

As per IS-4756: 1978 (Safety Code for Tunnelling Work)

All contractors carrying out excavation or tunnelling work at a construction site of a building or other construction work shall provide for emergency generators on such construction site to ensure adequate lighting / illumination of intensity as mentioned in IS-4756: 1978 (Safety Code for Tunnelling Work) at all work places where such excavation or tunnelling work is being carried out;

In case of power failure, all workplaces where excavation or tunnelling works are carried out shall be adequately illuminated

Minimum Illumination	TUNNEL (Ref. IS-4756: 1978, Safety Code for Tunnelling Work)
50 Lux	Minimum illumination at tunnel and shaft headings during drilling, mucking and scaling
30 Lux	When mucking is done by tipping wagons running on trolley trucks
10 Lux	Any area inside the tunnel or outside an approach road, etc.

28.14 Elements of THDCIL Environmental Management System

Pre-Construction Planning and Design

THDCIL makes all-out efforts to integrate environment protection measures at project planning stage itself. This approach is more cost-effective than establishing environmental controls after the commencement of project.

THDCIL, after site selection conducts Environment Impact Assessment (EIA) studies to ascertain that project's construction / operation activities are not vulnerable to cause any damage to the environment and prepare Environment Management Plan (EMP). EMP is aimed at mitigating the possible adverse impact of the project and maintaining the existing environmental quality. The EMP converge all aspects of planning, construction and operation of the project, which are relevant to environment. Based on the findings of EIA/ EMP studies, environmental clearance for the project is obtained in accordance with EIA Notification 2006 issued by Ministry of Environment, Forest and Climate Change, Government of India.

Land Disturbance

Large projects usually involve extensive land disturbance, involving removing vegetation and reshaping topography. Such activities make the soil vulnerable to erosion. Soil removed by erosion may become airborne and create a dust problem or be carried by water into natural waterways and pollute them.

Measures to address the impact of land disturbance on the environment should be included in planning and design phase of the project, before any land is cleared.

Erosion Control Measures

Erosion control measures shall be formulated as per the site, its erodibility index, type, nature and intensity of earthwork.

Ground cover provides the most effective means of preventing erosion. Consequently, sediment run-off and dust controls depend on retaining existing vegetation or re-vegetating and mulching disturbed areas as soon as possible.

The following measures may be taken to minimise erosion:

- Keep land clearance to a minimum.
- Wherever possible, avoid clearing areas of highly erodible soils and steep slopes prone to water and wind erosion.
- Re-vegetate and mulch progressively as each section of works is completed. The interval between clearing and re-vegetation should be kept to an absolute minimum.
- If more than one contractor is working on a site, coordinate work schedules as such that there are no delays in construction activities which may result in disturbed land remaining unsterilized.
- Program construction activities so that the area of exposed soil is minimized during times of the year when the potential for erosion is high.
- Stabilize the site and install and maintain erosion controls so that they remain effective during any pause in construction. This is particularly important if a project stops during the wetter months.
- Keep vehicles to well-defined haul roads.
- Keep haul roads off sloping terrain wherever practical.
- Designed the slope of a cut to minimize the angle of incline.
- Cultivating the cut surface.

Muck Management Plan

The overall idea of muck management plan is to avoid contamination of any land or water resource due to muck disposal and enhance aesthetic view in the surrounding area of the project. The muck rehabilitation plan involves both engineering and biological measures that depend on the terrain and eco-climatic conditions. Under the muck management following should be considered:

- As far as possible, generated muck shall be utilized in various construction activities and balance quantity of muck shall be disposed only at pre-identified muck disposal sites.
- Suitable reinforced earth wall shall be constructed on lower end, well above the high flood level (HFL). Approach road shall be first constructed to gain access to lower end of dumping area from the existing road. Road alignment shall be such so as to cater the maximum dumping area, ease in storing and reusing top soil and safe movement of vehicles. To avoid dumping of muck at unauthorized area, details of muck loaded on truck at source shall be entered in trip sheet. Supervisors at dispatching and receiving ends shall signoff the trip sheet with date, time, quantity etc.
- The muck received at dumping area shall be taken from lower end above HFL and spread gently with a dedicated dozer deployed for this purpose.
- The muck shall be dumped along the direction of river flow or road dip direction, whichever

is nearer. It shall then be compacted using compactor to reduce the air voids and maximize the area available. Water shall be spray over muck during compaction process.

- Care shall be taken to maintain slope for draining rain water without damaging filled area.
- The next bench shall be prepared in similar way maintaining an appropriate angle of repose from face wall.
- The process will continue till all benches are filled to its maximum limit. Catch water drains shall be provided across benches to collect rain water and drain it off to river.
- Top soil shall be spread to fill air voids and prepare a base for vegetation growth.
- Dumping site shall be rehabilitated by using biological measures like planting of grass, shrubs and tree species.

Management of contaminated storm water

Soil eroded during land disturbance can wash away and contaminate storm water. If contaminated storm water enters a drainage line or storm water drainage system, it will eventually discharge into an adjacent waterway and pollute it.

The sediment control measures depend on the nature of the site, rainfall patterns, soil type and topography etc. These factors need to be taken into account when selecting appropriate controls. Ways of minimising sediment run-off are listed as under:

Reduce storm water on the site

- If uncontaminated water enters part of the site that has been cleared, it will quickly pick up sediment and may enhance erosion potential. Hence, diversion banks and intercept drains may be constructed around the site to catch clean storm water and discharge it into natural course without causing unwanted erosion.
- Wherever possible, the new storm water drainage system should be installed before any land disturbance activities commence.

Water velocities

- There is a direct relationship between the velocity of water flowing over exposed soil and the rate of erosion.
- Installation of rock structures on the site to retard water flows is an effective measure to reduce erosion in areas where high water flows are expected.
- To prevent scouring, drainage lines may need to be lined or velocity-reducing structures, such as crushed rock or geotextile placed in the drainage line.

Slopes

Any natural drainage lines that discharge water on to the top of a slope should be directed to grass areas by intercept drains. Otherwise water will run down the slope, eroding it. Perimeter banks or sediment fences should also be constructed at the toe of the slope to contain sediment run-off.

28.15 Air Pollution Control & Management

Construction Phase

There are three potential sources of air pollution on construction sites. They are

a) Exhaust gases and smoke emitted from vehicles, machinery and thermal work processes (like heating (surfacing), torch-cutting, hot coating, welding and detonation)

b) Solvents and other substances emitted during processing products containing solvents or during

chemical (detaching) processes at construction sites. Critical activities are: coating, gluing, dissolving, foaming, painting, spraying, etc

c) Dust originated at construction sites. Some major dusty activities are grinding, milling, drilling, abrading blasting, chipping, sharpening; demolition, crushing, heaping, dumping, separating, loading, unloading, grasping, transporting, etc.

The following measures are recommended to control air pollution:

- When practical, excavated spoils shall be removed as the excavation work proceeds along the length of the activity.
- When necessary, stockpiling of excavated material will be covered or staged offsite location with muck being delivered as needed during the course of construction. Construct the stockpile with no slope greater than 2:1 (horizontal to vertical). A less steep slope may be required where the erosion risk is high.
- The construction area and vicinity (access roads, and working areas) shall be swept with water sweepers on a daily basis or as necessary to ensure there is no visible dust.
- Restrict maximum speed of vehicle on construction site pathway to 30 km/h.
- Dust suppression through water sprinklers shall be attained for material transfer points of crushing plant.
- The batching plant shall be a closed system and will not emanate any dust.
- Screw conveyers may be used to transfer cement.
- Use bitumen having low emission rates of air pollutants.
- Choose environmentally friendly products for surface treatment, gluing and sealing gaps.
- Deploy low-emission equipment and use low emission explosives.
- All vehicles and machinery are fitted with appropriate emission control equipment, maintained and serviced as per the manufacturers' specifications. All machines and vehicles must possess valid Pollution under Control (PUC) certificate issued by competent authority.
- In case of Thermal Power Project (TPP), stack height shall be calculated as per the applicable guidelines provided by CPCB.

Operation Phase

In Hydro power project, air pollution potential is very much limited to the construction phase. However, necessary precautions must be taken maintain the National Ambient Air Quality Standards issued by Central Pollution Control Board, Govt. of India.

In Thermal Power projects (TPP), The amount and nature of air emissions depends on factors such as the fuel (e.g., coal, fuel oil, natural gas, or biomass), the type and design of the combustion unit (e.g., reciprocating engines, combustion turbines, or boilers), operating practices, emission control measures (e.g., primary combustion control, secondary flue gas treatment), and the overall system efficiency. The primary emissions to air from the combustion of fossil fuels in thermal power plants are Sulphur Dioxide (SO_2), Nitrogen Oxides (NO_x), Particulate Matter (PM), Carbon Monoxide (CO), and Greenhouse Gases, such as Carbon Dioxide (CO_2). Depending on the fuel type and quality, mainly solid fuels, other substances such as heavy metals (i.e., mercury, arsenic, cadmium, vanadium, nickel, etc), halide compounds (including hydrogen fluoride), unburned hydrocarbons and other volatile organic compounds (VOCs) may be emitted in smaller quantities, but may have a significant influence on the environment due to their toxicity and/or persistence.

Pollutant-specific recommendations for air pollution control measures are provided below.

Nitrogen Oxides:

- Use low NO_x burners with other combustion modifications, such as Low Excess Air (LEA) firing, for boiler plants. Installation of additional NO_x controls for boilers may be necessary to meet emissions limits; a Selective Catalytic Reduction (SCR) system can be used for pulverized coal- fired, oil-fired, and gas-fired boilers or a Selective Non- Catalytic Reduction (SNCR) system for a fluidized-bed boiler.
- Use dry low-NO_x combustors for combustion turbines burning natural gas.
- Use water injection or SCR for combustion turbines and reciprocating engines burning liquid fuels.
- Optimization of operational parameters for existing reciprocating engines burning natural gas to reduce NO_x emissions.

Particulate Matter:

- Install dust control equipment's capable of over 99% removal efficiency, such as ESPs or Fabric Filters (baghouses), for coal-fired power plants.
- Use loading and unloading equipment that minimizes the height of fuel drop to the stockpile to reduce the generation of fugitive dust.
- Use water spray systems to reduce the formation of fugitive dust from solid fuel storage in arid environments.
- Use enclosed conveyors with well designed, extraction and filtration equipment on conveyor transfer points to prevent the emission of dust.
- For solid fuels of which fine fugitive dust could contain vanadium, nickel and Polycyclic Aromatic Hydrocarbons (PAHs), use full enclosure during transportation and covering stockpiles where necessary.
- Use wind fences in open storage of coal or use of enclosed storage structures to minimize fugitive dust emissions where necessary, applying special ventilation systems in enclosed storage to avoid dust explosions and use of cyclone separators at coal transfer points.

Other Pollutants:

Mercury

Mercury emissions from thermal power plants pose potentially significant local and trans-boundary impacts to ecosystems and public health and safety through bioaccumulation. Recommendations to prevent, minimize, and control emissions of mercury and other air pollutants include the use of conventional secondary controls such as fabric filters or ESPs operated in combination with FGD techniques, such as limestone FGD, Dry Lime FGD, or sorbent injection. Additional removal of metals such as mercury can be achieved in a high dust SCR system along with powered activated carbon, bromine- enhanced Powdered Activated Carbon (PAC) or other sorbents.

Sulphur Dioxide

Depending on the plant size, fuel quality, and potential for significant emissions of SO_2, use of Flue Gas Desulfurization (FGD) for large boilers using coal or oil and for large reciprocating engines must be explored.

- Use fuels with a lower content of sulphur where economically feasible.
- Use lime (CaO) or limestone ($CaCO_3$) in coal-fired fluidized bed combustion boilers to have integrated desulfurization which can achieve a removal efficiency of up to 80-90 % through use of Fluidized Bed Combustion.

Air Quality Monitoring

During construction phase, parameters namely $PM_{2.5}$, PM_{10}, NOx, SO_2 shall be monitored every year for three seasons namely, winter, summer and post-monsoon. Apart from this, the atmospheric monitoring of underground works e.g. tunnel shall also be carried out for levels of oxygen, CO_2, methane, etc.

During operation phase of TPP, levels of $PM_{2.5}$, PM_{10}, NOx, SO_2 shall be continuously monitor in flue gases.

18.16 Noise Pollution & Vibration Control & Management

The management of noise level shall be executed in complete construction and operation phase. The following measures are suggested for noise level management.

- The construction work occurring within 100-150 meter of a residential area, the work hours should be limited depending on the convenience of the people.
- Acoustic enclosure for DG set and similar provision like noise attenuator shall be provided so as to comply with the 75 dBA at 1m sound levels specified by CPCB. A proper routine and preventive maintenance procedure for the DG set should be plan and followed in consultation with the DG set manufacturer which would help prevent noise levels of the DG set from deteriorating with use.
- Noise generating equipment's like pump, motors, compressors, blower, turbine/engines and power generator sets/ engines etc. shall be mounted on sturdy concrete foundations with proper & suitable rubber padding to reduce vibrations & thereby noise generation.
- The controlled blasting should be undertaken involving non electric delay detonation technique. Blasting shall be done during day time at pre-notified time only.
- Noise generated by crushers is in the range of 79-80 dB (A) at a distance of 250 ft or 80 m from the crusher. Thus, noise level at a distance of 2 m from the crusher shall be of the order of 110 dB (A). The exposure to labour operating in such high noise areas shall be restricted up to 30 minutes on a daily basis. Alternatively the workers need to be provided with ear muffs or plugs, so as to attenuate the noise level near the crusher by at-least 15 dB (A). The exposure to noise level in such a scenario is limited up to 4 hours per day.
- Safety blow off valves, discharge pipes, relief valves, etc. will be equipped with silencers. Regular lubrication & preventive maintenance shall be done to reduce vibration & noise generation. Use of PPE like ear plugs and ear muffs shall be made compulsory near the high noise generating machines.
- Periodic monitoring of noise levels shall be conducted at major project sites and nearby areas on regular basis as per approved project monitoring plan. Noise Pollution monitoring must comply with the Noise Pollution (Regulation and Control) Rules, 2000.

28.17 Water Pollution Control and Management

Disposal of untreated wastewater in river / nallahs / other natural water stream may have negative impact on the quality of water that may results in degradation of aquatic ecosystem. Any wastewater disposed in natural water stream must complied the standards issued by CPCB/SPCB. TPP has different

(A) Control of Water Pollution during Construction Phase

1. Sanitary waste from labor camps, industrial establishment and project colonies etc. shall be treated prior to its disposal. Waste discharge stream must meet the standards issued by SPCB/CPCB.

2. The effluent having high suspended solids generated from crushers may be treated in settling tanks prior to its disposal in natural stream.

(B) Control of Water Pollution during Operation Phase

The amount, source and quality of wastewater generation is different in Hydro Power Plant (HPP) and Thermal Power Plant (TPP). Hence different control measures shall be adopted for HPP and TPP.

Hydro Power Plant (HPP):

1. Adequate river water shall be secured to meet the requirements of riparian species, livestock, and wild animals and to sustain the aquatic ecosystem.
2. The growth of aquatic weeds is to be monitored in the reservoir and excess weeds will be removed.
3. Fish (after introducing in the reservoir) production in the reservoir will be monitored for any possible decrease. If any unexpected negative impact occurs, fish will be restocked.
4. In case of RoR schemes, slit flushing tunnels shall be operated in a manner to provide sufficient dispersion time and water velocity.

Thermal Power Plant (TPP):

The wastewater streams in a TPP include cooling tower blow down; ash handling wastewater; material storage runoff; metal cleaning wastewater; and low-volume wastewater, such as air heater and precipitator wash water, boiler blow down, boiler chemical cleaning waste, floor and yard drains and sumps, laboratory wastes, and backflush from ion exchange boiler water purification units. Management measures to water quality and aquatic ecology are as under:

1. Reduce maximum through-screen design intake water velocity to 0.5 feet per second.
2. Maintain water intake flow to the following levels:
    - For freshwater rivers or streams, to a flow sufficient to maintain resource use (i.e., irrigation and fisheries) as well as biodiversity during annual mean low flow conditions.
    - For lakes or reservoirs, intake flow must not disrupt the thermal stratification or turnover pattern of the source water.
    - For estuaries or tidal rivers, reduction of intake flow to 1% of the tidal excursion volume.
3. The elevated temperature areas because of thermal discharge from the project should not impair the integrity of the water body as a whole or endanger sensitive areas (such as recreational areas, breeding grounds, or areas with sensitive biota.
4. Use multi-port diffusers.
5. Extend length of discharge channel before reaching the surface water body for pre-cooling or change location of discharge point to minimise the elevated temperature areas.
6. Use closed-cycle, recirculating cooling water system (e.g., natural or forced draft cooling tower), or closed circuit dry cooling system (e.g., air cooled condensers) if necessary to prevent unacceptable adverse impacts.
7. Recycling of wastewater from flue gas desulphurisation (FGD) systems in coal-fired plants as FGD makeup.
8. Where ever possible, collection of fly ash in dry form and bottom ash in drag chain conveyor systems in new coal-fired power plants.

9. Consider use of soot blowers or other dry methods to remove fireside wastes from heat transfer surfaces so as to minimize the frequency and amount of water used in fireside washes.
10. Spray coal piles with anionic detergents to inhibit bacterial growth and minimize acidity of leachate.
11. If feasible, use of SOx removal systems that generate less wastewater.
12. Treat low-volume wastewater streams that are typically collected in the boiler and turbine room sumps in conventional oil-water separators before discharge.
13. Treat acidic low-volume wastewater streams, such as those associated with the regeneration of makeup demineraliser and deep-bed condensate polishing systems, by chemical neutralization in-situ before discharge.
14. Use the minimum required quantities of chlorinated biocides in place of brominated biocides.
15. Zero discharge concepts shall be followed by using treated effluent for gardening and floor cleaning purpose.

28.18 Solid Waste Management

Solid Waste Management plan is particularly based on the concept of avoidance and/or Reduction, Reuse and then Recycling.

To identify opportunities it is necessary to consider all aspects of the project and the wastes it generates. Wastes have been categorized as:

1. Bio-degradable waste
2. Non-Biodegradable waste
3. Contaminated waste
4. Hazardous Waste
   a) Industrial
   b) Biomedical

Coal or biomass-fired TPPs generate the greatest amount of solid wastes in India due to the relatively high percentage of fly ash in the fuel. The other solid waste from large-volume coal combustion wastes includes bottom ash, boiler slag. Fly ash generated is typically not classified as a hazardous waste due to its inert nature. However, it may be enriched with metals being constituents of concern in both coal fired and low-volume solid wastes as a result ash residues and the dust removed from exhaust gases may contain significant levels of heavy metals and some organic compounds, in addition to inert materials. Therefore, where ash residues are expected have potentially significant levels of heavy metals or other potentially hazardous materials, they are required to be tested at the start of plant operations to verify their classification as hazardous or non-hazardous according to National Hazardous Waste rules. Following measures shall be adopted for handling fly ash:

i. Fly ash shall not be used for agriculture purpose. No mine void filling will be undertaken as an option for fly ash utilization without adequate lining of mine with suitable media such that no leachate shall be take place at any point of time.

ii. Fly ash shall be collected in dry form and storage facility (silos) shall be provided. Unutilized fly ash shall be disposed off in the ash pond in the form of slurry. Mercury and other heavy metals (As, Hg, Cr, Pb etc.) shall be monitored in the bottom ash and also in the effluents emanating from the existing ash pond. No ash shall be disposed off in low lying area.

iii. Ash pond shall be lined with HDPE/LDPE lining or any other suitable impermeable media such that no leachate takes place at any point of time.

iv. Efforts shall be made for 100% utilization of fly ash from 4th year of operation.

28.19 Generation and collection other wastes

All types of wastes are to be put into designated bins after generation. Those are to be disposed of in identified bins for further handling.

1. Biodegradable waste like paper, cotton waste, wood shall be kept in green bins which shall be transferred in identified area in Scrap Yard for further disposal.
2. Non-Biodegradable waste include plastic, polythene, rubber, concrete debris, fire bricks, glass and welding slugs are to be kept at blue bins and to be disposed to identified place at Scrap Yard for further disposal.
3. Welding slugs are to be collected and used for land filling
4. Oil Contaminated wastes are to be collected in one red bin which will be transferred to identified area in Scrap Yard for further disposal.
5. Industrial hazardous wastes in liquid form (used lubricant and used coolant oils) are to be collected in empty oil drums & to be kept under shed and lock and key and the floor must be made of concrete with non-permeable membrane below ground. The content must be labelled.
6. Biomedical wastes are to be sent to Medical Centre for disposing by deep burial method or incinerated.

Disposal

1. Biodegradable waste includes paper waste, wood waste, cotton waste, and cardboard packets can be used for landfill or sold to vendor through auction.
2. Non-Biodegradable wastes include plastic, polythene, rubber, concrete debris; glass cannot be used for landfill. Those are to be sold through auction for recycling.
3. Contaminated waste include oil/ grease impregnated cotton waste cannot be used for land filling and to be incinerated through authorized vendors.
4. Metallic Waste include off-cuts of steel tubes, plates and turning and borings of tubes and bars, and also nonferrous metallic scrap like aluminium, copper and bronze coming out of maintenance. These wastes are to be sold through auction.
5. Old machinery list which is approved are disposed off through open auction.
6. Hazardous waste include batteries, empty paint containers, paint sludge, empty dye penetrate cans, used lubricants, used cutting oil, used transformer oil, ETP sludge & asbestos waste, generated out of shop floor roof sheets and rain water pipes of roof sheds. These are to be disposed through approved recyclers or approved disposers of Central/ State Pollution Control Board. The vendors must be able to provide all legal documents prescribed in legal register.

28.20 Biodiversity and Wildlife Conservation & Management

The legal framework of biodiversity management and conservation is covered under the National Biodiversity Strategy & Action Plan (NBSAP), Biological Diversity Act (2002), Forest Act (1980), Wildlife (Protection) Act (1972) etc.

Various mitigation measures shall be implemented to protect the biodiversity from adverse environmental and social impacts. These measures are as follows:

1. Tree felling for road construction/works should be kept bare minimum
2. Equivalent amount of new trees should be planted as integral part of the project within the available land and if necessary, separate additional land may be acquired for this purpose.
3. Depending on the availability of land and other resources, afforestation of roadside land should be carried out to a sufficient distance on either side of the road.

   During the construction phase, various adverse impacts on the wildlife are anticipated in the surrounding areas of the proposed project in terms of increased noise levels, land vibrations during tunnelling and blasting, release of air and water pollutants, etc. Mammals are the most vulnerable group affected by these negative impacts, which affect their movement, behaviour and breeding habit. To avoid and minimize the negative impacts from these activities project authorities are advised to prepare strict guidelines as follows.

   (i) Strict restrictions shall be imposed on the workers at project sites to ensure that they do not harvest any species/produce from the natural forests and cause any danger or harm to the animals and birds in the wild.

   (ii) The fuel wood to the labourers shall be provided from plantations meant for the purpose and/or the provision made for the supply of the free/subsidized kerosene/LPG from the depots being set up for this purpose to avoid forest degradation and destruction of animal habitats.

   (iii) The interference of human population would be kept to a minimum in the adjacent forested areas and it would be ensured that the contractors do not set up labour colonies in the vicinity of forests and wilderness areas.
4. It will be ensured that the noise levels in no case go above 100-120 dB in the project area, particularly where human and wildlife habitats are located.
5. The green belt shall be developed around periphery the project area. Apart from providing the aesthetic value, green canopy has the inherent capacity to absorb pollution, increase water retention by soil and decrease sediment transport. The general considerations involved while developing the green belt are :

   a) Generally local/native fast growing trees should be planted around various project appurtenances of the proposed project.

   b) Planting of trees should be undertaken in appropriate encircling rows around the project site.

   c) The trees should be protected by plantation of non-palatable shrub species to avoid grazing by animals.

Annexure: Environment Policy.

Nomenclature

ANNEXURE
(Chapter-28)

THDC INDIA LIMITED

ENVIRONMENT POLICY

Preamble

Vision

THDCIL strives to become the world's leader in sustainable power generation.

Mission

To achieve the target of a carbon-neutral power generator.

To achieve the highest possible standards in environmental management, minimise ecological footprints and optimise resource utilisation through continual improvement in processes and adopting innovative environment-friendly technologies, stakeholder engagements, and environmental compliances.

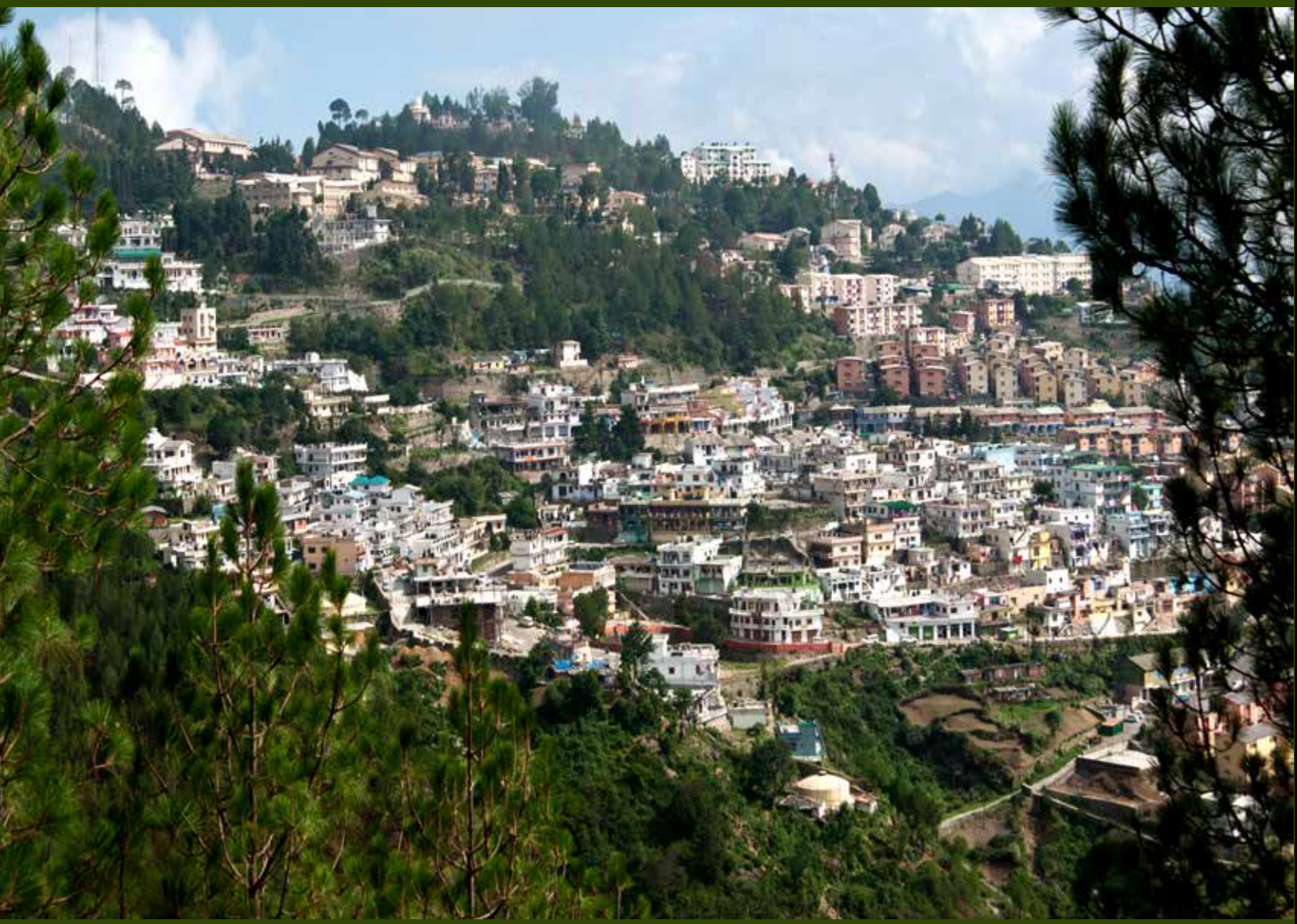
To achieve thc Sustainable Development goals.

Values

We recognise the importance of environmental stewardship and strive to minimise the impact of our operations on the environment. Therefore, We will:

1. **Comply with legal requirements:** We will establish and follow international best practices and comply with all applicable legal requirements, laws, and regulations related to the environment.
2. **Adopt a proactive approach:** We will adopt a proactive approach to environmental considerations in our decision-making process. We will place environmental aspects as one of the prime considerations in our business decisions.
3. **Innovate and adopt environment-friendly technologies:** We will conduct research and development activities to innovate and adopt environment-friendly technologies that ensure climate resilience in our area of operations.
4. **Conserve resources and reduce waste:** We will strive to conserve resources, reduce waste, and mitigate environmental risks associated with our activities. We will adopt best practices to reduce our environmental footprint.
5. **Continually improve our environmental management systems:** We will review and continually improve our environmental management systems and integrate them into our business processes.
6. **Communicate and empower stakeholders:** We will communicate our environmental policy to all our stakeholders and empower them to attain the goals enshrined in this policy.

11/2/2023
HoD (Social and Environment)



29 Housekeeping

29.1 Role and Responsibility

The role and responsibility to ensure maintain good housekeeping at workplaces shall be of the;

Immediate Responsibility

- All HODs are responsible to ensure maintaining good housekeeping in their respective Departments.
- All Contractors are responsible to maintain good housekeeping at their place of work and construction sites.

Ultimate Responsibility

- Projector Manager of Main Contractor.
- Occupier / Owner / Employer / Manager in case Mines of THDC Project

29.2 Legal Requirement

- Section 7-A, 11 to 14, 17, 20, 32, 33, 37, 38 and 41-F of the Factories Act, 1948.
- Rule-4-4(f) of the CEA Regulations, 2011.

29.3 Introduction

Good housekeeping is not just about cleanliness. Good housekeeping plays a pivotal role in accident prevention. Good housekeeping means "A place for everything and everything should be in its place".

By maintaining clean, organized, and clutter-free environments, potential hazards are minimized. Neatly arranged tools, equipment, and materials reduce the risk of tripping, falling, or other mishaps and employee can work without fear of injury. Proper waste disposal and regular cleaning prevent the accumulation of flammable or toxic substances, mitigating fire and health hazards. Well-organized workspaces enhance visibility, allowing early detection of dangers. Good housekeeping fosters a safe atmosphere and minimizing the likelihood of accidents, thus safeguarding both individuals and property and also helps in enhancing productivity.

29.4 THDCIL Management continuously strive to maintain good housekeeping at workplaces and expects from contractors and THDC employees to;

The contractor and THDC employees shall be responsible for maintaining Good housekeeping at workplaces and to ensure that their workplace is clean, tidy and free from debris generated by their activities. All debris/scrap should be stored in separate bins. The workplace must be cleaned on daily basis. All tools, equipment, materials shall be stored in an orderly manner. Access to emergency exits and equipment such as Fire Extinguishers, Safety Showers / Eye Washer, Fire Hydrant Points, etc. shall always be kept free from obstructions at all the time.

Tips to maintain good housekeeping

- Ensure adequate and safe means of access and egress shall be provided in all workplaces. Means of access and egress shall be kept free from obstruction at all times;
- Keeping floors clear of clutter and debris, which can cause slips and trips. Loose materials that are not required for use shall not be placed or left behind so dangerously as to obstruct workplaces or passageways;
- Store materials and equipment in a safe and organized manner, to prevent falls and collisions.
- Equipment, tools and small objects shall not be left lying unattended or unsecured from where a person can fall;
- Scrap, waste or rubbish shall not be allowed to accumulate in the site as these combustibles can create serious fire hazards and affect safe working;
- Workplaces and passageways that become slippery owing to spillage of oil or other causes shall be cleaned up or strewn with sand, wood dust or the like;
- Portable equipment shall be returned after use to their designated storage place.
- Properly dispose of waste materials, to prevent fires and other hazards.
- Keep work areas clean and well-lit, to improve visibility and reduce the risk of accidents.
- Create a culture of safety where employees are encouraged to report unsafe conditions and take steps to prevent accidents.
- Effective good housekeeping results in:
  - Minimize trip, slip and fall accidents in clutter-free and spill-free work areas;
  - Minimize fire hazards;
  - Minimize worker's exposure to hazardous substances (e.g. dusts, vapors);
  - Better management and control of tools and materials;
  - Regular cleanup and preventive maintenance;
  - Better hygienic conditions leading to improved health;
  - Effective use of space;
  - Improved morale;
  - Higher productivity (tools and materials will be easy to find);

Visual management shall be followed to assist in enhancing housekeeping by displaying critical information so that anyone can easily understand the system to be followed to maintain housekeeping.

29.5 5S method of housekeeping,

5S method of housekeeping, a popular approach to organization and cleaning that uses five Japanese words, all starting with the letter "S":

1. **Seiri (Sort):** Identify and eliminate unnecessary items from your space. Keep only what you need and use regularly.

2. **Seiton (Set in Order):** Organize and store remaining items efficiently and logically. Utilize designated places for everything to facilitate easy access and use.
3. **Seiso (Shine):** Clean and maintain your space thoroughly. This includes regular cleaning tasks as well as deep cleaning every now and then.
4. **Seiketsu (Standardize):** Establish systems and routines to maintain the previous steps. Develop consistent practices for sorting, storing, cleaning, and so on.
5. **Shitsuke (Sustain):** Continuously practice and advocate for the 5S system. Make it a habit and encourage others to follow it for long-term effectiveness.

The 5S method applies not only to housekeeping but also to various other areas like workplaces, workshops, and even personal organizing. By implementing these five steps, workplace environment can be more efficient, productive, and pleasant.

Normative References

- *Building and Other Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996 and Central Rules, 1998*
- *Central Electricity Authority (Safety Requirements for Construction, Operation and Maintenance of Electrical Plants and Electric Lines) Regulations, 2011*
- *Manufacturing, Storage and Import of hazardous chemical Rules, 1989*
- *Occupational Safety, Health and Working Conditions Code 2020 and (Central) Rules 2020*
- *The Chemical Accidents (Emergency Planning, Preparedness and Response) Rules, 1996*
- *Hazardous Wastes (Management, Handling and Transboundary Movement) Rules, 2008*
- *The Factories Act, 1948 and rules made therein.*


THDC INDIA LIMITED

30 Road Safety

30.1 Responsibility for reporting of accident

Immediate Responsibility

Immediate responsibility for road safety shall be of the;

- Contractor in case of contractor's owned or vehicles hired by the contractor.
- Site In-charge in case of THDC hired vehicles.

Ultimate Responsibility

- Ultimate responsibility shall be of the Project Manager of Contractor
- Occupier / Owner / Employed / Manager Mines Head of THDC Project

30.2 Introduction

The increased traffic on roads has challenged the safety of road users and has resulted in increase in fatalities and losses in road crashes. Non-routine maintenance of vehicles, Overloading, Over Speed, Non-use of Seat Belts, Drinking and Driving, Non-use of Helmets by two-wheeler riders, or insufficiently maintained road Infrastructure and vehicles or poor traffic regulation and enforcement, are some of the main reasons of road accidents.

Road Signs play an important role in the regulation of traffic and ensuring Road Safety. Road signs are displaced along, beside, or above a roadway, pathway, or other route to guide, warn and regulate the flow road traffic smoothly. Every road user should know the marking and signs displayed on the road and the meaning thereof. They give advance information about road conditions ahead. Road signs and markings also give orders, warning or guidance to drivers.

30.3 Traffic Regulations Traffic Signs

Whenever road closures and diversions are necessary, the concerned Site In-charge / Site-Engineer shall ensure to provide/display road signs as per the motor vehicle rules.

Enforcement failure to observe the rules of the road when driving within the project/construction sites can lead to disciplinary action.

30.4 The speed limit within the project is 40 km/hr and at construction sites speed limit is 20 km/hr. As speed causes many accidents and increases the severity of injuries these speed limits must be rigidly adhered to.

30.5 The rules of the road, which apply on the public highway should also to be followed within the project and at construction sites.

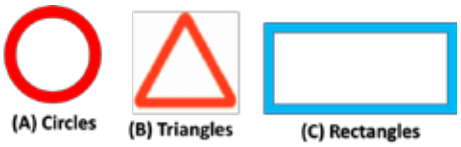
30.6 The classes of Road Signs, are broadly categorized into:

A - Danger warning signs

B - Regulatory signs

C - Informative signs

30.7 There are three basic types of traffic sign: signs that give orders, signs that warn and signs that give information. Each type has a different shape. Circles give orders, Triangles warn and Rectangles inform.



Signs shall be so placed that the drivers for whom they are intended can recognize them easily and in time.

30.8 No parking areas should be marked by yellow lines at the roadside. In addition parking is not allowed in front of a fire hydrant points.

30.9 Vehicles when parked shall have the engine stopped.

30.10 During the hours of darkness vehicles shall have their dipped headlights switched on when moving inside the complex and at construction sites.

30.11 Information Road Signs

30.12 Know the road safety signs used by NHAI (National Highways Authority of India)

30.13 Cautionary Traffic Sign

30.14 Drivers

- Before permitting drivers to drive the vehicle, the Contractor and THDC Site In-charge / Site-Engineer must be satisfied that the driver is physically fit and competent to drive the type of vehicle involved.
- Drivers must be licensed in accordance with national regulations and must adhere to traffic regulations at all times.
- Drivers must ensure that their vehicles remain roadworthy by carrying out daily checks of the state of the vehicle before starting work. Defects shall be reported immediately.
- Safety performance of all drivers should be monitored continuously.
- Drivers' proficiency of drivers shall be improved by regular training and assessment.

30.15 Vehicles

- All vehicles should be maintained in a road-worthy condition. The driver of the vehicle shall check that the vehicle is satisfactory before driving and shall report any defects to the appropriate supervisor.
- Ensure that vehicles have valid insurance cover.
- Ensure that PUC of vehicle is done.
- Heavy vehicles with restricted rear vision shall be fitted with reversing alarms.
- Loads shall be kept within the manufacturer's limits.
- Loads should be properly secured. Drivers should be trained in safe methods of fastening loads in place on their vehicles.
- All vehicles shall be provided with a display of emergency contact telephone numbers. Vehicles carrying hazardous materials shall display the appropriate warning signs.

- All vehicles shall carry a fire extinguisher and First-aid Box.
- Vehicles must not be left unattended with the engine running even for very short periods.
- The vehicles should be checked every day to ensure safe operation of vehicles and protect drivers, passengers, and other road users. Some key checkpoints include:

Brakes	Verify that the brakes are responsive and not making unusual noises.
Tires	Check tire pressure, tread depth, and overall condition regularly.
Lights	Ensure all headlights, taillights, turn signals, and brake lights are functioning correctly.
Steering	Check for smooth and precise steering response.
Fluids	Regularly inspect oil, coolant, brake fluid, and windshield washer fluid levels.
Seatbelts	Confirm all seatbelts are in proper working condition.
Windshield & Mirrors	Ensure a clear view of the road through the windshield and all mirrors.
Horn	Check that the horn is working effectively
Wipers	Verify the windshield wipers can provide adequate visibility during rain
Emergency Kit	Carry essential tools, a spare tire, and a first aid kit

30.16 Explosive Van Safety Rules

- Explosive van safety is of paramount importance to prevent accidents and protect both the drivers and the public. Here are some essential rules to follow:
- Drivers operating explosive vans must undergo specialized training and obtain the necessary certificate from the competent authority to handle explosives / hazardous materials safely.
- Conduct thorough daily inspections of the van before each use. Check for any leaks, mechanical issues, or signs of damage that could compromise safety.
- Follow strictly PESO (Petroleum Explosive & Safety Organization) guidelines for loading and securing explosive materials. Use appropriate containers and ensure they are well-protected during transport.
- Implement a strict no-smoking policy in and around the explosive van at all times. Even small sparks can cause catastrophic accidents.
- Ensure that van has proper ventilation systems to dissipate any fumes or gases that might accumulate during transport.
- Equip the van with suitable fire extinguishers, and ensure that (i) they are easily accessible to the driver in case of emergencies and (ii) driver is trained in its safe operation.
- Develop and communicate a comprehensive emergency response plan to all personnel involved in transporting explosives. This plan should cover procedures for accidents, spills, or any unforeseen incidents.
- Plan routes carefully to avoid congested areas, schools, residential neighbourhoods, and other high-risk locations whenever possible.
- Adhere to speed limits and drive cautiously to prevent accidents and reduce the impact of potential collisions.
- Never leave the van unattended, especially if it contains explosive materials. Park in designated, secure areas.
- Maintain constant communication with the base or control centre, providing updates on location and any issues encountered during transport.

- Immediately report any incidents, spills, or accidents, no matter how minor they may be. Prompt reporting helps prevent potential hazards from escalating.
- Keep the van in top-notch condition through regular maintenance checks and scheduled servicing.

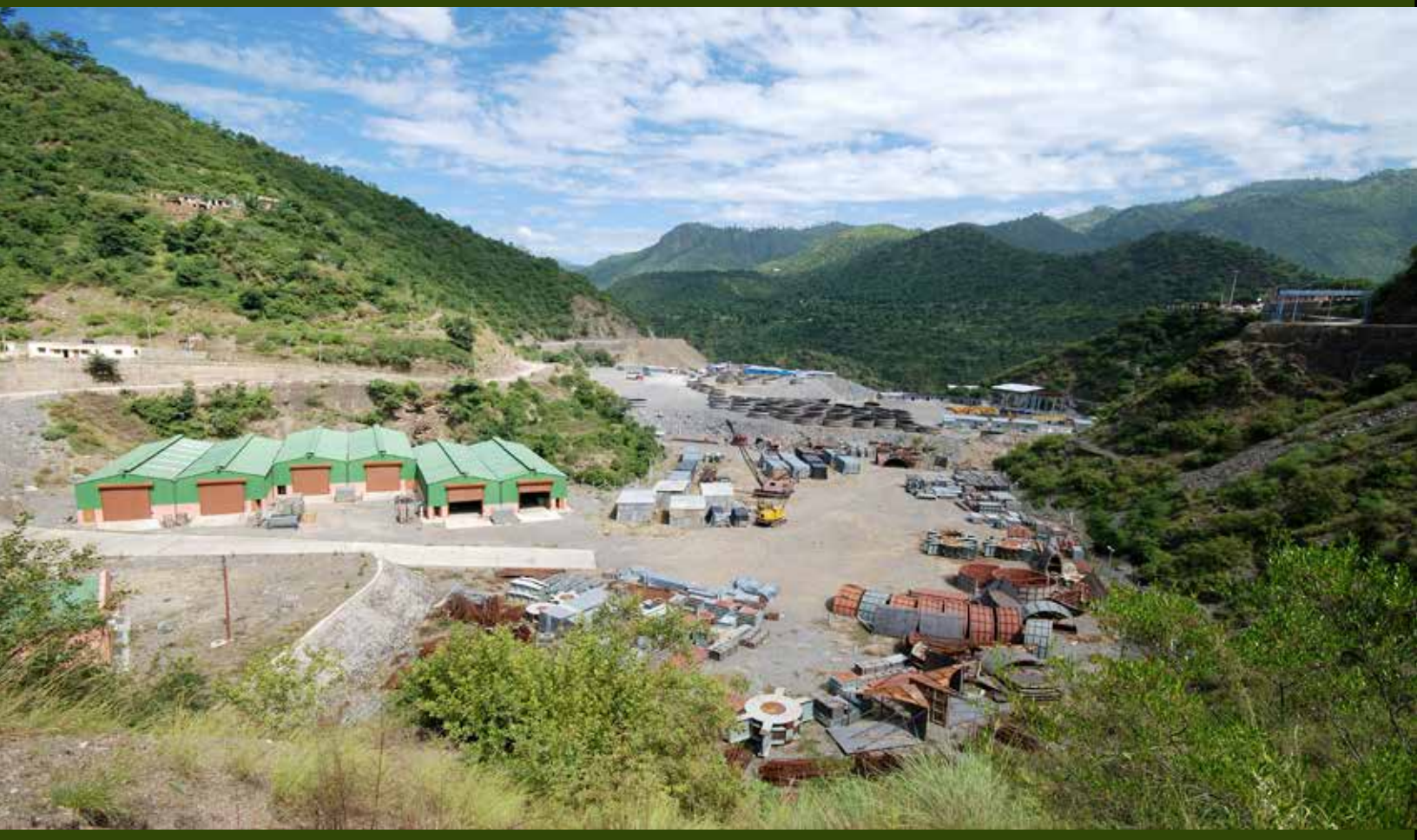
By following above safety rules, accidents handling and transport of explosive materials can be avoided.

30.17 Action to be taken after vehicle accident

- Vehicle involve in accidents shall be immediately reported to the Vehicle Owner, Contractor and Site In-charge / Site Engineer.
- Vehicle accidents shall be promptly investigated by the owner of Explosive Van and submit recommendations to project head.
- The owner of explosive van shall take suitable action to report the accident to competent authority on the prescribed format and within time as per rules and submit a copy of accident report to HOP (Head of the Project).
- The owner of explosive van shall take suitable action to preserve the evidences at the accident site till the external / statutory investigation is complete.
- In case vehicle, accident of explosive van occurred at the construction site, the THDC Site-Engineer or Site In-charge shall take suitable safety measures to cordon off the accident site to prevent entry of unauthorized persons at accident site and report the incident to HOP (Head of the Project).

Normative References

- *BOCW Act 1996 and BOCW Central Rules 1998*
- *Coal Mines Regulations, 1957*
- *Motor Vehicles Act, 1988 (2023)*
- *Motor Vehicles Rules, 1989*
- *NHAI Road safety Rules*
- *Occupational Safety, Health and Working Conditions Code 2020*
- *Occupational Safety, Health and Working Conditions (Central) Rules 2020*



31 Penalty Provisions for Non-Compliance of Legal & THDCIL Safety Policy And Procedures

Penalty provisions for non-compliance / contravention of any of the provisions of Occupational Health & Safety related applicable legal requirements and safety measures recommended in SHE Manual of THDCIL by contractors.

31.1 Authority to impose penalty on contractors

Engineer I/C or Safety Officer or Representative of Safety Department authorized in writing by HOD – Safety Department of THDCIL shall be authorized to impose penalty on contractors as per the provisions of this chapter.

31.2 Penalty Provisions

31.2.1 If the contractor fails in providing safe working environment as per BOCW Central Rulers, 1998 and SHE Manual of THDCIL or continues to work even after being instructed to stop the work by engineer I/C or Safety Officer / Authorized Representative of Safety Department, the contractor shall be penalized at the rate of Rs.25000/- per day or part thereof till the instructions are complied with and so certified by Engineer I/C or Authorized Representative of Safety Department.

However, in case of accident, the penalty provision of clause-2.2 shall be also apply in addition to the penalties already imposed as per clause-2.1.

31.2.2 If the contractor does not take all safety precautions and / or fails to comply with applicable legal and other provisions including safety provisions of SHE Manual of THDCIL for the safety of the plant, equipment and safety of personnel and the contractor does not prevent hazardous conditions which cause injury to his/her own employees or employees of other contractors or THDCIL employees or another person who are at site or adjacent thereto, the contractor shall be responsible for payment of penalty to THDCIL as per the following schedule:-

a)	Fatal injury or accident causing death	Penalty @10% of contract value or Rs.5,00,000/- per person which ever is less.

These are applicable for death to any person whosoever.

b)	Major injuries or accident causing 25% or more permanent disablement to work- men or employees	Penalty @ 2½ % of contract value or Rs.1,00,000/- per person whichever is less.

Permanent disablement shall have the same meaning as indicated in The Workmen's Compensation Act' 1923. The penalty mentioned above shall be in addition to the compensation payable to the workmen / employees under the relevant provisions of the Workmen's Compensation Act 1923 and rules framed there under or any other applicable laws as applicable from time to time.

31.2.3 If any contractor worker found working without using the safety equipment as shown below such as safety helmet, safety shoes, safety belts, etc. or without anchoring the safety belts while working at height the Engineer l/C or Safety Officer or Authorized representative of Safety Department of THDCIL shall have the right to penalize the contractor for Rs.. 200/- per person per day and such

worker shall be sent out of the workplace immediately and shall not be allowed to work on that day. Engineer I/C or Safety Officer or Authorized Representative of Safety Department of THDCIL will also issue a notice in this regard to the contractor.

Sl. No.	Details of Non-compliance	Image	Reference of Legal Non-compliance / Violation of THDC Safety Rules	Penalty Amount (Rs.)
1.2	**Not Wearing PPE (Personal Protective Equipment) while working at construction site / workplace such as;**			
1.2.1	PPE Matrix, SHE Manual, Chapter-10: PPE		'Industrial Safety Helmet' while working at Construction Site / Height (More than 1.8 M Height)	Rs.200/= per person per day for the first time and Rs. 100/= per person per day for repeated violation.
1.2.2	-do-		'Safety Shoes' while working at construction site	-do-
1.2.3	-do-		'Rubber Gum Boots' while working in chemical, muddy and wet areas at construction site	-do-
1.2.4	-do-		'Ear Muff' or 'Ear Plug' while working in High Noise Area	-do-
1.2.5	-do-		Welders' 'Safety Goggle or Welder's Shield' not used while welding.	-do-
1.2.6	-do-		'Full Body Harness Safety Belt' not used while working at height	-do-
1.2.7	-do-		'Hand Gloves' not used while handling Cement, Materials and doing housekeeping	-do-
1.2.8	-do-		'Chrome Leather Gloves' not used while doing hot work	-do-
1.2.9	-do-		'Electrical Gloves' not used while working on electrical lines	-do-
1.2.10	-do-		'PVC / Rubber Gloves' not used while Handling Chemicals	-do-
1.2.11	-do-		'Arc Flash Suit' not used while working on LT / HT Lines	-do-

1.2.12	-do-		'Chemical Cartridge Mask' not used while Handling Chemicals	-do-
1.2.13	-do-		'Disposable Mask' not used while working in Coal / Cement Handling Area and Housekeeping work.	-do-
1.2.14	-do-		'PVC Apron / Coat' not used while Handling Chemicals	-do-
1.2.15	-do-		'Safety Goggle or Face Shield' not used while working on Lathe / Milling Machines, Grinding / Chipping and Handling Chemicals	-do-
1.2.16	-do-		'SCBA (Self Contained Breathing Apparatus)' Set not used while working in Confined Space or Handling Chemical Spills.	-do-
1.2.17	Clause-3, SHE Manual Chapter-14: Safety Work Permit	Non-compliance of SWP (Safety Work Permit) Not Used for; a) Hot work. b) Confined Space / Vessel Entry Work. c) Excavation Work. d) Work on Electric Lines / Equipment. e) Work at Height.		Rs.1000/= (Rupees One Thousand) per day till the compliance of safety provision is done.
1.2.18	Clause-3, SHE Manual Chapter-20; Welding /Cutting	a) Flashback Arrestor(s) not found in Gas Welding Set; and (b) / (c) / (d) b) Pressure Gauge was found Damaged / Not Working; and (a) / (c) / (d) c) Deep Cracks were observed on the hose pipe; and (a) / (b) / (d) d) Gas Cylinders were found laid on ground.		-do-
1.2.19	SHE Manual, Chapter-27, Safety In Use of Earth Moving Equipment at Construction Sites	a) Following unsafe condition(s) were found in the 'Earth Moving Equipment' (Excavator/ Backhoe Loader/ Trencher/ Bulldozer/ Motor Grader/ Loader/ Power Paver/ Compactor/ Dump Truck/ Tipper/ Concrete Mixer Truck) being used at construction sites; b) Driving Licence was not found / not valid c) Registration Certificate was not available d) Driver was under the influence of Alcohol e) Horn / Reverse Horn was not working f) Head Light / Back Light was not working g) Tyre condition was not good h) Wiper was not working i) First-aid Box / Fire Extinguisher was not available		Rs.1000/= (Rupees One Thousand) per vehicle per day and that unsafe vehicle should be removed from the construction site till the compliance is done.

1.2.20	➢ Section-29, Factories Act, 1948 ➢ Rules 56 and 74(B) of BOCW Rules,1998	**Unsafe Conditions observed in Lifting Machines / Lifting Tackles / Hoists / Winch / Derick** Following unsafe conditions were observed; a) Examination / Testing Certificate of competent person was not displayed b) Identification Number and SWL not marked c) Damaged Slings / D-Shackles were found in use d) Competency Certificate of Operator was not found	Rs.5,000/= (Rupees Five Thousand) per day till the compliance of legal provision is done.
1.2.21	➢ Section-31, Factories Act, 1948 ➢ Rules 207 of BOCW Rules,1998	**Unsafe Condition observed in use of Pressure Vessels** a) Examination / Testing Certificate of competent person was not displayed b) Pressure Gauge was damaged / Not working c) Safety Valve not provided d) Safe Working Pressure was not marked	Rs.5,000/= (Rupees Five Thousand) per day till the compliance of legal provision is done.
1.2.22	Section-31, Factories Act, 1948 and Rue-110, State Factories	**Notice of Accident / Dangerous Occurrence** Not Reporting "Accident / Dangerous Occurrence" i) Immediately after the occurrence in writing to THDCIL Site In-charge and HOD – Safety. ii) Notice of accident per legal requirement to authorities on prescribed Form within prescribed time period; **A. As per Factories Act (Form-18 or Form-18A)** **A1. Fatal Accident:** iii) Immediate; by telephone to Inspector of Factories of the region and Chief Inspector of Factories. **iv) Notice shall also be sent to;** v) District Magistrate or Sub-Divisional Officer vi) Officer In-charge of nearest Police Station vii) Relatives of the injured or diseased person viii) **Within 12 Hours** of the accident **on Form-18** or **Form-18-A** as the case may be; **A2. Loss-time / Reportable Accident** When a person, due to bodily injury caused in factory prevent him from working for a period of 48 hours or more immediately following shall send notice on Form-18 within 24 hours after the expiry of 48 hours from the time of accident or dangerous occurrence.	As per Clause-31.2.1 and /or Clause 31.2.2 .

1.2.23	Section-39 of BOCW Act, 1996 and Rules-210 of BOCW Rules, 1998	**Notice of accident at Construction Site (Form-XIV)** **Not Reported accident of building worker at construction site as per rules.** (A) Immediately after knowledge of the occurrence of the fatal accident or other accidents in writing to THDCIL Site In-charge and HOD – Safety; and (B) Written Report of accidents shall be submitted on Form-XIV as per Rules-210 of BOCW Rules, 1998 under proper acknowledgement. a) Causes loss of life; or b) Building Worker is prevented from working for a period of forty-eight hours or more immediately following the accident. c) Disables such building worker from work for more than ten days following the accident, shall also be sent to— (i) Regional Labour Commissioner (Central); (ii) Board with which the building worker involved in accident was registered as a beneficiary; (iii) Director General; and (iv) The next of kin or other relative of building worker involved in accident.	
1.2.24	Section-161 of Electricity Act, 2003 and Rule-44A	**Notice of accidents and injuries (Annexure-XIII / Form-XIII)** **Not Reported electrical accident as per rules.** An accident occurred in generation, transmission, distribution, supply or use of electricity or any part of the electric lines or electrical plant of any person and accident results or is likely to have resulted in loss of human or animal life, the intimation shall be sent to Electrical Inspector and other Govt. authorities within 24 hours of the knowledge of the occurrence of the fatal accident and a written report in Annexure XIII within 48 hours of the knowledge of occurrence of fatal and all other accidents.	Rs.5,000/= (Rupees Five Thousand) per day till the compliance of legal provision is done.

31.3 If two or more fatal accidents occur at same THDCIL site under the control of contractor during the period of contract and he/she has

(1) Not compiled with keeping adequate PPEs in stock; or

(2) Defaulted in providing PPEs to his workmen;

(3) Not followed statutory requirement/THDCIL safety rules;

(4) Been issued warning notices by THDCIL head of the project on non-observance of safety norms;

(5) Not provided safety training to all his/her workmen, the contractor can be debarred from getting tender documents in THDCIL for two years from the date of last accident.

The safety performance will also be one of the overriding criteria for evaluation of overall performance of the contractor by THDCIL. The contractor shall submit the accident data including fatal / non-fatal accidents for the last 3 years where he has undertaken the construction activities Projects-wise along with tender documents. This will also be considered for evolution of tender documents, if the, information given by the contractor found incorrect, his/her contract will be liable to be terminated.

31.4 Award

If the Contractor's performance on safety front is found satisfactory i.e without any Fatal/reportable accident in the year of consideration; he may be considered for suitable award " ACCIDENT FREE SAFETY MERITORIOUS AWARD" as per scheme of the employer.

Annexure: Safety Rule Violation Penalty Format

Normative References

- *SHE Manual, THDCIL*
- *Factories Act, 1948 and Rules made thereunder*
- *BOCW Act 1996 and BOCW Central Rules 1998*
- *Electricity Act, 2003 and Rules made thereunder*
- *Occupational Safety, Health and Working Conditions Code 2020 (Section-10)*
- *Occupational Safety, Health and Working Conditions (Central) Rules 2020 (Rule-8)*

ANNEXURE
(Chapter-31)

THDC INDIA LIMITED

SAFETY RULE VIOLATION PENALTY FORM

Date: / /

Construction Site: _____ Name Site In-charge Contractor: Mr._____

Main Contractor: _____ Sub Contractor: _____

Employee Name: _____ Designation: _____

Type of violation (✓ Tick Mark): Unsafe Act Unsafe Condition

PPE Not used or damaged / Working without SWP / Unsafe Earth Moving Equipment / Unsafe Gas Welding Set / Gas Cylinders laid on the ground / Unsafe Lifting Machine / Unsafe Pressure Vessel /Accident Not Reported / Other

Violation in Brief: _____

_____

Consequence of violation: _____

_____

I, _____ Design _____ an employee of M/s _____

_____ Contractor have read and understand that above violation committed by me on _____ date against THDCIL safety policy / safety rules.

Worker Name: _____ IC No. _____ Signature: _____ Date: _____

Supervisor Name: _____ IC No. _____ Signature: _____ Date: _____

Remarks of THDCIL Safety Officer / Site Engineer / Site In-charge;

_____

_____

Penalty of Rs. _____ for first / second violation by M/s _____ Contractor is recommended.

Name, Designation & Signature of THDC Officer:
Name: _____ Designation: _____ Signature: _____ Date: _____

Recommended penalty amount is approved, the same may be charged from the contractor against his billing.

Signature & Designation of HOD

Through: Project Head

To,

1. Project Manager, M/S _____: For necessary CAPA at the earliest.
2. HOD Finance: For necessary action.

32 Safety Organization, Role and Responsibility

32.1 Introduction

Safety is every body's responsibility. In THDCIL, safety is of paramount importance. Accident prevention programme can be effective with the support of top management in safety promotional activities, involvement of middle management and co-operation of supervisors and workers. THDCIL firmly believe that good HSE performance is the fundamental for long-term success and it is therefore an integral part of our business strategy. Safety, in THDCIL starts from blueprint level. The THDCIL is committed to perform all its operations so as to protect human Health, Safety and Environment.

To achieve above safety objective, THDCIL has safety organization at corporate level which is headed by a senior officer of General Manager Level. Every project has a Safety Department which is headed by a senior officer. As per the requirement of State Factories (Safety Officers) Rule adequate numbers of safety officer(s) are appointed in every project.

32.2 Role and Responsibilities

Occupier / Employer / Owner

- In case of THDC India limited, either any one of the Director or Project Head notified by Ministry of Power, Govt. of India shall be the Occupier / Employer / Owner.
- In relation to a building or other construction work carried on by or through a contractor, or by the employment of building workers supplied by a contractor, the contractor shall be the Employer / Owner.

32.3 Legal provisions

Section-7A of the Factories Act, 1948.

Regulation-4 of CEA (Safety Requirements for Construction. Operation and Maintenance of Elect. Plant & Elect. Lines) Regulation, 2011

Section-44 of the BOCW Act, 1996

32.4 Responsibilities of Occupier / Employer/Owner

The responsibilities of employer/owner shall include the following;

(a) Compliance of all applicable legal requirements and other requirements related to Occupational Health & Safety (OH&S).

(b) Setup a sound and scientific safety management system to ensure compliance of all applicable Occupational Health & Safety related legal and other requirements identified and listed in Annexure-1.

(c) To incorporate safety provisions in the contract document which are required to be complied by the contractor's employees during execution of the contract to facilitate safe working during execution of the work.

(d) To establish system for periodic monitoring compliance of applicable legal requirements and periodic review of the safety management system.

Role of Safety Department

The role and responsibilities of safety department shall be to advice and assist project management in the fulfilment of its obligations, statutory or otherwise concerning prevention of personal injuries and maintaining a safe work environment.

Responsibility of Head of Safety Department

The responsibilities of Head of Safety Department shall include the following, namely-

1. To communicate OH&S Policy to all workers including contractual workers, apprentices, transport workers, suppliers, stakeholders and interested parties;
2. Display of OH&S Policy at conspicuous places in the project;
3. Ensure compliance of OH&S Policy statements;
4. Update list of applicable legal and other requirements by legal department at least once in six month or as and when required to add changes in the acts and rules or delete any act/ rule which is not applicable to THDCIL;
5. Collect and assess the annual requirement of PPE (Personal Protective Equipment) from Department Heads;
6. Select and procure PPE meeting national and/or international standards;
7. Ensure examination and testing of pressure vessels and lifting machines & lifting tackles by competent person as per rules.
8. Ensure reporting of all accidents (including near-miss incidents), analysis, investigation and implementation of recommendations.
9. Report all lost time injuries to Project Head and Head of P&A Department immediately;
10. Develop procedure to capture near-miss incidents and maintain records;
11. Ensure periodical safety inspections and coordinate internal/external safety audits;
12. Follow up to ensure compliance of safety inspection / safety audit observations;
13. Ensure root cause analysis of every accident and/or near miss incident is done before taking CAPA (Corrective Action and Preventive Action);
14. Ensure compliance of SWP (Safety Work Permit) System.
15. Ensure supervision of activities carried out by the contractors by competent person;
16. Send monthly safety progress report to Project Head and Quarterly safety progress report to Corporate Safety. In case of no accident 'NIL' Report to be send;
17. Ensure compliance of Rule-11 of CEA Regulations, 2011 by organizing safety training programs for the employees at all levels including contractual workers with the assistance of internal and/or external faculty members; and
18. To supervise the activities of safety Officer and guide to enhance workplace safety standards.

Responsibility of Safety Officer

The responsibilities of safety officer shall include the following, namely—

1. to advise the departmental heads, supervisors and other such officers in planning and organising measures necessary for the effective control of personal injuries;

2. to check and evaluate the effectiveness of the action taken or proposed to be taken to prevent personal injuries;
3. to advise the personnel of store purchase department in ensuring high quality and availability of personal protective equipments etc.;
4. to advise on matters relating to carrying out project safety inspections;
5. to carry out project safety inspections in order to observe the physical conditions of work and the work practice procedures followed by the workers and to render advice on measures to be adopted for reducing the unsafe physical conditions and preventing unsafe actions by workers;
6. to render advice on matters relating to reporting and investigation of industrial accidents and diseases;
7. to investigate fatal and serious accidents and to suggest remedial measures to the management;
8. to investigate the cases of industrial disease contracted and dangerous occurrences reportable under Rules 110 and 112 of the State Factories Rules;
9. to advise on the maintenance of such records as are necessary relating to accidents; dangerous occurrences and industrial diseases;
10. to constitute safety committee and to act as an adviser and catalyst to such committee;
11. to organise in association with the concerned department, campaign, competitions, contests and other activities which will develop and maintain the interest of the workers in establishing and maintaining safety conditions of work and procedure;
12. to design and conduct either independently or in collaboration with the external safety professional's industrial safety training, suitable for the prevention of personal injuries and to hold safety seminars at least once in a year;
13. to prepare accidents/incident and industrial diseases report every month including corrective and preventive action taken and submit the monthly report to project head and quarterly report within three days after every quarter ending to Corporate Safety including recommendations to address them.

Responsibility of Contractor

(Rule-7 of CEA Regulation, 2011 and BOCW Rules, 1998)

The contractor's responsibilities related to OH&S shall include the following;

1. Shall observe the safety requirements as laid down in the contract and in case of sub-contract, it shall be the responsibility of main contractor that all safety requirements are followed by the employees and staff of the sub-contractor.
2. The contractor employing two hundred employees, including contract workers, shall have a safety co-ordinator in order to ensure the implementation of safety requirements of the contract. A contractor with lesser number of employees, including contract workers, shall nominate one of his employees to act as safety co-ordinator who shall liaise with the safety officer on matters relating to safety and his name shall be displayed on the notice board at a prominent place at work site.
3. The main contractor shall appoint qualified safety officer(s) as per the BOCW Rules if the strength of workers exceeds five hundred before the start of construction activities. The contractor shall prepare safety set-up chart and display at conspicuous locations at construction site. The contractor's safety officer shall functionally report to the Head of project Safety Department
4. The contractor shall be responsible for non-compliance of the safety measures, implications, injuries, fatalities, and compensation arising out of such situations or incidents.

5. In case of any accident, the contractor shall immediately submit a statement of the same to the owner/employer and the safety officer, containing the details of the accident, any injury or causalities, extent of property damage and remedial action taken to prevent recurrence and in addition, the contractor shall submit a monthly statement of the accidents to the owner at the end of each month.

6. In case the contractor fails to make payment of compensation in respect of a building worker employed by him, where he is liable to make such payment when due, or makes short payment thereof, then, in the case of death or disablement of the building worker, then as per the provision under Section 45(2) of BOCW Act, 1996 the employer shall make payment of that compensation in full or the unpaid balance due in accordance with the provisions of the Workman's Compensation Act, 1923 and recover the amount so paid from the contractor either by deduction from any amount payable to the contractor under any contract or as a debt payable to the contractor.

7. The contractor shall submit in writing before the start of his/her work;

   (i) A written statement of Safety & Health Policy exhibiting his/her (Employer/Occupier/ Owner) commitment towards safety and health of workers and all those who are working for and/or on behalf of him to the head of 'Project Safety Department'.

   (ii) That he/she will ensure compliance of all legal and other requirements which are applicable to THDCIL including BOCW Act, 1996 and Rules, 1998 and CEA Regulations, 2010 and 2011 etc. In case of any violation noticed during execution by any Authority / THDCIL Officer, I (the contractor) shall be fully responsible for the consequences including punishment, if any and/or financial liability whatsoever it may be.

Responsibility of worker (Employee)

The responsibilities of worker shall include; mainly-

(a) Compliance of THDCIL safety instructions and OH&S conditions as mentioned in the contract.

(b) No employee shall do anything which is not in accordance with the generally accepted principles of standard safe operating practices.

(c) No worker shall wilfully do any act which may cause injury to him or to others.

32.5 Reporting and investigation of accidents and dangerous occurrence

Reporting of Accidents and Dangerous Occurrence as per Section-88 and 88A / Rule-110 and Rule-111 of the Factories Act, 1948 and State Factories Rules

The following provisions shall apply for the areas for which THDCIL has obtained license under the above stated act and rules.

1. An accident which results in death of any person or which results in such bodily injury to any person as is likely to cause his death, or any dangerous occurrence takes place in the project, the Factory Manager shall forthwith send a notice thereof by telephone or special messenger to the Inspector of Factories of the region concerned and the Chief Inspector of Factories.

2. Any accident or any dangerous occurrence which results in the death of any person or which results in such bodily injury to any person as is likely to cause his death, takes place in the project a notice shall also be sent to:

   (a) The District Magistrate or Sub-Divisional Officer;

   (b) the Officer-in-charge of the nearest police station; and

   (c) the relatives of the injured or deceased person.

Any notice as mentioned under Point 1 and 2 shall be confirmed by the Factory Manager of the project to the above mentioned authorities within 12 hours of the accident or the dangerous occurrence by sending them a written report in Form 18 in the case of an accident or dangerous occurrence causing death or bodily injury to any person. The copy of Form 18 of Rule-210 of the State Factories Rules is placed at Annexure 5(A).

3. When an accident or dangerous occurrence causes such bodily injury to any person as prevents the persons injured from working for a period of 48 hours or more immediately following the accident or the dangerous occurrence, as the case may be, the Factory Manager of the project shall send a report thereof to the Inspector of Factories of the region concerned as well as to the Chief Inspector of Factories in Form No. 18 within 24 hours after the expiry of 48 hours from the time of the accident or the dangerous occurrence.

4. If in the case of an accident or dangerous occurrence, death occurs of any person injured by such accident or dangerous occurrence after the notice and reports referred to in Point 3 have been sent, the Factory Manager of the project shall forthwith send a notice thereof by telephone or special messenger to the authorities and persons as mentioned in Point 2 and also have this information confirmed in writing within 12 hours of the death.

5. Provided further that, if the period of disability from working for 48 hours or more referred to in Point-3 does not occur immediately following the accident, or the dangerous occurrence but later, or occurs in more than one spell, the reports referred to shall be sent to the Inspector of Factories of the region concerned as well as to the Chief Inspector of Factories in Form No. 18 within 24 hours immediately following the hour when the actual total period of disability from working results from the accident or the dangerous occurrence becomes 48 hours.

Rule-111

No person shall be allowed to disturb the site at which a fatal accident has occurred or any objects involved in the accident before the arrival of the Inspector, or a police officer, not below the rank of a Sub-Inspector, or without the consent of such officer, provided that such action may be taken as may be necessary to prevent a further accident or to secure persons from danger.

Section-89/Rule-112:

Notice of Poisoning from Notified Diseases as specified under Third Schedule of the Factories Act, 1948.

Notice of accident under BOCW Act, 1996 (Section-39) & BOCW Central Rule, 1998 / State Rules, 2005 (Rule-210)

The following provisions of above acts and rules shall apply for areas/sites registered under the above Acts and Rules.

Notice of an accident on the construction site which either (a) causes loss of life; or (b) disables a building worker from working for a period of forty-eight hours or more immediately following the accident, shall be sent by telephone, fax or similar other means including special messenger within four hours in case of fatal accidents and seventy-two hours, in case of other accidents involving building workers to on the prescribed format. The Copy of the Accident Report Form-XIV of Rule-210 of the BOCW Uttaranchal Rules, 2005 is placed at Annexure-5(B);

(i) The Regional Labour Commissioner (Central), having jurisdiction in the area in which the establishment in which such accident or dangerous occurrence took place is located.

(ii) The Board with which the building worker involved in accident was registered as a beneficiary;

(iii) The Director General; and

(iv) The next of kin or other relative of building worker involved in accident.

Rule-211 OF BOCW Central Rules, 1998 / State Rules, 2005

Notice of any accident at a construction site of a building or other construction work which causes;

a) loss of life; or

b) disables such building worker from work for more than ten days following the accident, shall also be sent to—

(i) the officer In-charge of the nearest police station;

(ii) the District Magistrate or if the District Magistrate by order so desires to the Sub-Divisional Magistrate;

(iii) In the case of an accident falling under clause (b) the injured building worker shall be given first-aid and immediately thereafter be transferred to a hospital for medical treatment.

c) Where any accident-causing disablement subsequently results in death of a building worker, notice in writing of such death shall be communicated to the authorities as mentioned Rule-210 within seventy-two hours of such death.

d) The following classes of dangerous occurrences shall be reported to the Inspector having jurisdiction, whether or not any death or disablement is caused to a building worker, namely;

- collapse or failure of lifting appliances or hoist or conveyors or other similar equipment for handling building or construction material or breakage or failure of rope, chain or loose gears; overturning of cranes used in building or other construction work; falling of objects from height;
- collapse or subsidence of soil, any wall, floor, gallery, roof or any other part of any structure, platform, staging, scaffolding or any means of access including formwork;
- Contract work, excavation, collapse of transmission;
- explosion of receiver or vessel used for storage, at a pressure greater than atmospheric pressure, of any gas or gases or any liquid or solid used as building material;
- Fire and explosion causing damage to any place on construction site where building material;
- Spillage or leakage of hazardous substances and damage to their container;
- Collapse, capsizing, toppling or collision of transport equipment;
- Leakage or release of harmful toxic gases at the construction site.

Note: *In case of failure of a lifting appliance, loose gear, hoist or building and other construction work machinery and transport equipment at a construction site of a building or other construction work, such appliances, gear, hoist, machinery or equipment and the site of such occurrence shall, as far as practicable, be kept undisturbed until inspected by the inspector having jurisdiction.*

Reporting of Accident under CEA Regulations, 2011 [Rule-4-4(i)]

The following provisions of above regulations shall apply for areas covered under purview of CEA Regulations, 2011.

The cases of outage of an electrical plant or an electric line of the following nominal rating due to any accident related to any equipment e.g. fire, explosion of pressure piping or pressure vessel, implosion, emission of hazardous chemicals, collapse of transmission tower, flooding of power house area, shall be reported to the authority (Electrical Inspector) [Refer; Rule-2(w) of the Indian Electricity Rules-1956] within 24 hours, whether or not any death or disablement is caused to any person on the prescribed format. The copy of the Accident Report Form, i.e. Schedule-XIII of Rule-44(A) of the Indian Electricity Rules, 1956 is placed at Annexure-5(C);

Hydro-electric generating units : 50 MW and above.

(a) Electric Lines / Sub-stations : 132 kV and above.

32.6 Responsibility for reporting of accident

32.5.1 Immediate Responsibility

The immediate responsibility for reporting of accident on the prescribed format and within the prescribed time period as per rules to the concerned authorities shall be of the Contractor and HOD (HR&A) of THDCIL. Safety Officer may also assist, if required.

32.5.2 Ultimate Responsibility

The ultimate responsibility to ensue reporting of accident as per rules to the concerned authorities shall be of the;

(a) Project Manager of the contractor in case of accident of contract worker.

(b) Head of Plant / Project to ensure reporting of accident on the prescribed format within time period as per the statutory provision.

33 Fundamentals of Safety

33.1 Safety

Safety is the proper planning of work, proper usage of safety tools, exercise of good judgement and intelligent supervision. Experience proves that majority of the accidents are preventable.

33.2 Fundamentals of Safety

(a) Prevention of accidents requires the whole hearted co-operation of all employees of the organisation. A capable mentally alert employee will avoid accidents.

(b) A careless man is a liability to the Organisation. He is dangerous to himself, his fellow workers, the public and the Organisation.

(c) Accidents do not just happen. Accidents are the result of unsafe acts or unsafe conditions or a combination of both.

33.3 Unsafe Acts

An act which may cause accidents, include the following:

1. Working without authority.
2. Opening and Closing of switches without authority or warning, operating hoists and trucks without warning, failure to place warning signs or signals where needed.
3. Making safety devices inoperative.
4. Using unsafe equipment, wrong tools for the job, or using hands instead of hand tools despite availability of proper equipment/tool.
5. Working on live electrical equipment that could conveniently be de-energised.
6. Taking unsafe position or posture.
7. Distracting, teasing, practical joking, horseplay, quarrelling or annoying.
8. Failure to use safe clothing or Personal Protective Equipment (PPE) such as failure to use rubber gloves, helmet and safety belt with full body-harness.
9. Distracting, teasing, abusing and startling etc.

33.4 Unsafe conditions

A condition which may result in accidents, include the following:

1. Unguarded floor openings and excavations, exposed live circuits.
2. Improper illumination such as insufficient light or unsuitable location producing glare or objectionable shadows.
3. Unsafe design and construction, such as poor scaffolding and structure, like platforms should have large safety factors, and their construction and design in general should incorporate safety features.

4. Inadequate or improper ventilation.

7 Unsafe dress or apparel.

6. Defective conditions (Rough, Sharp, Slippery, Decayed, Corroded or hot surface) etc.

33.5 Accident causation theory

Accidents are the unplanned occurrences which result in injuries, fatalities, loss of production or damage to property and assets. Preventing accidents is extremely difficult in the absence of an understanding of the causes of accidents. Efforts are being made to develop a theory of accident causation which will help to identify, isolate and ultimately remove the factors that contribute to or cause accidents but so far none has been universally accepted.

7.4.1 Domino theory

According to W.H. Heinrich (1931), who developed the domino theory, 88% of all accidents are caused by unsafe acts of people, 10% by unsafe actions and 2% by "acts of God". He proposed a "five-factor accident sequence" in which each factor would actuate the next step in the manner of toppling dominoes lined up in a row. The sequence of accident factors is as follows:

1. Ancestry and social environment
2. Worker fault
3. Unsafe act together with mechanical and physical hazard
4. Accident
5. Damage to property or injury.

The removal of a single domino in the row would interrupt the sequence of toppling, Heinrich suggested that removal of one of the factors would prevent the accident and resultant injury; with the key domino to be removed from the sequence being number 3.

33.6 Multiple causation theory

Multiple causation theory is an outgrowth of the domino theory, but it postulates that for a single accident there may be many contributory factors, causes and sub-causes, and that certain combinations of these give rise to accidents. According to this theory, the contributory factors can be grouped into the following two categories:

33.6.1 Behavioural

This category includes factors pertaining to the worker, such as improper attitude, lack of knowledge, lack of skills and inadequate physical and mental condition etc.

33.6.2 Environmental

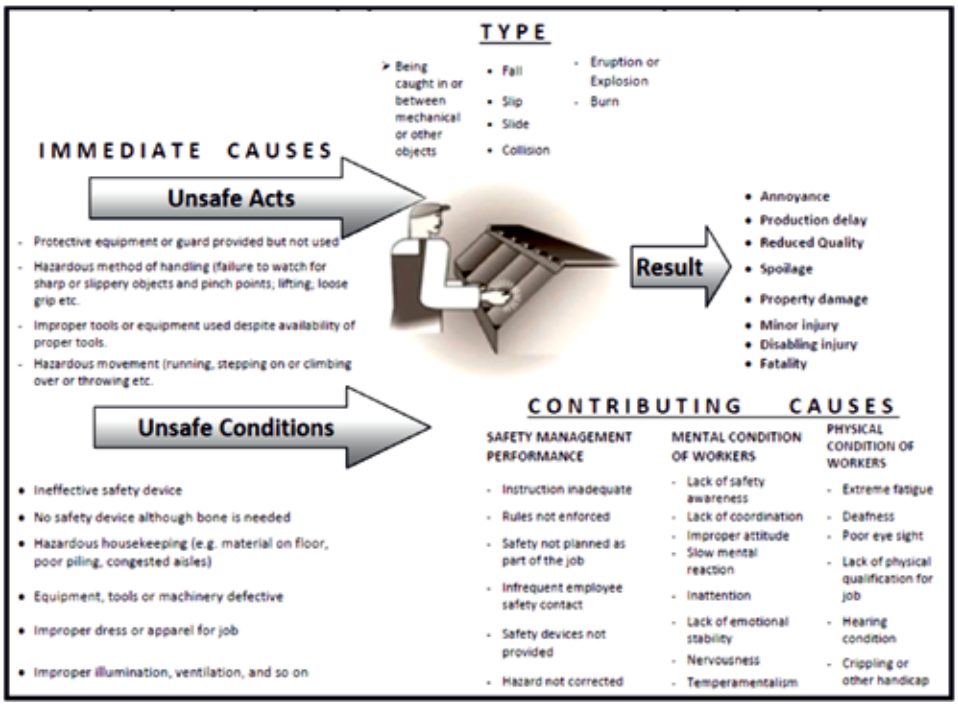
This category includes improper guarding of other hazardous work elements and degradation of equipment through use and unsafe procedures.

The major contribution of this theory is to bring out the fact that rarely, if ever, is an accident the result of a single cause or act.

Usually, when investigating accidents, we tend to fasten upon the obvious causes of the accident to the neglect of the root causes. Unsafe acts and unsafe conditions are the symptoms — the proximate causes — and not the root causes of the accident.

33.7 Structure of Accidents

The belief that accidents are caused and can be prevented makes it imperative for us to study those factors which are likely to favour the occurrence of accidents. By studying such factors, the root causes of accidents can be isolated and necessary steps can be taken to prevent the recurrence of the accidents. These root causes of accidents can be grouped as “immediate” and “contributing”. The immediate causes are unsafe acts of the worker and unsafe working conditions. The contributing causes could be management-related factors, the environment and the physical and mental condition of the worker. A combination of causes must converge in order to result in an accident.



STRUCTURE OF ACCIDENTS

The above Figure shows that the structure of accidents, including the details of immediate causes, contributing causes, types and results of accidents. An understanding of the “Cause and Effect” relation of the accident-causing factors should be required before improvement of safety processes is undertaken.

33.8 Computation of Frequency and Severity Rates of Injuries and Classification of Industrial Accidents as per IS: 3786-1983

33.9 Objective

The computation of accident “Frequency Rate” (FR) and “Severity Rate” (SR) shall be done by every project to achieve the following goals;

a) To evaluate safety performance of the project.

b) To assess the relative safety need for taking accident prevention measures in different departments of the project;

c) To encourage employees by communicating them, the methods used for the prevention of accidents are successful; and

d) To compare the safety performance of THDCIL projects.

The Head of Projects will ensure that report of FR and SR of accidents of the calendar year of their project reaches in the office the Head of Corporate Safety by 31st January of next calendar year.

33.10 Following definitions shall apply for this purpose;

1. Accident

An unintended occurrence arising out of and in the course of employment of a person resulting in injury.

2. Death

Fatality resulting from an accident.

3. Reportable Lost Time Injury

An injury when a person is not able to resume his/her normal work for more than 48 hours immediately after the accident.

4. Days of Disablement (Lost Time)

In case of disablement of a temporary nature, the number of days on which the injured person was partially disabled. In the case of death or disablement of a permanent nature whether it be partial or total disablement, man-days lost means the charges in days of earning capacity lost due to such permanent disability or death. In other cases the day on which the injury occurred or the day the injured person returned to work are not to be included as man-days lost; but all intervening calendar days (including Sundays or, days off, or days of project shut down) are to be included. If after resumption of work, the person injured is again disabled for any period arising out of the injury which caused his earlier disablement, the period of such subsequent disablement is also to be included in the man-days lost.

5. Partial Disablement

This is of two types: disablement of a temporary nature which reduces the earning capacity of an employed person in any employment in which he was engaged at the time of the accident resulting in the disablement; and disablement of a permanent nature, which reduces his earning capacity in every employment which he was capable of undertaking at the time.

6. Total Disablement

Disablement, whether of a temporary or permanent nature, which incapacitates a workman for all work which he was capable of performing at the time of the accident resulting in such disablement, provided that permanent total disablement shall be deemed to result from injury.

7. Man-Hours Worked

The total number of employee-hours worked by all employees working in the industrial premises. It includes managerial, supervisory, professional, technical, clerical and other workers including contractors' labour.

Man-hours worked shall be calculated from the pay roll or time clock recorded including overtime. When this is not feasible, the same shall be estimated by multiplying the total man-days worked for the period covered by the number of hours worked per day. The total number of man-days for a period is the sum of the number of men at work on each day of the period. If the daily hours vary from department to department separate estimates shall be made for each department and the result added together. When actual man-hours are not used, the basis on which the estimates are made shall be indicated.

33.11 Assessment of work injury

(i) General

Thorough investigation of all factors relating to the occurrence of each reported injury is essential. Determination as to whether or not the injury should be considered a work injury shall be based on the evidence collected during investigations.

(ii) Evidence

The evidence to be considered in determining whether or not the reported injury should be considered a work injury may include, but not necessarily be limited to, the following:

a) Facts resulting from investigation of the injured employee's work activities and working environment to which the injury might be related;

b) Statements (written if possible) of the injured employee, fellow employees, witnesses and supervisors;

c) Medical reports classifying the work injury; and

d) Facts concerning the injured employee's work activity for other employers, and other off-the-job activities, injuries and illnesses.

33.12 Accident Frequency Rate (FR):

(For further details refer IS-3786-1983 (RA2002) Computation of FR & SR of industrial injuries)

The frequency rate shall be calculated both for lost time injury and reportable lost time injury as follows:

$$\text{FR (Reportable Lost Time Injury)} = \frac{\text{No. of Reportable Lost Time Injury x 106}}{\text{Man-hours worked}}$$

Note:

1. *If the injury does not cause loss of time in the period in which it occurs but in a subsequent period, the injury should be included in the frequency rate of the period in which the loss of time begins.*
2. *If an injury causes intermittent loss of time, it should only be included in the frequency rate once, that is, when the first loss of time occurs.*
3. *For the purpose of comparison of safety performance, frequency rate FR should be used.*

33.13 Severity Rate (SR)

The Severity Rate shall be calculated both for lost time injury and reportable lost time injury as follows:

$$\text{SR (Lost Time Injury)} = \frac{\text{Man-days lost due to Lost Time Injury x 106}}{\text{Man-hours worked}}$$

Note: For calculation of FR and SR, refer IS: 3786 -1983.

33.14 Classification of industrial accidents

1. Classification according to agency

Agency is the object or substance which is most closely associated with the accident causing the injury and with respect to which adoption of a safety measures could have prevented the accident like machines, means of transportation and moving equipments, pressure vessels, furnaces,

ovens, refrigerating plants, electrical installations, ladders, mobile ramps, scaffoldings, explosives, dusts/gases/liquids/chemicals, radiations, flying objects, fires, environmental factors (heat, light, ventilation etc.), floors, stairs, water, traffic, confined spaces, mining and tunneling work, animal and animal products, other agencies not elsewhere classified and agencies not classified for lack of sufficient data.

2. Classification according to unsafe materials or physical conditions

This identifies the unsafe mechanical or physical condition or conditions related to the agency, which contributed to the causation of accident like improperly guarded agency, defects in agency, hazardous arrangement, procedure, etc in, on, or apparel, improper illumination, unsafe dress or apparel, improper ventilation and others.

3. Classification according to the unsafe act

This identifies the deviation from the accepted and laid down safe procedure, which contributed to the causation of accident like operating without authority, failure to secure or warn, operating at unsafe speed, marking safety devices inoperative, using unsafe equipment, hand instead of equipment, or equipment unsafely, unsafe loading, placing, mixing, combining, etc, taking unsafe position or posture and others.

4. Classification according to unsafe personal factor

This identifies the anatomical, physiological or the psychological characteristic which permitted or occasioned the selected unsafe act like unsuitable anatomical, physiological, or psychological characteristics, lack of knowledge or skill, unsuitable mechanical or physical conditions, social environment, etc.

5. Classification according to type of accidents

The type of accident is the manner in which the object or substance causing the injury comes into contact with the injured person, or the movement of the injured person which resulted in the injury like falls of persons, fall of objects, stepping on, striking against or struck by object, caught in or between objects, over-exertion or wrong movements, exposure to or contact with extreme temperature, exposure to or contact with electric current, exposure to or contact with harmful substances, including relations, explosions, inundations and eruption, exposure to high noise, bursting and rupture of vessels.

6. Classification according to nature of the injury

This identifies the injury in terms of its principal physical characteristics like fractures, dislocations, sprains and strains, concussions and other internal injuries, amputations, wounds, superficial injuries, contusions and crushing, burns, acute poisonings, effects of weather, exposure and related conditions, asphyxia, effects of electric currents, effects of radiations, multiple injuries of different nature, others and unspecified injuries.

7. Classification according to the location of the injury

Location of injury identifies the part of the injured person's body directly affected by the injury identified like head, Cranium region (skull brain, scalp), Eye (including orbit and optic nerve), ear, Mouth (including lips, teeth and tongue), nose, Face, head, Neck (including Throat and Cervical Vertebrae), Trunk, Upper Limb, Lower Limb etc.

34 Pressure Vessels/Plants and Lifting Machines, Tools and Tackles

34.1 Role and Responsibility

- **Immediate Responsibility**

  (a) In case of THDCIL Pressure Vessels/Pressure Plants and Lifting Machines, the immediate responsibility for periodical examination and/or testing as per the legal requirement by Competent Person approved by Director Safety (CIF) of the State Govt. shall be of the Department Head where pressure vessels and lifting machines are being used in presence of HOD-Safety or his/her representative.

  (b) In case of Pressure Vessels/Pressure Plants and Lifting Machines belongs to the contractor, the responsibility for periodical examination and/or testing as per the legal requirement by Competent Person approved by Director Safety (CIF) of the State Govt. shall be of the contractor.

- **Ultimate Responsibility**

  The ultimate responsibility to ensure compliance of legal requirements in this regard shall be of the Occupier / Owner / Employer / Manager Mines and Project Manager in case of contractor.

34.2 Legal Provision

- Section-28 (Hoist & Lifts), 29 (Lifting Machines, Chains, Ropes and Lifting Tackles) and 31 (Pressure Plants) of the Factories Act, 1948
- Rule-55 (Hoist & Lifts), 55A (Lifting machines, chains, and ropes and lifting tackles) and 56 (Pressure Vessels or Plants) of the State Rules made under the Factories Act-1998.
- Rule-65 (Hoist), 70 (Test and Periodical Examination of Lifting Gears) and Rule-207 (Pressure Plant and Equipment), of the Building and Other Construction Worker's (Regulation of Employment and Conditions of Service) Central Rules, 1998

34.3 Hoists and Lifts

34.3.1 Legal provision: Section-28 of the Factories Act-1948

1(a) every hoist and lift shall be—

(i) of good mechanical construction, sound material and adequate strength:

(ii) properly maintained, 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) every hoist way and lift way shall be sufficiently protected by an enclosure fitted with gates, and the hoist or lift and every such enclosure shall be so constructed as to prevent any person or thing from being trapped between any part of the hoist or lift and any fixed structure or moving part;

(c) the maximum safe working load shall be plainly marked on every hoist or lift, and no load greater than such load shall be carried thereon;

(d) the cage of every hoist or lift used for carrying persons shall be fitted with a gate on each side from which access is afforded to a landing;

(e) every gate referred to in clause (b) or clause (d) shall be fitted with interlocking or other efficient device to secure that the gate cannot be opened except when the cage at the landing and that the cage cannot be moved unless the gate is closed.

(2) The following additional requirements shall apply to hoists and lifts used for carrying persons and installed or reconstructed in a factory after the commencement of this Act, namely:-

(a) Where the cage is supported by rope or chain, there shall be at least two ropes or chains separately connected with the cage and balance weight, and each rope or chain with its attachments shall be capable of carrying the whole weight of the cage together with its maximum load;

(b) Efficient devices shall be provided and maintained capable of supporting the cage together with its maximum load in the event of breakage of the ropes, chains or attachments;

(c) An efficient automatic device shall be provided and maintained to prevent the cage from over-running.

Explanation

For the purposes of this section, no lifting machine or appliance shall be deemed to be a hoist or lift unless it has a platform or cage, the direction or movement of which is restricted by a guide or guides.

34.4 Legal provision: Rule-55 of State Factories Rules under

1. A register shall be opened with the following columns to record particulars of examination of hoists and lifts:

(i) Date of examination

(ii) Number of hoists and lifts if more than one

(iii) Details of examinations made

(iv) Result of examination

(v) Signature of examiner

(vi) Designation and qualifications of the examiner.

2. Exemption of certain hoists and lifts

In respect of any class or description of hoists or lift specified in the first column of the Schedule, the requirements of Section 28 specified in the second column of said schedule and set opposite to that class or description of hoist or lift shall not apply:

SCHEDULE

Class or description of hoist or lift requirements which shall not apply

(a) Hoist or lifts mainly used for raising materials for charging blast furnaces or lime-kilns.	Sub-section 1(b) in so far as it requires a gate at the bottom landing; sub-section 1(e).
(b) Hoists not connected with mechanical power and which are not used for carrying persons.	Sub-section 1(b) in so far as it requires the hoist way or lift way enclosure to be so constructed as to prevent any person or thing from being trapped between any part of the hoist or lift and any fixed structure or moving part; sub-section (l)(e).

34.5 Lifting machines, chains, ropes and lifting tackles

34.5.1 Legal provision: Section-29 Lifting machines, chains, ropes & lifting tackles

(1) The following provisions shall be complied with in respect of every lifting machine (other than a hoist and lift) and every chain, rope and lifting tackle for the purpose of raising or lowering persons, goods or materials:-

(a) All parts, including the working gear, whether fixed or movable, of every lifting machine and every chain, rope or lifting tackle shall be—

(i) Of good construction, sound material and adequate strength and free from defects;

(ii) Properly maintained; and

(iii) Thoroughly examined by a competent person at least once in every period of twelve months, or at such intervals as the Chief Inspector may specify in writing; and a register shall be kept containing the prescribed particulars of every such examination;

(b) No lifting machine and no chain, rope or lifting tackle shall, except for the purpose of test, be loaded beyond the **Safe Working Load (SWL) which shall be plainly marked thereon together with an identification mark** and duly entered in the prescribed register; and where this is not practicable, a table showing the **safe working loads of every kind and size of lifting machine or chain, rope or lifting tackle in use shall be displayed in prominent positions on the premises;**

(c) While any person is employed or working on or near the wheel track of a travelling crane in any place where he would be liable to be struck by the crane, effective measures shall be taken to ensure that the crane does not approach within [six meters] of that place.

Explanation:

(a) **"lifting machine"** means a crane, crab, which tangle pulley block, gin wheel, transporter or runway;

(b) **"lifting tackle"** means any chain sling, rope sling, hook, shackle, swivel, coupling, socket, clamp, tray or similar appliance, whether fixed or movable, used in connection with the raising or lowering of persons, or loads by use of lifting machines."

34.6 Legal provision: Rule, 55-A of State Factories Rules regarding Lifting machines, chains, ropes & lifting tackles

(1) No lifting machine, and no chain, rope or lifting tackle, except fibre rope or a fibre rope sling, shall be taken into use in any factory unless it has been tested and all parts have been thoroughly examined by a competent person and certificate to that effect, specifying the safe working load or loads, has been obtained from that person and is kept available for inspection.

(2) Every jib-crane, which is so constructed that die safe working load varies with raising or lowering of the jib, shall have attached thereto either an automatic indicator of safe working loads or an automatic jib-angle indicator and a table indicating the safe working loads at the corresponding inclinations of the jib, or corresponding radii of the load.

(3) The register to be maintained under clause (a)(iii) of sub-section (1) of Section 29 of the Act shall be—

(i) Name of occupier of the factory.

(ii) Address of the factory.

(iii) Distinguishing number or mark, if any, and description sufficient to identify the lifting machine, chain, rope, multiple sling or die lifting tackle.

(iv) Date when the lifting machine, chain, rope, or multiple sling or lifting tackle was first brought into use in the factory.

(v) Date and number of the certificate relating to any test and examination made under sub-rules (1) and (7) together with the name and address of the person who issued the certificate.

(vi) Date of each periodical thorough examination made under clause (a) (iii) of sub-section (1) of Section 29 of the Act and sub-rule (6) and name and designation of the person by whom it was carried out.

(vii) Date of annealing or other heat treatment of die chain and other lifting tackle made under sub-rule (5) and name and designation of the person by whom it was carried out.

(viii) Particulars of any defects affecting the sate working load found at any such thorough examination or after annealing and of the steps taken to remedy such defects.

The register shall be kept readily available for inspection.

4. Every lifting machine, chain, rope and lifting tackle, except a fibre rope, or fibre rope sling, which has been lengthened, altered or repaired by welding or otherwise, shall, before being again taken into use, be adequately re-tested and re-examined by a competent person and a certificate of such test and examination be obtained and particulars entered in the register kept in accordance with sub-rule (3).

5. No person under 18 years of age and no person who is not sufficiently competent and reliable shall be employed as driver of a lifting machine, whether driven by mechanical power or otherwise, or to give signals to a driver.

34.7 Legal provision for Test and Periodical Examination of Lifting Gears under Rule-56 and Rule-74 of the Building and Other Construction Worker's (Regulation of Employment and Conditions of Service) Central Rules, 1998.

Rule-56: Test and periodical examination of lifting appliances

Ensure at construction site of a building or other construction work that-

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.

Explanation:-

For the purpose of this rule, thorough examination means a visual examination, supplemented, if necessary, by other means such as hammer test, carried out as carefully as the conditions permit, in order to arrive at a reliable conclusion as to the safety of the parts examined; and, if necessary, for such examination, parts of the lifting appliance and gear, shall be dismantled.

Rule-74(b) Periodical test, examination of Cranes or Hoists and certificates thereof:-

Ensure at a construction site of a building or other construction work that—

Certificate in respect of each of the following is obtained from competent person in the forms as mentioned below, namely:

Form V, Examination and Testing Certificate of Winches, Derricks and their accessory gears is placed at Annexure-2.

Form VI, Examination and Testing Certificate of Cranes or Hoists and their accessory gears is placed at Annexure-3.

34.8 Pressure Plant / Vessels

34.8.1 Legal provision under Section-31 of the Factories Act, 1948

(1) If in any factory, any plant or machinery or any part thereof is operated at a pressure above atmospheric pressure, effective measures shall be taken to ensure that the Safe Working Pressure of such plant or machinery or part is not exceeded.

(2) The State Government may make rules providing for the examination and testing of any plant or machinery such as is referred to in sub-section (1) and prescribing such other safety measures in relation thereto as may in its opinion be necessary in any factory or class or description of factories.

34.9 Legal provision for Pressure Plant or Vessel under Rule-56 of the State Factories Rules under Section-31 of the Factories Act, 1948

1. Interpretation—In this rule-

(a) "design pressure" means the maximum pressure that a pressure vessel or plant is designed to withstand safety when operating normally;

(b) "maximum permissible working pressure" means the maximum pressure at which a pressure vessel or plant is permitted to be operated or used under this rule and is determined by the technical requirements of the process;

(c) "plant" means a system of piping that is connected to a pressure vessel and is used to contain a gas, vapour or liquid under pressure greater than the atmospheric pressure, and includes the pressure vessel;

(d) "Pressure vessel" means an unfired vessel that may be used for containing, storing, distributing, transferring, distilling, processing or otherwise handling any gas, vapour or liquid under pressure greater than the atmospheric pressure and includes any pipe line fitting or "other equipment attached thereto or used in connection therewith ; and

(e) "competent person" means a person who is, in the opinion of the Chief Inspector, capable by virtue of his qualifications, training and experience, of conducting a thorough examination and pressure tests, as required, on a pressure vessel plant, and of making full report on its condition.

Exceptions—Nothing in this rule shall apply to—

(a) vessels having **internal diameter not exceeding 150 milli meters and a capacity not exceeding 142 litres**;

(b) vessels made of ferrous materials having an **internal operating pressure not exceeding 1 kilogram per square centimetre;**

(c) steam boilers, steam and feed-pipes and their fittings coining under the purview of Indian Boilers Act, 1923;

(d) metal bottles or cylinders used for storage or transport of compressed gases or liquefied or dissolved gases under pressure covered by the Gas Cylinder Rules, 1940 framed under the Indian Explosives Act, 1884;

(e) vessels in which internal pressure is due solely to the static head of liquid;

(f) vessels with a nominal **water capacity not exceeding 500 litres** connected in a water-pumping system containing air that is compressed to serve as a cushion;

(g) vessels for nuclear energy application ;

(h) **refrigeration plant having a capacity of 3 tons** or less of refrigeration in 24 hours ; and

(i) working cylinders of steam engines or prime movers, feed pumps and steam traps; turbine casings; compressor cylinders ; steam separators or dryers ; steam strainers; steam de-super-heaters ; oil separators; air receivers for fire sprinkler installations ; air receiver of monotype machines provided the **maximum working pressure of the air receiver does not exceed 1.33 kilograms per square centimetre and the capacity 85 litres**, air receivers of electrical circuit breakers; air receivers of electrical relays; air vessels on pumps ; pipe coils, accessories of instruments and appliances such as cylinders and piston assemblies used for operating relays and interlocking type of guards; vessels with liquids subjected to static head only; and hydraulically operating cylinders other than any cylinder communicating with an air loaded accumulator.

2. Safety devices—Every pressure vessel shall be fitted with—

(a) a suitable **safety valve or other effective pressure relieving device** of adequate capacity to ensure that the maximum permissible working pressure of the pressure vessel shall not be exceeded. **It shall be set to operate at a pressure not exceeding the maximum permissible working pressure and when more than one protective device is provided only one of the devices need be set to operate at the maximum permissible working pressure and the additional device shall be set to discharge at a pressure not more than 5 per cent in excess of the maximum permissible working pressure;**

(b) a suitable **Pressure Gauge with dial range not less than 1.5 times the maximum permissible working pressure**, easily visible and designed to show at all times the correct internal pressure and marked with a prominent red mark at the maximum permissible working pressure of the pressure vessel;

(c) **a suitable 'Nipple and Globe Valve' connected for the exclusive purpose of attaching a test pressure gauge for checking the accuracy of the pressure gauge referred to in clause (b)** of this sub-rule;

(d) **a suitable stop valve or valves by which the pressure vessel may be isolated from other pressure vessels or plant or source of supply or pressure. Such a stop valve or valves shall be located as close to the pressure vessel as possible and shall be easily accessible;** and

(e) **a suitable drain cock or valve at the lowest part of the pressure vessel for the discharge of the liquid or other substances that may collect in the pressure vessel:**

3. Pressure vessel or plant being taken into use—

(a) **No new pressure vessel or plant** shall be taken into use in a factory after coming into force of this rule **unless it has been hydrostatically tested by competent person at a pressure at least 1.3 times the design pressure**, and no pressure vessel or plant which has been previously used or has remained isolated or idle for a period exceeding 2 months or which has undergone alterations or repairs shall be taken into use in a factory unless it has been **thoroughly examined by a competent person externally, and internally, if practicable and has been hydrostatically tested by the competent person at a pressure which shall be 1.5 times the maximum permissible working pressure:**

(b) **No pressure vessel or plant shall be used in a factory unless there has been obtained from the maker of the pressure vessel or plant or from the competent person a certificate specifying the design, pressure or maximum permissible working pressure thereof and**

stating the nature of tests to which the pressure vessel or plant and its fittings (if any) have been subjected and every pressure vessel or plant so used in a factory shall be marked so as to enable, it to be identified as to be the pressure vessel or plant to which the certificate relates and the certificate shall be kept available for perusal by the Inspector.

6. In-service test and examinations—

(a) **Every pressure vessel or plant in service shall be thoroughly examined by a competent person—**

(i) Externally, once in every period of six months;

(ii) Internally, once in every period of twelve months:

Provided that if by reason of the construction of a pressure vessel or plant, a thorough internal examination is not possible, **this examination may be replaced by a hydrostatic test which shall be carried out once in every period of two years:**

Provided further that for a pressure vessel or plant in continuous process which cannot be frequently opened, **the period of internal examination may be extended to four years;** and

(iii) Hydrostatically tested once in every period of four years:

Provided, that in respect of a pressure vessel or plant with thin walls such as sizing cylinder made of copper or any other non-ferrous metal, periodic hydrostatic test may be dispensed with subject to the condition that the requirements laid down in sub-rule (8) are fulfilled:

Provided further that when it is impracticable to carry out thorough external examination of any pressure vessel or plant every six months ,as required in sub-clause *(i)* or if owing to its construction and use a pressure vessel or plant cannot be hydrostatically tested as required in subclauses *(ii)* and *(iii)* **a thorough external examination of the pressure vessel or plant shall be carried out at least once in every period of two years and at least once in every period of four years a thorough systematic non-destructive test like ultrasonic test for metal thickness** or other defects of all parts of failure of which might lead to eventual rupture of the pressure vessel or plant shall be carried out.

(b) **The pressure for the hydrostatic test to be carried out for the purpose of this sub-rule shall be 1.25 times the design pressure for 1.5 times the maximum permissible working pressure, whichever is less.**

7. Thin walled pressure vessel or plant—

In respect of any pressure vessel or plant of thin walls such as sizing cylinder made of copper or any other non-ferrous metal, the maximum permissible working pressure shall be reduced at the rate of 5 per cent of the original maximum permissible working pressure for every year of its use after the first five year no such cylinder shall be allowed to continue to be used for more than twenty years after it was first taken into use.

8. Report by competent person—

(a) If during any examination any doubt arises as to the ability of the pressure vessel or plant to work safely until the next prescribed examination the competent person shall record in the prescribed register his observations, findings and conclusions with other relevant remarks with reasons and may authorise the pressure vessel or plant to be used and kept in operation subject to a lowering of maximum permissible working pressure, or to more frequent or special examination or test, or subject to both of these conditions.

(b) A report of **every examination or test carried out shall be completed in Form-9 and shall be signed by the person making the examination or test, and shall be kept available for perusal by the Inspector at all hours when the factory or any part thereof is working.**

(c) Where the report of any examination under this rule specified any condition for securing the safe working of any pressure vessel or plant, the pressure vessel or plant shall not be used unless the specified condition is fulfilled.

Annexure-1: **Form-9 'Report of Examination or testing of Pressure Vessel or Plant.**

34.10 Legal provision for Pressure Plant or Vessel under Rule-207 of the Building and Other Construction Workers' (Regulation of Employment and Conditions of Service) Central Rules, 1998

Ensure at a construction site of a building or other construction work that—

(a) The pressure plant and equipment—

(i) Are examined and tested by the competent person before being put into use for such work;

(ii) Is of proper design and construction, sound material and adequate strength to perform the work for which it is used;

(iii) Is properly maintained in good repairs and working condition.

(b) The pressure plant and equipment referred to in clause (a) is fitted with—

(i) A suitable **safety-valve or other effective device** to provide maximum safe discharge pressure from being exceeded at any time;

(ii) A suitable **pressure gauge with a dial range not less than one point five times and not exceeding twice the maximum working pressure**, easily visible and designed to show at all times the internal pressure in kilogram per square centimetre and **marked with the maximum safe working pressure at such plant and equipment;**

(iii) A suitable stop valve or valves by which the pressure plant or the system of the pressure plant may be isolated from the source of supply of pressure or otherwise.

(c) Every pressure plant or equipment shall be thoroughly examined by the competent person—

(i) Externally, once in every period of six months;

(ii) Internally, once in every period of twelve months and;

(iii) By hydrostatic test once in every period of four years

Annexure

Annexure-1: **Form-9**, Report of Examination or Test of Pressure Vessel or Plant under State Factories Rules

Annexure-2: **Form-V**, Certificate of Initial and Periodical Test and Examination of Winches, Derricks and Their Accessory Gear (Rules 56 and Rule-74(B), Schedule I)

Annexure-3: **Form-VI**, Certificate of Initial and Periodical Test and Examination of Cranes or Hoists and Their Accessory Gear (Rules 56 and Rule-74(B), Schedule I)

Normative References

- *SHE Manual, THDCIL*
- *Factories Act, 1948 and Rules made thereunder*
- *BOCW Act 1996 and BOCW Central Rules 1998*
- *Electricity Act, 2003 and Rules made thereunder*
- *Occupational Safety, Health and Working Conditions Code 2020 (Section-10)*
- *Occupational Safety, Health and Working Conditions (Central) Rules 2020 (Rule-8)*

ANNEXURE-1

Report of Examination or test of Pressure Vessel or Plant

Form No. 9

(Prescribed under rule 56)

Report of Examination or test of Pressure Vessel or Plant

1. Name of occupier (or Factory) .....

2. Situation and address of factory .....

3. Name, description and distinctive number of pressure vessel or plant .....

4. Name and address of manufacturer and reference to their test certificate or certificates of competent person .....

5. Nature of process in which pressure vessel or plant is used .....

6. Particulars of pressure vessel or plant--

(a) Date of construction .....

(b) Thickness of walls .....

(c) Date on which the pressure vessel or plant was first taken into use .....

(d) Maximum permissible working pressure recommended by the manufacturer .....

(e) Design pressure, if known .....

(f) The history should be briefly given and the examiner should state whether he has seen the last previous report.

7. Date of last hydrostatic test, if any, and pressure applied .....

8. Is the pressure vessel or plant in open or otherwise exposed to weather or to damp?

9. What parts (if any) were inaccessible?

.....

10. What examination and tests were made?

Specify pressure if hydrostatic test was carried out .....

11. Condition of pressure vessel or plant External (state any defects materially affecting the maximum permissible working pressure of the safe working of the pressure vessel or plant) ..... Internal.

12. Are the required fitting and appliances provided in accordance with the rule .....

13. Are all fittings and appliances properly maintained and in good condition? Have the pressure settings been checked and corrected?

14. Repairs (if any) required, within which they should be executed and any other condition which the person making examination thinks it necessary to specify for securing safe workings. ....

15. Maximum permissible working pressure, calculated from dimensions and from the thickness, and other data ascertained by the present examination, due allowance being made for conditions of working if unusual or exceptionally severe)State minimum thickness of walls measured during the examination) .....

16. Where repairs affecting the maximum working pressure are required, state the working pressure--

(a) Before the expiration of the period specified in item 14.

(b) After the expiration of such period if the required repairs have not been completed.

(c) After the completion of the required repairs .....

17. Other observations .....

I certify that on ..... the pressure vessel or plant described above was thoroughly cleaned and (so far as its construction permits) made accessible for through examination and for such tests as were necessary for through examination and that on the said date, I thoroughly examined this pressure vessel or plant including its fittings and that the above is a true report of my examination.

Signature .....

Qualification .....

Address .....

Date .....

If employed by a Company or Association give name and Address.]

ANNEXURE-2

FORM- V.

[See rules 56 and 73(b) Schedule I]

CERTIFICATE OF INITIAL AND PERIODICAL TEST AND EXAMINATION OF WINCHES, DERRICKS AND THEIR ACCESSORY GEAR

Test Certificate No…….

(a) In case of construction site , name of the construction site where lifting appliances are fitted/ located :

Situation and Description of lifting appliances and gear with distinguishing number or marks (if any) which have been tested, thoroughly examined	*Angle to the horizontal of derrick boom at which test load applied*	*Test load applied*	*Safe working load at the angle shown in column(2)*
1	2	3	4
	(Degrees)	(Tonnes)	(Tonnes)

5. Name and address of public service, association, company, or firm or testing establishment making the test and examination.

6. Name and position of the Competent person of public service, association, company or firm or testing establishment.

I certify that on the ---------- day of ----------20---------- the lifting appliance shown in Col (1) together with its necessary gear was tested in the manner set forth overleaf in my presence that a careful examination of the said lifting appliances after the test showed that it had with stood the test load without injury or permanent deformation and that the safe working load of the said lifting appliance and accessory gear is as shown in column (4)

Date…… Seal **Signature of the Competent Person- Registration /Authority number of the competent person.**

ANNEXURE-3

FORM- VI.

[See rules 56 and 74(b)]

CERTIFICATE OF INITIAL AND PERIODICAL TEST AND EXAMINATION OF CRANES OR HOISTS AND THEIR ACCESSORY GEAR.

Test Certificate No……

(a) Name of the construction site where Cranes or hoists are fitted/ located:

Situation and Description	*For jib cranes radius at the test load was applied*	*Test load applied*	*Safe working load for jib cranes at radius shown in column (2)*
1	2	3	4
	(Meters)	(Meters)	(Tonnes)

5. Name and address of public service, association or firm or testing establishment making the test and examination.
6. Name and position of Competent Person of public service, association, company or Firm or testing establishment.

I certify that on the ……day of ……the above lifting appliances together with its accessory gear, was tested in the manner set forth overleaf that a careful examination of the said lifting appliance and gear after the test showed that it had withstood the test load without injury or permanent deformation; and the safe working load of the said lifting appliance and gear is as shown in column (4).

Date……. **Seal** **Signature of the Competent Person.**

Registration/Authority number of the Competent person.


30/12/2023

35 Tunnel Safety and Tunnel Boring Machine (TBM)

35.1 Role and Responsibility

➢ **Immediate Responsibility**

(a) The immediate responsibility to ensure safety in TBM Operation shall be of the Site Engineer / Supervisor of the contractor; and

(b) THDCIL Site In-charge of TBM construction site.

➢ **Ultimate Responsibility**

a) The ultimate responsibility of safety in TBM operation shall be of the Project Manager of the contractor; and

b) Project Head THDCIL.

35.2 Legal Provision

Rule-119 to 132 (Chapter-XIII) of the Building and Other Construction Worker's (Regulation of Employment and Conditions of Service) Central Rules, 1998

35.3 Tunnel Safety

- As per Rule-119, Employer carrying out any excavation or tunnelling work at a construction site of a building or other construction work shall, within thirty days, prior to the commencement of such excavation or tunnelling work, shall inform in writing the detailed layout plans, method of construction and schedule of such excavation or tunnelling work to the Director General.
- As per Rule-120, employer shall appoint a project engineer for safe operation of excavation or tunnelling. His / Her duties and responsibilities shall include—
  - to carry out smoothly such excavation or tunnelling work;
  - to inspect and rectify any hazardous situation relating to such excavation or tunnelling work;
  - to take remedial measures to avoid any unsafe practice or conditions relating to such excavation or tunnelling work
- As per Rule-122, Suitable warning signs or notices, required for the safety of building workers shall be displayed at conspicuous places in Hindi and in a language understood by the majority of such building workers. Warning signs shall include—
  (i) the danger involved in such compressed air work;
  (ii) fire and explosion hazards; and
  (iii) the emergency procedures for rescue from such danger or hazards.
- As per Rule-123, employer shall ensure at a construction site of excavation or tunnelling work that a register of employment of building workers carrying out such excavation or tunnelling work, is maintained.

Periods of work of such excavation or tunnelling work, in which such building workers are employed, shall be maintained in a register on day-to-day basis and such register shall be produced on demand to the Inspector having jurisdiction.

- As per Rule-124, Illumination at construction site shall be adequate in accordance with the relevant national standards. Provision of emergency generators should be done to ensure adequate illumination at all workplaces where such excavation or tunnelling work is being carried out, in case of power failure.
- As per Rule-127, ensure that ladders, stair cases or ramps are provided, as the case may be, for safe access to and egress from excavation where the depth of such excavation exceeds one point five metres.
- As per Rule-132, It should be ensured at a construction site that—
  - (a) where there is a danger of falling or sliding of material from the roof face or wall of a tunnel, adequate measures such as shoring, supporting by means of rock bolts, segments or steel sets are taken for the safety of building workers;
  - (b) the excavated areas are made safe by use of suitably designed and installed steel sets, rock bolts or similar other safe means;
  - (c) the responsible person examines and inspects the workplaces in a tunnel before the commencement of work in such tunnel, and at regular intervals thereafter, to ensure safety of the building workers in such tunnel;
  - (d) the portal areas of a tunnel with loose soil, or rock, likely to cause injury to a person are adequately protected with supports.
- As per Rule-136, such means of communication shall be ensured at a construction site that—
  - (a) reliable and effective means of communication such as telephone or walkie- talkie are provided and are maintained in working order for arranging better and effective communication at an excavation or tunnelling work at the following locations, namely:—
    - (i) working chamber of an excavation;
    - (ii) intervals of hundred metres along the tunnel;
    - (iii) working chamber side of a man lock near the door of such man lock;
    - (iv) interior of each chamber of a man lock;
    - (v) location conspicuous lock attendant's station;
    - (vi) a compressor plant;
    - (vii) a first-aid station; and
    - (viii) outside the portal or the top of a shaft;
  - (b) such number of Bells and Whistles are made available at all times at the locations referred to in sub-clause (i) to sub-clause (viii) of clause (a) as are necessary for the safety of persons at such locations.
- As per Rule-137, signals; It should be ensured at a construction site that the standard audio or video signals are used in excavation or tunnelling work and are conspicuously located or displayed near entrance to the workplace and in such other locations as may be necessary to bring such signals to notice of all building workers employed in excavation or tunnelling work.
- As per Rule-146, Storing of oil and fuel underground; It should be ensured that—
  - (a) All oils, greases or fuels stored underground in excavation or tunnelling work are kept in tightly sealed containers and in fire resistant areas at safe distances away from explosive and other flammable chemicals;
  - (b) Appropriate flame proof installation is used in such storage areas as specified in clause (a).

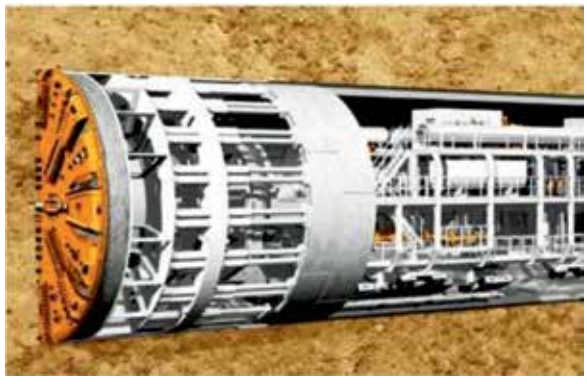
- As per Rule-147, Use of gases underground; It should be ensured that-
  - (a) Petrol or liquefied petroleum gas or any other flammable substances are not used, stored inside the tunnel except with the prior approval of the project engineer;
  - (b) After the use of the petroleum or liquefied petroleum gas, or highly inflammable substances referred to in clause (a), all remaining petroleum or liquefied petroleum gas or highly inflammable substances are removed immediately from such tunnel;
  - (c) No oxy-acetelene gas is used in a compressed air environment in excavation or tunnelling work.
- As per Rule-152, Permissible limit of exposure of chemicals; It should be ensured that the working environment in a tunnel or a shaft in which building workers are employed does not contain any of the hazardous substances in concentrations beyond the permissible limits as laid down in the Schedule XII to these rules;
- As per Rule-153, Ventilation; It should be ensured that all working areas in a free air tunnel are provided with ventilation system as approved by the Director General and the **fresh air supplied in such tunnel is not less than six cubic metres per minute for each building worker** employed underground in such tunnel and the **free air-flow movement inside such tunnel is not less than nine metre per minute.**
- As per Rule-154, It should be ensured that air supply intake points for all air compressors are located at places where such intake air does not get contaminated with dust, fumes, vapour and exhaust gases or other contaminants.
- As per Rule-154, It should be ensured that every compressed air system in a tunnel is provided with emergency power supply system for maintaining

continued supply of compressed air in such compressed air system and is capable of operating air compressor and ancillary systems of such compressed air system. The emergency power supply system is maintained and is readily available at all times at an excavation or tunnelling work.

35.4 TBM (Tunnel Boring Machine)

Tunnel, means a subterranean passage made by excavating beneath the over burden into which a building worker enters or is required to enter to work.

Tunnel Boring Machine also known as TBM, is used as an alternative to drilling and blasting methods in rock and conventional 'Hand Mining' in soil. Tunnel Boring machine have the advantages of limiting the disturbance to the surrounding ground and therefore they are able to produce a smooth tunnel wall. This also helps in reducing the cost of lining the tunnel. Tunnelling with TBM is much more efficient in comparison with drilling and blasting and results in shortening completion time when they operate successfully.



Safety Preventive measures in TBM Tunnelling

- ❖ Ground Monitoring instruments are installed in ground surface above tunnel alignment.
- ❖ Structural monitoring instruments are installed in the buildings above the tunnel influence zone.
- ❖ The instrument readings are recorded on daily basis during TBM Tunnelling.
- ❖ Ground distortion observation is ensured by Surface monitoring team during tunnelling.

- Existing building surveys including Structural & Plastering cracks are recorded and are acknowledged by residents.
- The building cracks that are found widen up after TBM crossing are repaired completely.
- All bore wells/Open wells in the influence zone properties are considered for Temporary/ Permanent plugging.
- Permanently plugged bore wells are provided with alternate bore wells.
- Open wells must be closed and provided with alternate bore wells.
- Bore wells which are plugged temporarily during TBM pass-through, adequate water supply is ensured for the residents.
- Always wear appropriate PPE, such as hard hats, safety glasses, hearing protection, gloves, and steel-toed boots.
- Be aware of the risk of falls and take precautions, such as using guardrails, safety lines, and harnesses.
- Never walk or stand under suspended loads or operate machinery without proper training and authorization.
- Keep the work area clean and free of debris to prevent tripping and slipping hazards.
- Use clear and concise communication signals with all co-workers, especially in noisy environments.
- Before starting the TBM, perform all necessary checks, such as ensuring that all guards and safety devices are in place and that there are no leaks or blockages.
- Only trained and authorized personnel should operate the TBM. Follow the manufacturer's operating instructions and never exceed safe speed limits.
- Be careful when handling materials, such as concrete segments or tunnel muck. Use proper lifting equipment and techniques to avoid injuries.
- Ensure adequate ventilation in the tunnel to remove dust, fumes, and harmful gases.
- Have a fire plan in place and know how to use fire extinguishers.
- Be familiar with emergency procedures and know how to evacuate the tunnel if necessary.
- Report any unsafe conditions or practices immediately.
- Be aware of your surroundings and watch out for hazards.
- Take breaks when needed to avoid fatigue

36

Checklists

Checklists are valuable tools for various reasons:

Checklists help reduce errors and oversights by providing a systematic way to ensure that all necessary steps or tasks are completed. They serve as a cognitive aid, helping individuals remember important items even when they are under stress or facing distractions.

Checklists promote consistency and standardization in processes and procedures. By following a predefined checklist, individuals and teams can ensure that tasks are performed uniformly each time, which is particularly important in fields where consistency is critical, such as aviation, healthcare, and manufacturing.

Checklists help improve efficiency by streamlining workflows and minimizing wasted time. Rather than relying on memory or ad hoc approaches, individuals can refer to a checklist to guide them through a series of steps in a logical order.

Checklists are valuable tools for training new employees or team members. They provide a clear roadmap of tasks and procedures, allowing newcomers to quickly learn and understand the requirements of their role

Checklists facilitate communication and collaboration among team members by providing a shared reference point for tasks and responsibilities. They help clarify expectations and ensure that everyone is on the same page regarding what needs to be done.

Overall, checklists are versatile tools that can enhance performance, reduce errors, and improve outcomes across a wide range of contexts and industries.

Following checklists are prepared and enclosed for ready reference during regular check and to maintain workplace safety;

Annexure-1: General Safety Checklist.

Annexure-2: Tunnel Safety Checklist.

Annexure-3: Electrical Safety Checklist.

Annexure-4: Vehicle Inspection Checklist.

Annexure-5: Safety Audit Checklist as per IS 14489-2018

Annexure-6: Safety Audit Checklist THDCIL Checklist.

Annexure-7: Ladder Safety Checklist.

Annexure-8: Ambulance Inspection Checklist.

Annexure-9: Dispensary Inspection Checklist

Annexure-1

THDC INDIA LIMITED			
GENERAL SAFETY INSPECTION CHECKLIST			
Site:			**Date:**
Sl. No.	ITEM	OBSERVATION	
[A] PPE`s (Personal Protective Equipments)			
1	Head Protection:	Wear/ Not wear /N.A (Some people wear) (Some people not wear)	
2	Hand Protection:	Wear/ Not wear /N.A (Some people wear) (Some people not wear)	
3	Eye Protection: Wear/Not Wear/N.A (Goggles/Spectacles)	Wear/ Not wear /N.A	
4	Ear Protection:	Wear /Not Wear/N.A (Ear Muff)	
5	Protection From Dust & other Gases:	Wear /not Wear /N.A (Mask)	
6	Body Protection: (Apron / Fire Suit/ reflective jackets)	Wear /not Wear /N.A	
7	Fall Protection: (Working above 1.8M) : (Full Body Harness)	Wear /Not wear /N.A	
8	Foot Protection:	wear Safety shoes/Not Wear Safety Shoes/N.A Wear Gum Boot/ Not wear Gumboot /N.A	
[B] General Housekeeping Safety Point			
1	General neatness of work area(s) (Work Shop/Batching Plant /Crusher Plant etc)	Yes/NO/N.A	
2	Regular disposal of waste and trash.	Yes/NO/N.A	
3	Procedures to handle hazardous waste.	Yes/NO/N.A	
4	Passageways and walkways clear.	Yes/NO/N.A	
5	Adequate lighting.	Yes/NO/N.A	
6	Waste containers provided and used.	Yes/NO/N.A	
7	Sanitary facilities adequate and clean.	Yes/NO/N.A	
8	Adequate potable water supply.	Yes/NO/N.A	
9	Adequate drinking cups/Glass.	Yes/NO/N.A	
10	Nails, boards, debris removed.	Yes/NO/N.A	
11	Eye flushing facilities available.	Yes/NO/N.A	
12	Emergency showers available.	Yes/NO/N.A	
13	Power Tools (Good Condition, Removed From Service if Defective)	Yes/No/N.A	
14	Tools Inspected Frequently (at least before each use)	Yes/No/N.A	Status

15	Cords & Plugs (3 Prong, Heavy Duty, Not Damaged) Tools effectively grounded or Double Insulated	Yes/No/N.A	
16	All Electrical Receptacles GFCI Protected Tools Used Properly	Yes/No/N.A	
17	Breakers Labeled, High Voltage Signs Posted and Adequate Access	Yes/No/N.A	
18	Damaged Tools Tagged & Removed from Service	Yes/No/N.A	
19	Temporary Lighting (Adequate Bulb Guards, Suited for Location, No Empty Sockets, Not Used as Power Drop)	Yes/No/N.A	
20	All machine periodical checked and daily basis checked register.	Yes/No/N.A	
21	Danger /warning signboards installed suitable place :	Display/Not display/N.A	
22	Sufficient number of emergency light shall be kept for use during unforeseen trouble, there by causing failure of Power Supply inside the tunnel at any time during work/Operation.	YES/NO/N.A	
23	Safety tool box talk regular conducted before star of work :	YES/NO/N.A	
24	Emergency Exit route and emergency assembly point are clearly identified and communication to all employees contactor/sub contractor :-	YES/NO/N.A	
25	Emergency Contact numbers shall be displayed in visible location and also in security Cabin.	Yes/NO/Not available	
26	First Aid Box available at site.(Location Wise)	Yes /No/Not applicable	
27	Stretcher are available at all Site for rescue team/EPR	Yes/NO/Not Applicable	Nos ……
28	Breathing apparatus available at Site	Yes/No/Not Applicable	
29	All sites available EPR /Rescue Plan	Yes/No/Not Available	
30	Emergency Control Room	Yes/No/Not Available	
31	Fire Extinguishers status check Monthly and clearly marked mfg date & Due date.(Location Wise)	Yes /No/Not applicable	
32	Deployed Flag Man Danger location at Construction Sites.	Yes/ NO/Not Applicable	
33	Deployed Whistle Man Damping Yard area/ Any other places	Yes/ NO/Not Applicable	
34	Haul road at working sites water sprinkler	YES/NO/Not Applicable	
35	Head Count at All Tunnel – PH (VT, TRT, MAT), Dam (DT,DC,HRT)	YES/NO/Not Applicable	Nos ……
[C]Tool & Tackles certified by competent person			
1	Hoist & Lifts(Good Mechanical Construction, Sound material, Adequate strength Properly maintained) thoroughly examined by a Competent person-Certified	Yes/No/N.A	Next Due Date-

2	Lifting Machines, Chains, Ropes and Lifting tackles, Winch, Pulley block etc. (Good Mechanical Construction, Sound material, Adequate strength, Properly maintained, thoroughly examined by a Competent person-Certified	Yes/No/N.A	Next Due Date-
3	Pressure Plant and equipment are examined and tested by a competent person-Certified (Properly marked)	Yes/No/N.A	Next Due Date-
[D] Work permit system			
1	Work permit system of excavation	Issued/Not issued/N.A	
2	Work permit System of confined Space	Issued/Not Issued/N.A	
3	Permit to work for Working at Height(Above 2 mtr.)	Issued/Not Issued/N.A	
4	Permit to electrical work.	Issued/Not Issued/N.A	
5	Permit to Ht work	Issued/Not Issued/N.A	
[E] Gas Cylinders			
1	Cylinders are used in upright and secured position. :	Yes/NO/N.A	
2	Empty and full cylinders are properly separated and marked	Yes/NO/N.A	
3	Regulators and torches are undamaged and in sound working condition.	Yes/NO/N.A	
4	All connections are to be leak proof .	Yes/NO/N.A	
5	Hoses are in good condition, free from tape or wrapping materials used for plugging leaks and cracks.	Yes/NO/N.A	
6	Cylinders have been kept away from live electrical cables or ground wires.	Yes/NO/N.A	

Note :- Ensure CAPA on the above observations.
N.A. Stands for Not Applicable

Remarks:

Designation & Signature:

(Officer Contractor) (Officer THDCIL)

Designation:
Date:

Annexure-2

THDC INDIA LIMITED				
TUNNEL SAFETY INSPECTION CHECKLIST				
Site:				**Date:**
Contractor:		**Name of Sub-contractor:**		
Sl. No.	**ITEM**	**OBSERVATION**		**REMARKS**
		Yes	**No**	
A	General Safety			
1	Whether safe means of access provided?			
2	"Is the system of head count exists and followed. If yes. What is the strength today? _____ No."			
3	Is there system of checking use of PPE by the workers prior to their entry in tunnel? If yes, status of its implementation was found satisfactory.			
4	Whether workers inside the tunnel were found wearing helmet and gum boots?			If no, percentage of workers not wearing PPE_____ % Appox.
5	Wheter condition of PPE used by the workers at site was satisfactory to ensure their personal safety?			
6	Whether the vehicle used for transportation of materials inside tunnel are checked for: 1. Vehicle condition. 2. Woking of Head Lights, Reverse horn, Tail light, Brakes including hand brake etc.? 3. Condition of Tyres. 4. Validity of drivers' license.			
7	Ventilation system (Quality & Quantity of Air): 1. Is work environment monitoring done? If yes. 1.1 What is the periodicity? _____ 1.2 Check that monitoring result of following gasesare within following limits: 1.2.1 Oxygen percentage in work environment should not be less than 19.5% inside the tunnel. 1.2.2 Carbon Monoxide not more than 0.005%. 1.2.3 Methane not more than 0.5% at any place inside the tunnel, such as in a cavity in roof etc. 1.2.4 Hydrogen Sulphide not more than 0.001% 1.2.5 Carbon Dioxide not more than 0.5% 1.2.6 Nitrogen fumes not more than 0.0005% 1.2.7 Aldehyde as formaldehyde not more than 0.0002% 2. Whether every compressed air system in tunnel is provided with emergency power supply for maintaining continued supply of compressed air and is capable of operating compressor and ancillary systems of such compressed air system? 3. The emergency power supply system is maintained and is readily available at all times at tunnelling and excavation work.			**Note:** 1. It is essential to make working space safe for workers by keeping the air fresh and respirable and by eliminating harmful and obnoxious dust, dynamite fumes and other gases. 2. Testing of work ebvironment shall be done once in every 24 hrs or after every blast which ever is less. If percentage of following gases found beyond permissible limit withdraw workmen till the percentage is brought down. Record to be properly maintained.

8	Ensure that Air Pipe lines are connected to tunnel.			
9	Ensure emergency esacpe route is free from obstruction all time.			
10	Is the temerature in working chamber is measured once in every hour and record maintained?			Note: Inside temperature should not be more than 290C
11	Whether adequate quantity of suitabe type of fire extinguishers are provided			
12	**Housekeeping:** 1. Whether compressed gas cylinders are kept securely fastened in upright positions when not in use? 2. Whether covers of electrical panels found in place and pose no electrical hazard for the workers? 3. Drainage of seepage water is proper and there was no water logging.			
13	Ensure Fire Fighting Protection System.			
B	**Drilling (Wet)**			
1	Whether workers were found using PPE like Safety Helmet, Safety Shoes, Face Mask, Gloves etc.			
2	Whether loose rocks has been scaled down before drilling?			
3	Whether all mis-fired charges has been removed before resuming drilling operation?			
4	whether 'Ear Plugs/Ear Muff' are provided to the workers for protection against high noise?			
5	Whether working platform of sufficient width (min. 450mm) has been provided for working at height?			
6	Whether simultanous drilling/loading of explosive is being carried out?			
C	**Blasting**			
1	Whether the explosives have been stored in approved magzines?			
2	Whether explosives and detonators are placed in separate insulated standard boxes and in safe custody at site?			
3	Whether the explosives transported in approved explosive vans?			
4	Whether stemming of holes is done by wooden tamping sticks?			
5	Whether before use, each detonator is tested for a positive test with an Ohmmeter and the circuit is tested for insulation and continuity?			
6	Whether suitable Exploder of 25% excess capacity has been used?			
7	Whether electric power, light and other circuits in the vicinity within 70 Mtr. of loading point are switched off after charging and before blasting?			
8	Whether after 5 minutes of blast, a careful inspection of the face is made by the experts to ensure all charges have been blasted?			

9	Has the Alert Siren given 3 times before blasting?			
10	Whether explosive reconcilation records are maintained?			
11	Has the area been cordoned off and all persons maintained to a safe distance?			
D	**Shotcreting Work**			
1	Whether the loose rocks has been scaled down before shotcreting work?			
2	Whether proper illumination level provided at shotcreting workplace?			
3	Whether only special reinforced and approved concrete hoses and couplings are used for shotcrete work?			
4	Whether all connections/couplings (of concrete, water, accelerator and air hoses) are equipped with secondary safety fittings?			
E	**Rib / Segment Errection**			
1	Whether proper lifting arrangements is used for erection of Rib/Segment.			
2	Whether safety control measures are taken for Gas cutting / welding work as per specific welding checklist?			
3	Has the area been cordoned off during erection of Rib/ Segment?			
F	**Electrical Safety**			
38	Whether the electrical cables are in good codition and routed properly above the ground through 'Cable Trays'?			
39	Whether the siting of switch gear/equipment well away from wet/hazardous locations?			
40	Whether all the electrical connections are routed through ELCB?			
41	Whether all the metal parts of electrical equipment & light fittings / accessories are properly grounded?			
42	What is the periodicity of testing and inspection of emergency lights? Is the record of inspection / testing maintained?			
43	Whether statutory safety warning signs are displayed properly at the workplace.(DANGER)?			
44	Whether Insulated Rubber Mats are provided infront and back side of electrical panels inside tunnel?			
45	Whether Electrical Safety Shoes, Rubber Gloves and Insulated electrical tools provided and used for electrical maintenance?			

Signature:
Officer, THDCIL
Designation

Signature:
Officer, Contractor
Designation

Copy to;
1.
2.
3.
4.

Annexure-3

THDC INDIA LIMITED					
ELECTRICAL SAFETY INSPECTION CHECKLIST					
Site:					**Date:**
THDCIL:		**Name of Contractor:**			
Sl. No.	**DESCRIPTION**	**STATUS**			**REMARKS**
		Yes	**Corrective Action Required**	**NA**	
1	Verify adequate working clearances, dedicated spaces and headroom around equipment provided.				
2	Verify that working spaces have adequate illumination.				
3	Whether IS: 15652 mark Insulated Mats for electrical purpose Rubber are provided in front of electrical panels?				
4	Verify that electrical distribution boards are securely fastened, supported and covered.				
5	Verify that all electrical panels are accessible.				
6	Verify that nomenclature / Identification label is marked on all electrical panels / Distribution Boards.				
7	Verify that electrical switches in wet locations are properly installed in weatherproof enclosures.				
8	Are the equipments provided with main switch & emergency stop switch?				
9	Verify that improper/unsafe joints in electrical cables/ wire were not obsrved at site.				
10	Verify that single insulated flexible wires are not used at site.				
11	"Danger" signs are displayed at approprotae (High Voltage) locations like Transformer area etc.				
12	Are the installation protected against overload, short-circuit , and earth leakage by suitable protective devices.				
13	Are the Distribution Boards / SDBs are connected with 'Earth Conductor'?				
14	Varify that DBs and Extension Boards installed in uncovered areas are protected from rain or wheather conditions.				
15	Whether ELCBs are provided for electrical connections?				
16	Are ELCBs numbered & tested periodically and record of test results maintained?				
17	Does LOTO (Lock Out/Tag Out) system is used for electrical isolation during maintenance?				
18	Are the electrical cables routed above ground level and away from water line?				
19	Varify that exposed terminals are not existing at site.				

20	Is there adequate audio-visual warning system to warn workers before changing over to DG supply in case the main supply fails?				
21	Varify that portable electrical equipments are connected through loose wires. Three pin industrial plugs are used for electrical connection..				
22	Varify that temporary electrical connections to equipments are not given in usafe manner from open electrical panels.				
23	Varify that electrical maintenance staff do not use damaged or defective tools.				
24	Varify that PPE required for personal protection against electrical hazards are available and used by the workers at site.				

Officer THDCIL_____Designation_____Sign_____

Officer Contractor_____Designation_____Sign_____

Copy to;

1.

2.

Annexure-4

THDC INDIA LIMITED					
VEHICLE INSPECTION CHECKLIST					
Site:					**Date:**
Owner of the Vehicle:		**Contractor Name:**			
Vehicle Registration No.:		**Used For:**			
Sl. No.	**ITEM**	**STATUS**			**REMARKS**
		OK	**Needs Repair**	**N.A.**	
1	Validity of Vehicle Registration				
2	Valid Pollution Under Check Certificate valid				
3	Valid Vehicle Insurance				
4	Valid Driving Licence: Heavy / Medium /Light Vehicle				
5	Physical fitness of the Driver				
6	Driving skill / experience in hilly area				
7	Knowledge about road safety signs				
8	Visual checking of Engine condition of the vehicle / Oil leakage observed				
9	Working of Hydraulic System				
10	Rear Mirror				
11	Lights (Head Light/Brake Light/Reverse/Beacon Light				
12	Indicators (Left: Front / Back) (Right: Front / Back)				
13	Battery Condition / Instant Vehicle Start-up				
14	Brakes (Foot Brake / Hand Brake)				
15	Wipers condition				
16	Horn including Reverse Horn				
17	Drivers Seat Belt				
18	Tyre Condition including Stepney				
19	Emergency Information Panel & Phone Nos. Displayed				
20	Condition of portable Fire Extinguisher				
21	Drivers knowledge in operation of Fire Extinguisher				
22	Condition of First Box /Kit				
23	Overall physical condition of the vehicle				
24	Abnormal noise observed: Yes / No				
25	Any other observation:				

Inspector's Remark:

1. *The above vehicle has been checked and found fit for use.*
2. *The above vehicle has been checked and found unfit for use. The owner should be advised to repair / replace items listed at Sl. No. within two week. Re-inspection of this vehicle will be done after two weeks till then vehicle is allowed for use / considering potential risk in its operation, use of this vehicle is not allowed till it is declared fit for use after re-inspection.*

Joint Inspection conducted By:

THDCIL Officer: Name: _____Designation: _____Signature:_____

Contractor Officer : Name: _____Designation:_____ Signature:_____

Copy to:

1

2

3

Annexure-5

THDC INDIA LIMITED
SAFETY AUDIT CHECKLIST AS PER IS: 14489 – 2018

Sl. No.	Description	Present Status
1.	**Occupational Health & Safety (OH & S) Policy**	
1.1	Does the plant has Health & Safety or HSE or SHE Policy	
1.2	Does the organization have a corporate Safety policy	
1.3	Signatory of Safety policy	
1.4	As per statutory guideline Safety Policy is prepared	
1.5	When Safety Policy is declared & adopted	
1.6	How many times it has been updated till date?	
1.7	Is the SP is made known to all concerned?	
1.8	Is SP scrutinized by an expert external agency?	
1.9	What is the last date of updating of Safety Policy?	
1.10	Does it find a place in company's annual report?	
2.	**Safety & Health Organization (A) Safety Department**	
2.1	Safety department existing	
2.2	If yes, a) Head of Safety Dept.- Name, Designation,	
2.3	Qualification, Status	
2.4	b) Safety Dept. strength including Safety Officer and Staff	
2.5	Does Safety Head report to the Chief Executive	
2.6	How often Safety Officer are retrained in the latest techniques of Safety Management? Frequency	
2.7	What are the additional duties SO is required to do	
2.8	What is the power of SO regarding unsafe act and unsafe condition?	
3.	**(B) SAFETY COMMITTEE (S) (SC)**	
3.1	Does the Factory has Safety Committee? Their types, structure and terms of reference	
3.2	Is the tenure of the SC as per statute?	
3.3	Selection of SC elected or nominated	
3.4	Frequency of SC meet	
3.5	What are the subjects/ or the problem discussed in the meeting	
3.6	How are recommendations of the committee(s) implemented?	

3.7	Are the minutes of the safety committee(s) implemented?	
3.8	Are the minutes forwarded to the trade union(s) and chief executive and occupier?	
3.9	How the management and trade union are play their active roles in supporting and accepting the committee(s) recommendation(s)?	
3.10	How are the safety committee(s) members apprised of the latest developments in safety health and environment?	
4.	**(C) SAFETY BUDGET**	
4.1	What is the annual safety budget?	
4.2	How much percentage is this budget of the total turnover of the Company?	
4.3	How much budget has utilized till date?	
4.4	Is the safety budget adequate?	
4.5	How is the safety budget arrived at?	
4.6	What is the pattern of expenditure for the last five years?	
4.7	What are approved sanctions for the expenditure in this budget?	
4.8	Does this budget get reflected in the annual report of the company?	
5.	**ACCIDENT REPORTING, INVESTIGATION AND ANALYSIS**	
5.1	Whether accident data for the last three years for reportable and nonreportable accident available?	
5.2	Is there any system of classifying and analysing the near-miss incidents and accidents? Give the details.	
5.3	Are all near-miss incidents and accidents reported and investigated?	
5.4	For how many years are the investigation report retained?	
5.5	By whom the accident statistics and data are maintained?	
5.6	How is the management apprised of these data?	
5.7	Is the accident statistics effectively utilized?	
5.8	What nature of injuries occurred during last three years?	
5.9	How do you ensure implementation of the recommendations to avoid the recurrence of the incidents and accidents?	
6.	**SAFETY INSPECTIONS**	
6.1	What type of safety inspections are carried out and what are their frequency?	
6.2	Is there any system of internal inspection?	
6.3	Who does the inspections?	
6.4	Are the check-list prepared for these inspections? (Specify item-wise, e.g. House Keeping, fire protection, etc.).	

6.5	To whom the recommendations are submitted?	
7.	**SAFETY EDUCATION AND TRAINING (A) Training**	
7.1	Is there any training department?	
7.2	Is there any program of induction training?	
7.3	Mention the duration of induction training for each category of employees	
7.4	Whether the assessment of the trainee worker is done?	
7.5	What infrastructure facilities with audio-visual support are available for training?	
7.6	Do the programs cover the plant safety rules, hazard, communication and any other special safety rules or procedures unique to the plant or specific departments?	
7.7	Whether the training programs are conducted in the local language?	
7.8	Whether visits to safety institutions / organizations are arranged?	
8.	**(B) Periodic Training / Retraining**	
8.1	Are all the employees trained and what is the frequency of such training?	
8.2	Do training programs cover safety and health aspects and if so how many sessions?	
8.3	Do the trained supervisors train their own employees in safety and health aspects?	
8.4	Is the retraining performed whenever new hazard / process changes are followed / introduced?	
8.5	How are the senior management personnel trained in safety and health?	
8.6	How many employees have been trained in safety and health in the last five years? Give break up?	
8.7	How may man-days / hours are used in training the employees?	
8.8	How do you ensure that the training is put to use by the employees trained in safety and health.	
8.9	What is the training plan for next two years? Give details?	
8.10	What documentation system has been established regarding safety and health training?	
8.11	Does the factory has safety suggestion schemes?	
8.12	Does your factory participate in National Awards / Suggestion schemes?	
8.13	Has your factory been awarded during last five years?	
8.14	Are safety contest organized in the factory?	
8.15	What are the publications of your organization? Do they include information on safety and health subjects?	
8.16	Is the literature on safety and health made available to the employees?	

8.17	How is the safety and health publicized in your factory? i) Bulletin boards ii) Post serious accidents iii) Newsletter iv) Others, specify	
8.18	Does the organization celebrate safety day / week or organize safety exhibition?	
8.19	When was the last safety day / week celebrated?	
8.20	Are adequate number of first aid boxes provided? Give locations details?	
8.21	Is there any first aid / ambulance room?	
8.22	Are qualified / trained first aider available in each shift?	
8.23	How many qualified / trained first aider are available?	
8.24	How many persons are trained /given refreshers training in first aid in a year?	
8.25	Whether occupational safety and health centre is provided or not?	
8.26	Does it confirm to the provisions of the existing legislation	
8.27	Are the Medical Attendants / Doctors available in each shift?	
8.28	Is ambulance van available in each shift?	
8.29	Any liaison with the nearest hospital (s)? Give details.	
	GENERAL WORKING CONDITION	
9.	**(A) House Keeping**	
9.1	Are all the passages, floors and the stairways in good condition?	
9.2	Do you have the system to deal with spillage?	
9.3	Do you have sufficient disposable bins clearly marked and whether these are suitably located?	
9.4	Are drip trays positioned wherever necessary?	
9.5	Do you have adequate localized extraction and scrubbing facilities for dust, fumes and gases? Please specify.	
9.6	Whether walkways are clearly marked and free from obstruction?	
9.7	Do you have any inter-departmental competition for good housekeeping?	
9.8	Has your organization elaborated good housekeeping practices and standards and made them known to the employees?	
9.9	Are there any working conditions which make the floors slippery? If so, what measures are taken to make safe?	
9.10	Does the company have adequate measures to suppress polluting dust arising our from road transport?	
9.11	Are there any machine/processes generating noise. Specify?	
9.12	Was any noise study conducted?	
9.13	Which are the areas having high-level noise?	

9.14	Have engineering and administrative controls been implemented to reduce noise exposure below the permissible limits?	
9.15	Is there a system of subjecting all those employees to periodic audiometric test who work in high level noise areas?	
9.16	Whether the workers are made aware of the ill effects of high noise?	
9.17	Whether any personal protective equipment along with ear muffs / plugs are provided and used?	
10.	**(B) Ventilation**	
10.1	Whether natural ventilation is adequate or not?	
10.2	Whether dust / fumes / hot air is generated in the process?	
10.3	Is there any exhaust dilution, ventilation system in any section(s) to check the record?	
10.4	Whether any ventilation study has been carried out in the section(s) to check the record?	
10.5	Are periodic / preventive maintenance of ventilation system carried out and record is maintained.	
10.6	Does any ventilation system recirculate the exhausted air in work areas?	
10.7	Is the work environment assessed and monitored?	
10.8	Whether personal protective equipment are given to workers exposed to dust / fumes and gases? Give details.	
11.	**(C) Illumination**	
11.1	Was any study carried out for the assessment of illumination level?	
11.2	Is there any system of periodical cleaning and replacing the lighting fittings / lamps in order to ensure that they give the intended illumination levels?	
11.3	Are the workers subject to periodic optometry test and records maintained?	
12.	**Hazard Identification and Control**	
12.1	Are all the hazardous areas identified?	
12.2	What are the types of hazards (physical-noise, heat, etc. and chemicalfire, explosion, toxic release etc.)?	
12.3	What steps have been taken to prevent these hazards?	
12.4	Are there any safety inter-locks, alarms and trip systems? Give details	
12.5	Are these tested periodically? How often? Please specify.	
12.6	Are there any ambient monitoring devices with alarm for leakage of hazardous materials?	
12.7	Are there audit of HAZOP or any other studies carried out and the recommendations implemented?	

12.8	What has been the major modification done in plant / process and has the approval of the competent authority concerned?	
12.9	What decision and monitoring equipment are available and used for checking the environmental conditions in and around the plant?	
	TECHNICAL ASPECT	
13.	**SAFE OPERATING PROCEDURES (SOP)**	
13.1	Are written safe operating procedures available for all operations?	
13.2	Whether the SOP are prepared jointly by the plant and safety departments?	
13.3	What system is used to ensure that the existing SOP is updated?	
13.4	Have the workers been informed of the consequence of failure to observe the SOP?	
13.5	Are contractor workers educated & trained to observe safety at workplace?	
13.6	Whether contractor's workers are permitted on process / operations?	
14.	**WORK PERMIT SYSTEM**	
14.1	What necessary type of work permits exists in your factory?	
14.2	What are the hazardous chemicals handled?	
14.3	Are the keys kept for individual locks which are used for electrical lock outs with the supervisor concerned?	
15.	**WASTE DISPOSAL SYSTEM**	
15.1	Is identification done for various types of wastes? Give details	
15.2	Are these quantities less than those specified by the Hazardous wastes? (Management & Handling) Rules, 1989	
15.3	What are their disposal modes?	
15.4	What is the system / measures adopted for controlling air / waste / land pollution?	
15.5	What is the system of effluent treatment plant and whether it is approved by the competent authority?	
15.6	How are the treated effluent used?	
16.	**PERSONAL PROTECTIVE EQUIPMENT (PPE)**	
16.1	Has a list of required PPE for each area / operation been developed and the required PPE is made available to the workers?	
16.2	Are the safety department & the workers consulted in the selection of PPE?	
16.3	Have the workers been trained in proper use of PPE?	
16.4	What is the system of replacement / issue / of PPE?	
16.5	What is the arrangement for safe custody and storage of PPE provided to the workers?	

16.6	Are the contractor's workers provided with the required PPE? Who is responsible? Give details.	
16.7	Are the PPE confirming to any standard?	
16.8	Give the details of PPE and also specify the responsibility for their inspection and maintenance?	
17.	**FIRE PROTECTION**	
17.1	Indication on a plant layout the location, number (quantity) and type of portable fire extinguishers available?	
17.2	Are the firefighting system and equipment approved, tested and maintained as per relevant standard?	
17.3	What is the inspection & maintenance schedule of the above extinguishers? Who performs these functions?	
17.4	Which areas of the plant are covered by the fire hydrants? Indicate the locations of hydrant points and how the required pressure maintained in the system and ensured.	
17.5	What is the capacity of water reservoir for supply to the hydrants? What is the source of water?	
17.6	i) How is the power supply to the hydrant pump ensured? ii) What is the alternate source of supply in case of power failure?	
17.7	Are all personnel conversant with the fire prevention and protection measures?	
17.8	What Percentage of plant personnel & staff and officers, have been trained in the use of portable fire Extinguishers?	
17.9	Do you have fixed or automatic fire fighting installation(s) in any section of your plant?	
17.10	Are the fire alarms adequate and free from obstruction?	
17.11	Do you have fire dept.? If yes, give details	
17.12	What is the system for conducting mock drills?	
17.13	Do you have any mutual aid scheme with any of your neighbouring industry or local organizations(s)?	
17.14	Give details of the existing fire resistant walls and doors	
17.15	Do you have any system of color coding for all the pipelines for hazardous chemical? Give details including marking of flow direction.	
17.16	Are there any safe containers for the movement of small quantities of hazardous chemicals? Give details	
17.17	Are all self-closing fire doors in good condition and free from obstructions?	
17.18	How many major and minor incidents/fires were there in the factory during last five years? Give department / Plant wise.	
17.19	Have all the fires / incidents been investigated and corrective actions taken?	

18.	**EMERGENCY PREPAREDNESS**	
18.1	Is there an on - site emergency plan for your factory?	
18.1	What is the frequency of conducting mock drill of on - site emergency plan?	
18.2	What are the number & location of emergency control centre, assembly points?	
18.3	Whether emergency team or the key personnel identified?	
18.4	Are suitable & adequate protective & rescue equipment available?	
	How is the emergency rescue team trained to use these equipment?	
18.5	How is the emergency communications with local bodies & other organizations ensured?	
18.6	Is any alternate power source identified?	
18.7	What is the medical emergency response system?	
18.8	Are you a member of any MUTUAL - AID - SCHEME of your area?	
18.9	How many emergency alarm system(s) is / are available?	
19.	**PLANT LAYOUT & AREA CLASSIFIACATION**	
19.1	What is the system of classification of hazardous zones in the plant for electrical installations?	
19.2	Whether a qualified person does periodic inspections and preventive maintenance of electrical installations & records in maintained?	
19.3	Whether plant layout with area classification has been displayed at appropriate place(s)?	
20.	**STATIC ELECTRICITY**	
20.1	Whether the process(s) & equipment generate & accumulate static charge have been identified? Give details.	
20.2	Whether all such equipment are properly bonded & earthed?	
20.3	Are Periodic inspections done and recorded.	
20.4	Are adequate arrangements made at the terminal points where hazardous chemicals are handled through pipes?	
20.5	Are anti-static charged devices fitted wherever necessary?	
20.6	Have all the fires / incidents been investigated and corrective action taken?	
21.	**PRESSURE VESSELS (FIRED & UNFIRED)**	
21.1	Give details of the plants, piping & Vessels / Pressure greater than the atmospheric pressure?	
21.2	How is it ensured that the working pressure inside the pressure vessels / pressure for which it is designed?	
21.3	What means of isolating the pressure vessels or means to prevent rise in pressure are installed?	

21.4	What standards / codes of practices are adopted for design, fabrication, operation & maintenance of the pressure vessels & records maintained?	
21.5	How are the pressure vessels tested?	
21.6	Is there any competent person for testing these pressure vessels?	
21.7	Give details of safety devices available for these pressure vessels?	
21.8	Whether log book for pressure vessels & pressure plant has been maintained?	
22.	**NEW EQUIPMENT REVIEW**	
22.1	What is the system for effecting any change in the existing plant equipment or process? Whether it is approved by the appropriate competent authority?	
22.2	Whether Piping & Instrumentation diagram & other related documents are updates accordingly?	
23.	**LIFTING MACHINES & TACKLES**	
23.1	Whether all the lifting machine are marked with SWL?	
23.2	Are all the examinations & tests documented in the prescribed form?	
23.3	Are all the examinations & tests carried out & certified by competent person? Give details.	
23.4	Are adequate lifting tackles provide at all places where it is required? Give details.	
23.5	Are the trained operators engaged for operating the equipment? Give details.	
23.6	What is the system of training such operators?	
23.7	Are all the lifting machine & tackles are maintained in good condition & record maintained?	
24.	**MOBILE EQUIPMENT 7 VEHICULAR TRAFFIC**	
24.1	Are all the mobile equipment are in good condition?	
24.2	Are trained drivers engaged for fork lift trucks?	
24.3	What is the system for identifying these drivers from other drivers?	
24.4	What system do you adopt to access their standard driving as poor/fair/ satisfactory/good?	
24.5	Are there adequate number of signs & signals?	
24.6	Are the hazards associated with transportation within the plant identified & safety measures taken? Give details.	
25.	**ACCESS**	
25.1	Is adequate safe access provided to all places there workers need to work?	
25.2	Are all such access in good condition?	
25.3	Are portable access platforms necessary? If yes:	
25.4	i) Are these sufficient?	

25.5	ii) Are these regularly inspected?	
25.6	iii) Are these provided with toe-boards and railings?	
25.7	Are all drain covers in good condition & fitting flush?	
26.	**MATERIAL HANDLING**	
26.1	Are these adequate storage facilities available?	
26.2	Are these areas clearly defined?	
26.3	Are all racks & steel ages in good condition?	
26.4	Have you adequate equipment for handling materials?	
26.5	Do the workers know the hazards associated with manual material handling?	
26.6	Where manual handling is necessary, are the workers been trained	
26.7	Do they practice this?	
26.8	Do Workers follow safe procedures for storage of materials?	
26.9	Whether contractor workers are trained in safety?	
26.10	What is the system for handing over plant to the maintenance department & receiving back?	
26.11	Is the system consistently applied?	
26.12	What is the system for the preventive & predictive maintenance & how do you ensure its effectiveness? Give details.	
27.	**TANK STORAGE VESSEL AREA**	
27.1	Whether it is pressure vessel or not?	
27.2	Give storage vessels designation (exceeding threshold quantities specified in MSIHC. Rules 1989)	
27.3	Give the names of storage materials in each of them.	
27.4	What are the vessel sizes (capacity of tones)?	
27.5	What is the material of construction for each vessel & what standards followed in designing fabricating the vessel?	
27.6	What are the operating pressure & temperature?	
27.7	What are the vessels location? (please indicate on-site plan or plot plan)	
27.8	Indicate whether vessels are above ground/ underground?	
27.9	If any of the tanks storing flammable material, whether	
27.10	Electrical installations are flameproof or not?	
27.11	Are these storage vessels bunded / dyked?	
27.12	If yes, what is the capacity of the bunds/dykes?	

27.13	Are the vessels isolated in the event of a mishap?	
27.14	How are the vessels isolated in the event of a mishap?	
27.15	Are the vessels fitted with remotely controlled isolation	
27.16	Are vessels provided with emergency vent relief valve, bursting disc, level indicator, and pressure gauge overflow line?	
27.17	Where such do vents discharge?	
27.18	Are the vessels provided with alarms for high level, high temperature & high pressure?	
27.19	Are stand by empty tanks provided for empty in case of emergencies?	
27.20	What are the provisions made for firefighting / tackling emergency situations around the storage vessels?	
27.21	Has any consequence analysis been carried out for these vessels? (If yes give details).	
27.22	What periodical testing is carried out on the vessels to find out the integrity of the vessels?	
27.23	Whether these tests are certified by the approved competent persons?	
27.24	Whether log sheets are filled up on daily basis for recording the parameters of these vessels?	
27.25	On-Site Gas Cylinders Storage Area	
27.26	What are the various gas cylinders used in the plant? Give details.	
27.27	What are the storage facilities?	
27.28	What are the measures taken for combating any emergency in the cylinders storage area?	
27.29	Are valid licenses available for storing all these cylinders?	
27.30	Whether public address system is checked periodically for its proper functioning?	
28.	**COMMUNICTION SYSTEM ADOPTED IN PLANT**	
28.1	Are public address system available in all plant areas?	
28.2	Are public address system provided with uninterrupted power supply?	
28.3	Whether public address system is checked periodically for its proper functioning?	
28.4	Is there any hot line provided to fire station?	
28.5	What is the means of communicating emergency in the plants?	
29.	**TRANSPORTATION**	
29.1	What potentially hazardous materials are transported to or from the site (Including Wasters)?	
29.2	What modes of transport are used?	

30.	**ROAD**	
30.1	Does the company employ licensed vehicle of its own/ outside sources?	
30.2	Are loading/unloading procedures, on-site & safety precautions displayed?	
30.3	Are loaded tankers or trucks parked in a specific area, on-site?	
30.4	Do all trucks & tanker drivers carry TREM card or instruction booklet?	
30.5	Do all truck & tanker drivers get training in handling emergencies during transport?	
31.	**RAIL**	
31.1	What hazardous materials are transported by rail?	
31.2	Does the company have a direct siding on site?	
32.3	Are tankers or others wagons used in transportation?	
32.4	PIPELINES	
32.5	What materials are transported to & from the site by pipeline?	
32.6	Are the pipelines underground or over ground?	
32.7	Are corrosion protection measures employed to the pipelines?	
32.8	Whether intermediate booster pumps are used?	
32.9	What the maximum, minimum & average transfer rates?	
32.10	Are the pipelines extended in the public domain?	
32.11	Are the pipelines dedicated for each type of chemicals?	
32.12	Are the pipelines fitted with safety equipment such as leak detectors, automatic shut off walls etc.	
32.13	What is the frequency & method of testing pipelines?	
32.14	Is there written procedures for tacking leakages in pipelines?	

Remark:

Signature:
Name:
Designation:
(Officer Contractor)

Signature:
Name:
Designation
(Officer THDCIL)

Date:

Annexure-6

THDC INDIA LIMITED
COMMON CHECKLIST FOR ALL THDCIL POWER PLANTS / PROJECTS

<table>
<tr><th>Sl. No.</th><th>Elements to be checked during audited</th><th>Section (S)
Rule (R)</th></tr>
<tr><td>1</td><td>Accredited for;
a) ISO 9001 – 2015, Quality Management System (QMS)
b) ISO 14001-2018, Environmental Management System (EMS)
c) ISO 45001 – 2018, Occupational Health and Safety Management System</td><td></td></tr>
<tr><td>2</td><td>Strength of the Plant / project
<table>
<tr><th>Sl. No.</th><th colspan="2">Strength</th></tr>
<tr><td>1</td><td>THDC Employee</td><td></td></tr>
<tr><td>2</td><td>Contract Workers</td><td></td></tr>
<tr><td colspan="2">Total</td><td></td></tr>
</table></td><td></td></tr>
<tr><td>3</td><td>Registration of establishment to submit information relating to employment of Inter-state Migrant Worker accompanied by fee within 60 days</td><td>R-3/2020</td></tr>
<tr><td>4</td><td>License and Registration of Factory (Form-4)</td><td>S-6 / R-7</td></tr>
<tr><td>5</td><td>Registration of Establishment under BOCW (the Building and Other Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996 & Central Rules, 1998)</td><td>S-7 / R-7</td></tr>
<tr><td>6</td><td>Notice of Opening of Mine (Form-I) (Coal Mines Regulations, 1957)</td><td>S-16 / R-4</td></tr>
<tr><td>7</td><td>Petroleum License under Petroleum Rules-2002
a) Petroleum Class-A: Capacity: KL Valid up to:
b) Petroleum Class-B: Capacity: KL Valid up to:
c) Petroleum Class-C: Capacity: KL Valid up to:</td><td>R-141</td></tr>
<tr><td>8</td><td>Fire NOC ‘No Objection Certificate’ under Approval of Plan</td><td>S-6/R-3(1g)</td></tr>
<tr><td>9</td><td>Notification of Occupier</td><td>S-3(n)</td></tr>
<tr><td>10</td><td>Notification of Employer (under BOCW Act, 1996)</td><td>2 (i)</td></tr>
<tr><td>11</td><td>Notification of Owner under the CEA Regulation, 2011</td><td>2 (c)</td></tr>
<tr><td>12</td><td>Notice of Manager (Form-4A)</td><td>R-14C / D</td></tr>
<tr><td>13</td><td>a) Drinking Water Monitoring (Twice a year) Under Factories Act/State Rules
b) Drinking Water Point should not be within 6M of Urinal, BOCW Act
c) Drinking Water Point Should not be within 6M of Urinal, Mines Act, 1952</td><td>S-18 / R-38
S-32
S-19</td></tr>
<tr><td>14</td><td>Health & Safety Policy (S-40 of BOCW Act) and Factories Act, 1948</td><td>S-7A(3)/R-63B</td></tr>
<tr><td>15</td><td>a) Constitution of Safety Committee, Factory Act and State Rules
b) Constitution of Safety Committee, (BOCW Act, 1996)
c) Constitution of Safety Committee, (CEA Regulation,2011)</td><td>S-41/R-62B
S-38
R-6</td></tr>
<tr><td>16</td><td>Nomination of ‘Electrical Safety Officer’ (CEA Regulation, 2010)</td><td>R-5</td></tr>
<tr><td>17</td><td>Inspection of electrical installation (CEA Regulation, 2010)</td><td>R-43</td></tr>
</table>

18	**First-aid boxes** (BOCW Rule-231)	S-45 / R-66
19	**Ambulance Van**	R-63K
20	**Occupational Health Centre**	R-63J
21	**Ambulance Room** (BOCW Rules, R-227, Schedule-V)	S-45 / R-67
22	a) **Medical Examination of Factory workers engage in hazardous process** b) **Medical Examination of Building workers** (BOCW Central Rules) c) Medical Examination of Power Plant Workers (CEA Regulation, 2011)	S-41C/R-63H R-81 & R-223 R-5
23	**Testing and Examination of Pressure Plant / Vessels** (BOCW Central Rules)	S-31/R-56 R-207
24	**Testing and Examination of Hoist / Lifting Machines** a) Hoists b) Lifts and Lifting Tackles (BOCW, R-56)	 S-28/R-55 S-29/R-55A
25	**On-site Emergency Plan** (Factory Act & CEMA Rules, 1996) (CEA Regulation, 2011) **Emergency Action Plan** (BOCW Central Rules) (a) Fire and explosion; (b) Collapse of lifting appliances and transport equipment; (c) Collapse of building, sheds or structures, etc.; (d) Gas leakage or spillage of dangerous goods or chemicals; (e) Drowning of building workers sinking of vessels; (f) Landslides worker buried, floods, storms, natural calamities; and (g) Electrocution	R-13 R-9 R-36
26	**Mock Drill Observation**	
27	**Work Permit System**	
28	**MSDS**	R-63C
29	**Consolidate Consent to Operate and Authorization, under EPA, 1986** - The Water (Prevention and Control of Pollution) Act, 1974 - The Air (Prevention and Control of Pollution) Act, 1981; and - Hazardous Waste (Management, Handling & Transboundary) Rules, 2008	
30	**Authorization of Biomedical Waste** (Bio Medical Waste Mgt. & Handling) Rules, 2016	R-10
31	**National Ambient Air Quality Monitoring** [Environmental (Protection) Rules, 1986]	R-3(3B) Sch-VII
32	**Ambient Air Quality Standard Monitoring in respect to Noise** [Environmental (Protection) Rules, 1986]	R-3(3B) Sch-III
33	**Work Zone Noise Monitoring** (Factories Act, 1948)	S-7A
34	**D.G. Set Noise Monitoring** [Environmental (Protection) Rules, 1986]	
35	**D.G. Set Stack Monitoring [Environmental** (Protection) Rules, 1986]	
36	Emergency Preparedness to manage SF6 emergency incident	

37	**Fire Safety Measures** a) Automatic Fire Dampers in AC/AHU Ducts b) Periodical Test Record of Smoke Detectors c) Availability of SCBA Sets and Training in donning SCBA Set d) Availability of Fire Extinguisher e) Training of persons in use of fire extinguishers	S-38 / R/63
38	**Display of safety signage and Emergency Escape Route**	
39	**Earthing Pits' Identification and Testing record**	

1.1 Thermal Power Station Related Safety Audit Checklist

1.	Registration of Boiler	
2.	Boiler Operation Engineer / Boiler Operator Certificate	
3.	Conveyor Belt Safety	
4.	Railway Safety	
5.	Safety in coal handling	
6.	Coal Dust Safety Measures	
7.	Coal yard fire safety measures	
8.	Safety in Storage and Handling of Hydrogen Gas	
9.	Safety in Handling and Storage of Chlorine Gas	
10.	Safety in Handling and Storage of HCl	
11.	Safety in Handling of ash	
12.	Ash disposal procedure	
13.	Safety measures in HSD Unloading Station *(Availability of Wheel Chock & Earthing arrangement of tankers)*	
14.	Fire Safety System in bulk HSD Storage / Pumping Station	
15.	Communication Systems including emergency communication	
16.	Fire Safety Measures in Control Room	
17.	Battery Bank Safety *(Eye Washer & Safety Shower installed and working)*	
18.	Training and awareness among workers in operation of fire safety	
19.	Road Safety Systems	
20.	Switch Yard LOTO System	
21.	Safety Work Permit	
22.	Housekeeping in Switch Yard	
23.	Display of 'Artificial Resuscitation Chart' in switchyard	
24.	Training of workers in CPR	
25.	Availability of Ambu Bag	
26.	Availability and use of PPE (Safety Helmet, Hard Toe Safety Shoes and Full Body Harness Safety Belt etc.)	
27.	Provision of emergency light in staircases	

28.	Testing record of 'Smoke Detectors' installed in Cable Galleries	
29.	Provision of Toe Board / Guards	
30.	Unsafe Floor Openings	
31.	Availability of MSDS of chemicals at points of their storage and/or use	
32.	Direction of flow markings on pipelines	
33.	Colour code of pipelines	
34.	Display of emergency communication numbers at important locations	
35.	Installation of 'Wind Soak'	
36.	Availability of Qualified Doctor in OHC	
37.	Number of Beds	
38.	Whether Bio-medical Waste is disposed of to an agency approved by SPCB.	
39.	Whether Hazardous Waste is disposed of to an agency approved by SPCB.	
40.	Record od submission of Annual Report on Form-5	

1.2 Hydro Power Station Related Safety Audit Checklist

1.	Safety measures in HSD Unloading Station *(Availability of Wheel Chock & Earthing arrangement of tankers)*	
2.	Fire Safety System in bulk HSD Storage / Pumping Station	
3.	Communication Systems including emergency communication	
4.	Fire Safety Measures in Control Room	
5.	Emergency Exits *(Displayed and Open Outward)*	
6.	Battery Bank Safety *(Eye Washer & Safety Shower installed and working)*	
7.	Training and awareness among workers in operation of fire safety	
8.	Road Safety Systems	
9.	Switch Yard LOTO System	
10.	Safety Work Permit	
11.	Housekeeping in Switch Yard	
12.	Display of 'Artificial Resuscitation Chart' in switchyard	
13.	*Training of workers in CPR*	
14.	Availability of Ambu Bag	
15.	Availability and use of PPE (Safety Helmet, Hard Toe Safety Shoes, High Visibility Jackets and Full Body Harness Safety Belt etc.)	
16.	Provision of emergency light in staircases	
17.	*Testing record of 'Smoke Detectors' installed in Cable Galleries*	
18.	Provision of Toe Board / Guards	
19.	Unsafe Floor Openings	
20.	Availability of MSDS of chemicals at points of their storage and/or use	
21.	Direction of flow markings on pipelines	
22.	Colour code of pipelines	

23.	Display of emergency communication numbers at important locations	
24.	Availability of Qualified Doctor in OHC	
25.	Number of Beds	
26.	Whether Bio-medical Waste is disposed of to an agency approved by SPCB.	
27.	Whether Hazardous Waste is disposed of to an agency approved by SPCB.	
28.	Record od submission of Annual Report on Form-5	
29.	Boat	

Remark:

Signature:
Name:
Designation:
(Officer Contractor)

Signature:
Name:
Designation
(Officer THDCIL)

Date:

Annexure-7

THDC INDIA LIMITED
LADDER SAFETY CHECKLIST

ITEM TO BE CHECKED	Needs Repair	O.K.
General		
Loose steps or rungs (considered loose if they can be moved at all with the hand).....	☐	☐
Loose nails, screws, bolts, or other metal parts	☐	☐
Cracked, split or broken uprights, braces, steps, or rungs	☐	☐
Slivers on uprights, rungs, or steps	☐	☐
Damaged or worn nonslip base	☐	☐
Rusted or corroded spots	☐	☐
Step Ladders		
Wobbly (from side strain)	☐	☐
Loose or bent hinge spreaders	☐	☐
Stop on hinge spreaders broken	☐	☐
Broken, split, or worn steps	☐	☐
Loose hinges	☐	☐
Extension Ladders		
Loose, broken, or missing extension locks	☐	☐
Defective locks that do not seat properly when the ladder is extended	☐	☐
Deterioration of rope, from exposure to acid or other destructive agents	☐	☐
Trolley Ladders		
Worn or missing tires	☐	☐
Wheels that bind	☐	☐
Floor wheel brackets broken or loose	☐	☐
Floor wheels and brackets missing	☐	☐
Ladders binding in guides	☐	☐
Ladder and rail stops broken, loose, or missing	☐	☐
Rail supports broken or section of rail missing	☐	☐
Trolley wheels out of adjustment	☐	☐
Trestle Ladders		
Loose hinges	☐	☐
Wobbly	☐	☐

Loose or bent hinge spreaders	☐	☐
Stop on hinge spreader broken	☐	☐
Centre section guide for extension out of alignment	☐	☐
Defective locks for extension	☐	☐
Sectional Ladders		
Worn or loose metal parts	☐	☐
Wobbly	☐	☐
Fixed Ladders		
Loose, worn, or damaged rungs or side rails	☐	☐
Damaged or corroded parts of cage	☐	☐
Corroded bolts and rivet heads on inside of metal stacks	☐	☐
Damaged or corroded handrails or brackets on platforms	☐	☐
Weakened or damaged rungs on brick or concrete slabs	☐	☐
Base of ladder obstructed	☐	☐

Signature:
Name:
Designation:
(Officer Contractor)

Signature:
Name:
Designation
(Officer THDCIL)

Date:

Annexure-8

AMBULANCE INSPECTION CHECKLIST

Date:

Plant/Project Site:

S.No	Items	Observation		
1	Vehicle Registration No.			
2	Valid Pollution Under Check Certificate Valid			
3	Valid Vehicle Insurance			
4	Whether Driver was available	YES / NO		
5	If yes, Driver's Name			
6	Driving License No. and date of validity			
7	Whether trained in first-aid	YES	NO	
8	PHYSICAL CONDITION OF THE Ambulance: **Engine condition** *(Oil leakage, Abnormal Noise etc.)*, **Wiper, Brakes** *(Foot and Hand)*, **Tyre's condition, Rear Mirror, Lights** *(Head Light/Brake Light/Reverse/Beacon Light)*, **Battery Condition, Horn including reverse horn, Seat Belt.**	YES	NO	
9	Fire Extinguisher	YES	NO	
10	Stepney available	YES	NO	
11	Condition of First Aid Kit	YES	NO	
12	Stretcher Available	YES	NO	
13	Pillow, Bed Sheet, Blanket and Towel Available	YES	NO	
14	Emergency Bag	YES	NO	
15	Oxygen Unit Available	YES	NO	
16	Oxygen Cylinder was found	YES	NO	**Cylinder was found % Filled / Empty**
17	Dirking Water	YES	NO	
18	Emergency medicines Under the advice of Construction medical officer	YES	NO	
19	Urinal Bag	YES	NO	

Signature: -
THDCIL Officer: -
Designation: -

Signature: -
Contractor Officer: -
Designation: -

Copy to;
1.
2.

Annexure-9

DISPENSARY CHECKLIST

S.No	ITEMS	QTY.	OBSERVATION		REMARKS
			YES	NO	
1	Construction Medical Officer				
2	Pharacist				
3	Male Nurse				
4	Female Nurse				
5	Nos of Bed				
6	No of Oxygen Unit				
7	No of Oxygen Cylinder				
8	No of Filled Oxygen Cylinder				
9	No of Empty Oxygen cylinder				
10	Pillows				
11	Blanket				
12	Bed sheet				
13	Towel				
11	Neatness of Bed sheet, Pillow, Blanket, Bedsheet etc				
12	Suction Unit				
13	I.V Stand				
14	ECG monitoring equipment				
15	B.P Equipments & Stethoscope				
16	meants of sterlizing Instruments				
17	No of Stretcher				
18	Nos of Couch				
19	Nos of Woolen blankets				
20	Hand Towles				
21	Tumbler				
22	Thermometer				
23	Hand Torch				
24	First Aid Box				
25	Syreage Destroyed				
26	Fire Extinguishers				
27	Latex Gloves				
28	Dust Bins for Bio medical waste				

Signature: -
THDCIL Officer: -
Designation: -

Signature: -
Officer Contractor: -
Designation: -

Copy to;
1.
2.

Checklists are valuable tools for various reasons:

Checklists help reduce errors and oversights by providing a systematic way to ensure that all necessary steps or tasks are completed. They serve as a cognitive aid, helping individuals remember important items even when they are under stress or facing distractions.

Checklists promote consistency and standardization in processes and procedures. By following a predefined checklist, individuals and teams can ensure that tasks are performed uniformly each time, which is particularly important in fields where consistency is critical, such as aviation, healthcare, and manufacturing.

Checklists help improve efficiency by streamlining workflows and minimizing wasted time. Rather than relying on memory or ad hoc approaches, individuals can refer to a checklist to guide them through a series of steps in a logical order.

Checklists are valuable tools for training new employees or team members. They provide a clear roadmap of tasks and procedures, allowing newcomers to quickly learn and understand the requirements of their role

Checklists facilitate communication and collaboration among team members by providing a shared reference point for tasks and responsibilities. They help clarify expectations and ensure that everyone is on the same page regarding what needs to be done.

Overall, checklists are versatile tools that can enhance performance, reduce errors, and improve outcomes across a wide range of contexts and industries.

Following checklists are prepared and enclosed for ready reference during regular check and to maintain workplace safety;

Annexure-1: General Safety Checklist.

Annexure-2: Tunnel Safety Checklist.

Annexure-3: Electrical Safety Checklist.

Annexure-4: Vehicle Inspection Checklist.

Annexure-5: Safety Audit Checklist as per IS 14489-2018

Annexure-6: Safety Audit Checklist THDCIL Checklist.

Annexure-7: Ladder Safety Checklist.

Annexure-8: Ambulance Inspection Checklist.

Annexure-9: Dispensary Inspection Checklist

37 Occupational Health & Safety Indian Standard

Safety regulations contained in Indian Standards shall also apply in addition to the instructions contained in this manual;

BIS Number	Title
IS 659: 1964	Safety code for air conditioning
IS 807: 2006	Code of practice for design, manufacture, erection and testing (structural portion) of cranes and hoists
IS 816: 1969	Code of practice for safety and health requirements in electric and gas welding and cutting operation
IS 818: 1968	Safety and health requirements in electric and gas welding and cutting operations
IS 1179: 1967	Equipment for eye and face protection during welding
IS 1991: 1988	Safety code for use, care and protection of abrasive wheels
IS 2148: 2004	Flame proof enclosure of electrical apparatus
IS 2189: 1999	Code of practice for selection, installation and maintenance of automatic fire detection & alarm system
IS 2190: 1992	Code of practice for selection, installations and maintenance of portable first-aid fire extinguisher
IS 2309: 1989	Protection of buildings and allied structures against lightning
IS 2379: 1990 (Reaffirmed 2006)	Pipeline – Identification – Colour Code
IS 2925: 1984	Industrial safety helmets
IS 3016: 1982	Fire precautions in welding and cutting operations
IS 3103: 1975 (R 2004)	Code of practice for industrial ventilation
IS 3362: 1977 (R 2004)	Code of practice for natural ventilation of residential buildings
IS 3521: 1999 (Reaffirmed 2002)	Industrial safety belts and harnesses
IS 3646 (Part-I): 1992 (R 2003)	Code of practice for interior illumination
BIS Number	Title
IS 3646 (Part-II): 1966 (R 2003)	Code of practice for interior illumination
IS 3646 (Part-III): 1968 (R 2003)	Code of practice for interior illumination
IS 3696 (Part 1): 1987 (R 2002)	Safety code for scaffold and ladders
IS 3696 (Part 2): 1991 (R 2002)	Scaffolds and ladders-code of safety
IS 3738:1975	Specification for rubber knee boots
IS 3764: 1992	Excavation work
IS 3786: 1983 (Reaffirmed 2002)	Computation of FR & SR for industrial injuries and classification of industrial accidents.
IS 3832: 2005	Specification for hand-operated chain pulley blocks

IS 4014 (Part-I): 1967	Steel tubular scaffolding (Definitions & Materials)
IS 4014 (Part-II): 1967)	Steel tubular scaffolding (Safety Regulations)
IS 4081: 1986 (Reaffirmed 2005)	Safety code for blasting and related drilling operations
IS 4130: 1991	Demolition of building
IS 4138: 1977	Working in compressed air
IS 4155: 1966	Glossary of terms relating to chemical and radiation hazards and hazardous chemicals
IS 4571: 1977	Specification for aluminium extension ladders for fire brigade use
IS 4573: 1982 (Reaffirmed 2006)	Specification for power driven mobile cranes
IS 4756: 1978	Safety code for tunnelling work
IS 4770: 1991	Rubber gloves-electrical purposes
IS 4912: 1978	Safety requirements for floor and wall openings, railings and toe boards
IS 5121: 1969	Piling and other deep foundations
IS 5216: (Part 1 & 2): 1982	Recommendations on safety procedures and practices in electrical work
BIS Number	Title
IS 5571: 2000	Guide for selection of electrical equipment for hazardous area
IS 5878 (Part-IV): 1972	Code of practice for construction of tunnels conveying water
IS 5878 (Part 1,2 & 3): 1972	Ventilation, Lighting, Mucking and de-watering in tunnel
IS 5916: 1970	Construction involving use of hot bituminous materials
IS 6305 (Part II): 1980	Safety codes for powered Industrial Trucks
IS 6539: 1972	Intrinsically safe magnet telephones for use in hazardous atmospheres
IS 6665: 1972 (R 2005)	Code of practice for industrial lighting
IS 6685: 2009	Life jackets
IS 6922: 1973 (R 2003)	Criteria for safety and design of structures subject to underground blasts
IS 7205: 1974	Safety code for erection structural steel work
IS 7293: 1974	Working with construction machinery
IS 7969: 1975	Handling and storage of building materials
IS 8235: 1976	Guide for safety procedure in hand operated tools
IS 8324: 1988	Code of practice for safe use and maintenance of non-calibrated round steel, lifting chains & slings.
IS 8347: 2008	Respiratory protective devices— definitions, classification and nomenclature of components
IS 8433: 1984	Dissolved acetylene cylinders
IS 8989: 1978	Erection of concrete framed structures
IS 9167: 1979	Specifications for ear protectors
IS 9296: 2001	Guidelines for inspection and maintenance of dam and appurtenant structures (first revision)
BIS Number	Title
IS 9297: 1979	Recommendations for lighting, ventilation and other facilities inside the dam
IS 9473: 2002	Filter type particulate matter respirator
IS 9474: 1980	Principles of mechanical guarding of machinery
IS 9563: 1980	Carbon monoxide filter self rescuers

IS 9583: 1981 (R 2003)	Specifications for emergency lighting units
IS 9623:2008	Recommendations for the selection use and maintenance of respiratory protective devices
IS 9668: 1980	Code of practice for provision and maintenance of water supplies for fire fighting
IS: 9679: 1980 (R 2003)	Code of practice for work environment monitoring
IS 9944: 1992	Recommendations on safe working loads for natural and manmade fibre rope slings
IS 10245 (Part 1 & 2)	Breathing Apparatus sets
IS 10291: 1982	Dress divers in civil engineering
IS 10386 (Part-I): 1983	Safety code for construction, operation and maintenance of river valley project and general aspects.
IS 10312: 1982	Safety code for powered tow trucks
IS 10386 (Part-II): 1982	Amenities protective clothing and equipment
IS 10386 (Part-III): 1992	Plant and machinery
IS 10386 (Part-IV): 1992	Handling, storage and transportation of explosive
IS 10386 (Part-V): 1992	Electrical aspects
IS 10386 (Part-VI): 1983	Construction
IS 10386 (Part-VII): 1993	Fire safety aspects
IS 10386 (Part-VIII): 1995	Open excavation
IS: 17893 (2023)	Safety Work Permit - Code of Practice
BIS Number	Title
IS 10386 (Part-IX): 1998	Canals and cross drainage works
IS 10386 (Part-X): 1983	Storage, handling, detection and safety measures for gases, chemicals and flammable liquids
IS 10665: 1982	Safety rubber ankle boots
IS 10667: 1883 (R 2002)	Guide for selection of industrial safety equipments for protection of foot and leg
IS 10665: 1982	Safety rubber ankle boots
IS 11016: 1984	General and safety requirements for machines tools and their operation
IS 11057: 1984	Specifications for industrial safety net
IS 11461: 1985	Code of practice for compressor safety
IS 11972: 1987 (R 2002)	Code of practice for safety precautions to be taken when entering a sewerage system
IS 13415: 1992	Protective barriers in and around buildings
IS 13416 (Part-I): 1992	Recommendations for preventive measures against hazards at workplaces (Falling material hazards prevention)
IS 13416 (Part-II): 1992	Recommendations for preventive measures against hazards at workplaces (Fall prevention)
IS 13430: 1992	Safety during additional construction and alteration to existing buildings
IS 14489: 1998 (Reaffirmed 2010)	Code of practice on occupational safety & health audit
IS 14665 (Part 3/Sec 1&2):2000	Electric traction lifts–service lifts, passenger and goods lifts
IS 18001: 2007	Occupational health & safety management system-requirements with guidance for use

38 Coal Mine Safety

38.1 Legal Provisions

- CMA between THDC India Limited and MDO for Coal Mines.

38.2 Role and Responsibility

Immediate Responsibility

Manager/Safety Officer, THDCIL, Coal Mine

Ultimate Responsibility

Mine Agent/HOP, THDCIL Coal Mine

38.3 Safety Requirements

- The Mines Act - 1952
- Mines Rules - 1955
- Coal Mine Regulation - 2017
- Central Electricity Authority – 2023
- Mines Vocational Training Rule – 1966
- Mine Rescue Rule – 1985
- Article 17: Safety Requirements as per CMA between THDC India Limited and MDO for Coal Mines.
- Circular issued by DGMS

38.4 Definitions

Agent

"agent", when used in relation to a mine, means every person, whether appointed as such or not, who, acting or purporting to act on behalf of the owner, takes part in the management, control, supervision or direction of the mine or of any part thereof.

A Person

A person is said to be "employed" in a mine who works as the manager or who works under appointment by the owner, agent or manager of the mine or with knowledge of the manager, whether for wages or not.

(i) In any mining operation (including the concomitant operations of handling and transport of minerals up to the point of despatch and of gathering sand and transport thereof to the mine)

(ii) In operations or services relating to the development of the mine including construction of plant therein but excluding construction of buildings, roads, wells and any building work not directly connected with any existing or future mining operations:

(iii) In operating, servicing, maintaining or repairing any part or any machinery used in or about the mine;

(iv) In operations, within the premises of the mine of loading for despatch of minerals;

(v) In any office of the mine:

(vi) In any welfare, health, sanitary or conservancy services required to be provided under this Act, or watch and ward, within the premises of the mine excluding residential area; or

(vii) In any kind of work whatsoever which is preparatory or incidental to, or connected with mining operations;

Chief Inspector

Chief Inspector" means the Chief Inspector of Mines appointed under the Mines Act.

Manager

"Manager" includes Mine Superintendent who is appointed by the owner or agent of a mine under section 17 of the Act and as such, responsible for the control, management, supervision and direction of a mine;

Ordinary employed

"Ordinary Employed" with reference to any mine or part thereof, means the average number of persons employed per day in the mine or part of mine during the preceding 4 [calendar year] (obtained by dividing the number of man days worked by the number of working days excluding rest days and other non-working days)

Owner

"Owner" when used, in relation to a mine, means any person who is the immediate proprietor or lessee or occupier of the mine or of any part thereof and in the case of a mine the business whereof is being carried on by liquidator or receiver, such liquidator or receiver but does not include a person who merely receives a royalty rent or fine from the mine, subject to any lease grant or license for the working thereof, or is merely the owner of the soil and not interested in the minerals of the mine; but (any contractor or sub- lessee for the working of a mine or any part thereof shall be subject to this Act in like manner as if he were an owner, but not so as to exempt the owner from any liability;

Reportable Injury

"Reportable Injury" means any injury other than a serious bodily injury which involves, or in all probability will involve, the enforced absence of the injured persons from work for a period of seventy-two hours or more.

Serious Bodily Injury

"Serious Bodily Injury" means any injury which involves; or in probability will involve the permanent loss of any part or section of a body or the use of any part or section of a body, or the permanent loss of or injury to the sight or hearing or any permanent physical incapacity or the fracture of any bone or one or more joints or bones of any phalanges of hand or foot.

38.5 Article 17: Safety Requirements as per CMA between THDC India Limited and MDO for Coal Mines.

38.6 Safety Requirements

38.6.1 The MDO shall comply with the provisions of this Agreement, Applicable Laws and Applicable Permits and conform to Standard Industry Practice for securing the safety of the Coal Mining Project, Equipment and individuals on or about the Site. In particular, the MDO shall develop, implement and administer a surveillance and safety programme for providing a safe environment on or about the Coal Mining Project, and shall comply with the safety requirements set forth in SCHEDULE K (the "Safety Requirements").

38.6.2 The MDO shall impart safety training to its employees and shall at all times be responsible for observance of safety procedures by its staff, Contractors and agents. The MDO shall provide statutory training under the Mines Vocational Training Rules, 1966, if applicable.

38.6.3 The MDO acknowledges and agrees that the Authority shall be entitled to inspect the Coal Mining Project to verify adherence to Safety Requirements and the MDO shall be obliged to facilitate such inspection and implement the corrective measures identified in such inspection.

38.6.4 Notwithstanding anything to the contrary contained in this Agreement, the Parties acknowledge and agree that the appropriate Government Instrumentalities shall be entitled to issue directions to the Authority and the MDO for complying with the provisions of the Mines Act, 1952 and the rules made thereunder and such directions shall be binding on them.

38.7 Guiding principles

38.7.1 Safety Requirements aim at reduction in injuries, loss of human life and damage to property resulting from accidents on the Coal Mining Project and Equipment, irrespective of the person(s) at fault.

38.7.2 Safety Requirements shall apply to all phases of development, operation and maintenance of the Coal Mining Project with emphasis on identification of factors associated with accidents, consideration of the same, and implementation of appropriate remedial measures.

38.8 Annual Safety Report

38.8.1 The MDO shall submit to the Authority before the 15th (fifteenth) day of January of each calendar year, an annual report (in ten copies) containing, without limitation, a detailed list and analysis of all accidents of the preceding calendar year and the measures taken by the MDO for averting or minimizing such accidents in future ("Annual Safety Report").

38.8.2 Once in every calendar year, a safety audit shall be carried out by the Authority. It shall review and analyse the Annual Safety Report and accident data of the preceding calendar year, and undertake an inspection of the Coal Mining Project.

The Authority shall provide a safety report recommending specific improvements, if any, required to be made in the Coal Mining Project and Equipment. Such recommendations shall be implemented by the MDO in accordance with Safety Requirements, Specifications and Standards and Applicable Laws in a time bound manner as specified by the Authority in the recommendations. For the avoidance of doubt, the Parties agree that not more than 15 (fifteen) months shall elapse between two safety audits to be conducted by the Authority hereunder.

SCHEDULE - K

SAFETY REQUIREMENTS

(See Article17.1.1)

38.9. Guiding principles

38.9.1 Safety Requirements aim at reduction in injuries, loss of life and damage to property resulting from accidents on or about the Coal Mining Project, irrespective of the person(s) at fault.

38.9.2 Users of the Coal Mining Project include staff of the MDO and its contractors working on the Project.

38.9.3 Safety Requirements apply to all phases of construction, operation and maintenance with emphasis on identification of factors associated with accidents, consideration of the same and implementation of appropriate remedial measures.

38.9.4 Safety Requirements include a safety management system comprising of reduction of, or wherever possible, mitigation of risks arising out of different operations and also principal/ major mining hazards inherently present in the Coal Mining Project including a structured and scientific emergency response plan.

38.10. Obligations of the MDO

The MDO shall abide by the following insofar as they relate to safety of the users:

(a) Applicable Laws and Applicable Permits;

(b) guidelines/ circulars/ bye laws of Directorate General of Mine Safety and any other order made thereunder;

(c) provisions of this Agreement; and

(d) relevant standards/ guidelines contained in internationally accepted codes in conformity with Applicable Laws; and

(e) Standard Industry Practice.

38.11 Safety measures during Development and Operation Period

38.11.1 MDO shall provide to the safety officer, in four copies, the relevant drawings containing the design details that have a bearing on safety of users (the "Safety Drawings"). Such design details shall include the design of the Coal Mining Project, Coal Handling Plant and the Railway Siding and other such installations along with other incidental or consequential information. The safety officer shall review the design details and after consulting the colliery engineer appointed pursuant to Regulation 33 of the Coal Mines Regulations, 2017, forward three copies of the Safety Drawings with its recommendations, if any, to the Independent Engineer

Who shall record its comments, if any, and forward one copy each to the Authority and the MDO within 15 (fifteen) days of the receipt thereof.

38.11.2 The design details shall be compiled, analysed and used by the safety officer for evolving a package of recommendations consisting of safety related measures for the Coal Mining Project [and the dedicated Railway Siding]. The safety audit shall be carried out by an independent expert appointed by the Authority and be completed in a period of three months from the submission of such drawings, in pursuance ofArticle12.3(a)and a report thereof (the "Safety Report") shall be submitted to the Authority, in five copies. One copy each of the Safety Report shall be forwarded by the Authority to the MDO and the Independent Engineer forthwith.

38.11.3 The MDO shall endeavour to incorporate the recommendations of the Safety Report in the design of the Coal Mining Project, as may reasonably be required in accordance with the Approved Mine Plan, Applicable Laws, Applicable Permits, guidelines/ circulars of Directorate General of Mine Safety, Specifications and Standards, and Standard Industry Practice. If the MDO does not agree with any or all of such recommendations, it shall state the reasons thereof and convey them to the Authority forthwith.

38.11.4 Without prejudice to the provisions of paragraph 3, the MDO and the Independent Engineer shall, within 15 (fifteen) days of receiving the Safety Report, send their respective comments thereon to the Authority, and no later than 15 (fifteen) days of receiving such comments, the Authority shall

review the same along with the Safety Report and by notice direct the MDO to carry out any or all of the recommendations contained therein with such modifications as the Authority may specify.

38.11.5 The MDO shall make adequate arrangements during the Operation Period for the safety of workers and other users of the Site in accordance with Applicable Laws and Standard Industry Practice for safety in Mine, and notify the Authority and the Independent Engineer about such arrangements.

38.11.4 The MDO in consultation with the safety officer will prepare the safety management plan, standard operating procedures, principal hazard management plan, emergency response plan and other such plans required as per the statute.

38.11.5 Safety committee shall be constituted by the MDO and will function as per statutory provisions. Such committee shall be formed as per the instructions issued to the MDO by the relevant statutory authorities.

❖ **Safety Management Plan:**

Based on the identified hazards and risks, the owner, agent and manager of every mine shall prepare an auditable document called "Safety Management Plan", that forms part of the overall management and includes organisational structure, planning, activities, responsibilities, practices, procedures, processes and resources for developing, implementing, achieving, reviewing and maintaining a safety and health policy of a company.

❖ **SOP's:**

safe operating procedures for the machinery or operation to which it relates to, examination and testing of the machinery before first use after erection, installation, re installation, modification, alteration, maintenance or repair; schedule and nature of examination and testing of the machine, including its sub-assemblies, so as to ensure its safe operation.

❖ **Internal Safety Organisation(ISO):**

In pursuance of recommendation of the 5th Conference on Safety in Mines, an Internal Safety Organisation (ISO), Group for Coal Mines Constituted in THDCIL.

The Brief and Responsibility of ISO:

- Effective monitoring of the state of implementation of the policy directives on safety.
- Periodic inspection of mines for assessing status of safety by DGMS approve Auditors.
- Enquiry into all accidents, dangerous occurrences and Notifiable diseases.
- Actively associated in opening new districts and in obtaining permissions, relaxations and exemptions under statute.
- The findings of ISO should be placed before Pit Safety Committee for discussion and dissemination

Normative References

- *The Mines Act - 1952*
- *Mines Rules - 1955*
- *Coal Mine Regulation - 2017*
- *Central Electricity Authority – 2023*
- *Mines Vocational Training Rule – 1966*
- *Mine Rescue Rule – 1985*
- *Article 17: Safety Requirements as per CMA between THDC India Limited and MDO for Coal Mines.*
- *Circular issued by DGMS*








टीएचडीसी इंडिया लिमिटेड
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(भारत सरकार व उत्तर प्रदेश सरकार का संयुक्त उपक्रम)
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